

Preconception Health and Care – Handbook for education

Edited by Jouni Tuomi

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Co-funded by the
Erasmus+ Programme
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Faculty of Health Sciences





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Introduction

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In the Erasmus+ Strategic Partnership project “Preconception Health of Youth, bridging the gap in and through education”, our intention was to bring lifelong fertility counselling to a new level by creating tools for educators to train health care professionals to be equipped in guidance and counselling of their clients and patients.

The first aim was to bridge the gap in health care education. Fertility protection and preconception health and care were not clearly stated in curricula. The other gap was that it is not an essential part of health promotion. Presently, after completing secondary school, youth are not being systematically counselled until they decide to have children. Preconception health is recognized as a critical component of life health development of women and men in reproductive age. Preconception health and care focus on men and women before pregnancy. The years before pregnancy are of great importance to fertility, healthy pregnancy and to the health of the baby.

The increase in wellbeing in Europe and throughout the world has brought up a notable need to strengthen young adults’ preconception health, which has in its part, significantly decreased. This growing societal problem also is evident in developing countries as the gap between different people groups is vast. The shift in culture and lifestyle has brought the increasing problem into light with force. Infertility is a major societal problem. The challenge and need can only be met with input

into good quality higher education. E.g. Lancet published in its Series three articles, which “calls for a social movement to achieve political engagement for health in this particular phase in life” (Lancet 2018).

Young adults (aged 18–30) postpone having children without proper knowledge about how age and cumulative health problems and lifestyle choices strip natural fertility. Infertility treatments and pregnancy complications increase and the number of children in families remain smaller than what was wished for. The birth rate decreases and some couples remain childless against their will. Delayed parenthood can be a choice for some couples, but socioeconomic problems and / or educational and cultural inequality may play their part in the inability for couples to receive reliable information to support their decision and lifestyle choices. Good fertility health is in the core of life course health development, even if the choice is not to have children. Good pre-pregnancy health of the mother-to-be, and also the father-to-be, have been reported in numerous research as crucial for the health of the unborn child. In addition, it affects the ability of the couple to conceive, the safety of the pregnancy, and the child’s health in the long run. As a long term effect, this also applies to the health of the next generation and even the following ones.

Preconception health has been researched and recognised in medicine, midwifery and e.g. in social sciences; it has been declared as a serious issue that influences health in the long run. Current educational programs of health professionals are inadequate, inconsistent, and scattered. Therefore, health professionals lack information in how to counsel their clients in this subject. Even in the current health care structure there is no system to resolve the growing problem of people who are kept in the dark when it comes to their sexual and reproductive

health and fertility awareness. It is nowhere to be found in health care or nursing education either. When EU-directives for nurse and midwife education were written, this problem was not recognised, and it is completely absent in directives concerning midwifery. The common directives for nurses are disease centred. Now it is time to turn the focus on life course health development education and training in fertility health.

The preconception health focus has previously been on unwanted pregnancies and sexually transmitted infections. Today, other issues would deserve more attention. As important, unless more, is to focus on protecting natural fertility. The guidance is directed towards girls and women. Equally important, for maintaining good fertility, are boys and men, who have previously been neglected, and now need to be reinstated.

The subject is highly sensitive, therefore empowering health professionals, to execute quality guidance and knowledge, is curial. The preparedness to guide fertility awareness and counsel how to retain reproductive abilities, when postponing parenthood, contains evidence-based knowledge, competencies, and skills.

In this project, we intended to develop necessary knowledge and training for health professionals, to be equipped for adequate counselling. We have developed digital material that allows distance learning, independent learning or can be offered as a module or integrated in many subjects throughout all the studies for nurses, midwives, public health nurses, and school nurses etc.

Over the past 20 years, many reviews and summaries have been published around the world on which are the key themes of preconception health and care. One key starting point can be found in a supplement published in the American Journal of Obstetrics & Gynaecology (AJOG) in 2008, in which 17 articles

examine preconception care. One article, by Jack et al. (2008) summarises the subjects of the supplement. In the last chapter of this book, Delbaere (Chapter 30) describes and comments the article of Jack et al. (2008), as if as a kind of summary for the texts of our book. For example, WHO (2012) also published a 13-point list of themes of preconception care. The difference between the AJOG and WHO is mainly that WHO emphasises the global perspective. The table of contents of books on the subject (e.g. Shawe et al. 2020) also gives a picture of the vast scope of the topic. A Google search also pictures a wide range of outlines, mainly along the lines defined by AJOG (2008) and WHO (2012).

One of the project's outputs was the Preconception Health and Care (PCHC) model (Figure 1), which is symbolised as Honeycomb model. The model is primarily intended as a tool for teaching and learning for health care teachers and students and it guided our choices. The model aims to parse the preconception health and health care area, adapted to nurses and nursing care. We have used it to structure the digital teaching and learning platform we have created. At the beginning of the project, there was much discussion about which perspective on the outputs is chosen – nursing care, health promotion or medicine. A significant part of the PCHC research is medical.

The main themes of the Honeycomb-model (Figure 1) are: understanding reproduction, age and fertility, lifestyle factors, infection risks, pre-existing medical conditions, environmental factors, occupational environment and social environment. The idea behind the model is that it is constantly expanding and deepening as more researched evidence about the impact and importance of preconception and pregnancy emerges. E.g. in 2008 preconception health was not known or understood the way it is today.

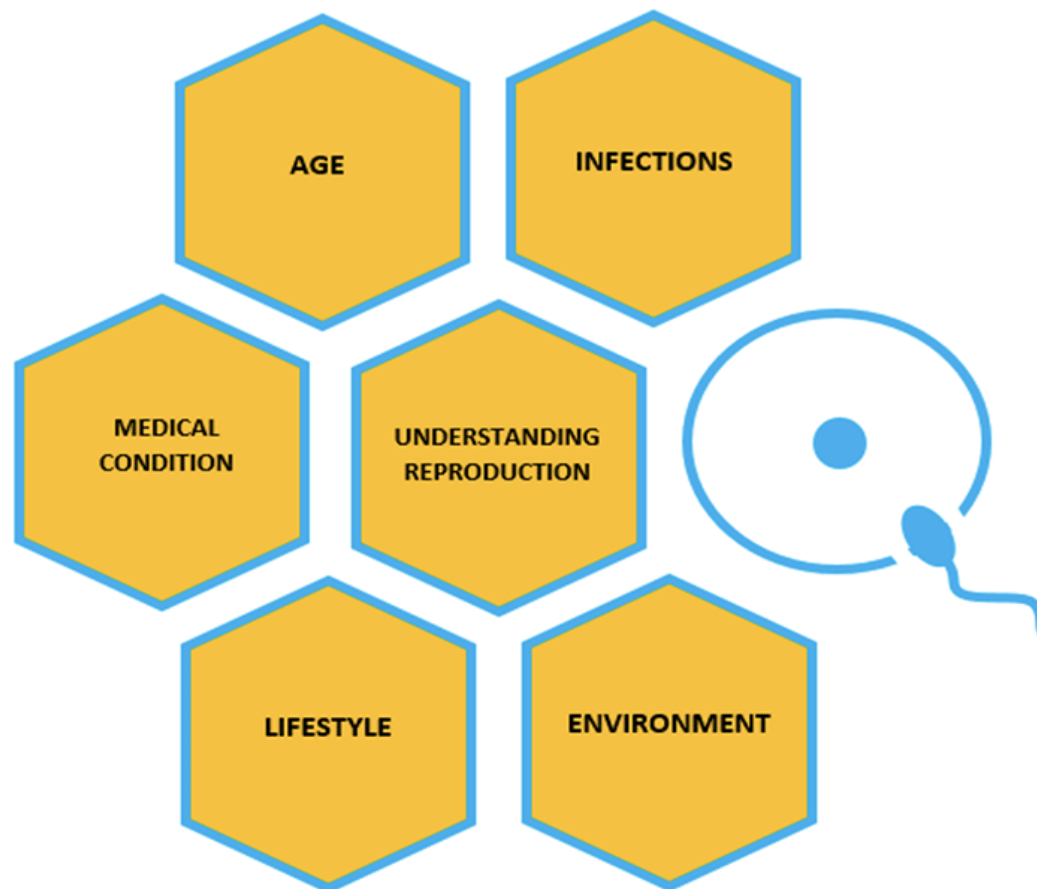


Figure 1. PCHC -model / the Honeycomb-model (<https://preco.tamk.fi/pchc-model/>)

This book is an independent output of the project, involving all project experts and people who volunteered for the project. The purpose of this handbook is to act as a tool and reinforcer for preconception health and health care learning and teaching. It also justifies the different tools of our digital learning and teaching platform. The digital learning and teaching tools and this handbook are placed on the same platform so that teachers and students alike easily find background information for different tools and, vice versa, easily find practical applications for self-study, teaching and guidance.

The book is divided into six main chapters. The first chapter describes the idea guiding the whole project where Preconception health is an essential part of life course health development and that life course health development is beyond health promotion. On the other hand, the articles highlight the multitude of

concepts: Preconception health, preconception care, preconception health and care, preconception health and health care. Each writer made their own choices.

The second chapter aims to increase understanding of the concept of preconception by looking at fertility from different perspectives. People do not always remember that age has an incontestable meaning in fertility. The third chapter looks at different lifestyle choices that may affect fertility. Critically one might add that investing in them does not unequivocally increase fertility, but poor choices can destroy fertility. The fourth main chapter focuses on pre-existing medical conditions. E.g people are quite unaware that already one sexually transmitted infection might cause infertility. The fifth main chapter looks at various environmental factors, from chemicals to violence, of which female circumcision is one example. In the final chapter, the focus shifts to guidance and counselling, not forgetting the possibilities of digitalisation.

This project was a three-year EU-funded project which, due to Covid-19, received an additional four months until the end of 2021. The project was led by Tampere University of Applied Sciences (TAMK; Finland) and strategic partners were the University of Ljubljana (UL; Slovenia), University of Primorska (UP; Slovenia), VIVES University College (VIVES; Belgium) and Carinthia University of Applied Sciences (CUAS; Austria). On behalf of the project, I would like to thank the EU for the project funding. I also thank all those who, as their volunteer work, lectured at the various conferences of the project. Thank you to all the professionals and students who contributed to this handbook.

I hope that the readers of the book will find issues that are important to them in the book and that the book will be used e.g. in nurse and midwife education. In addition, I hope that readers

would develop as much enthusiasm for promoting preconception health and care as we the authors of this book do have. Good reading moments.

All authors are responsible for their own articles.

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Part I;

Preconception health
as a part of life course

Health: an intergenerational process

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Abstract

Almost 35 years ago the so-called Barker's hypothesis showed for the first time the association between maternal nutrition during pregnancy, childbirth weight, and middle-aged cardiac deaths. These studies opened up a new perspective on the emergence of diseases and health promotion. The intergenerational nature of disease and health has been featured in one way or another in the views of individual thinkers for centuries, but it has not been able to challenge the prevailing medical views before moving into the 21st century. Over the last two decades, the 'Life Course Health Development', a vision of life course and health, has brought together numerous research trends from different disciplines, like an umbrella.

Keywords: development, generations, health, life course

Tiivistelmä

Lähes 35 vuotta sitten ns. Barkerin hypoteesi osoitti ensimmäistä kertaa yhteyden äidin raskauden aikana tapahtuvan ravitsemuksen, lapsen syntymäpainon ja keski-ikäisten sydänkuolemien välillä. Nämä tutkimukset avasivat uuden näkökulman sairauksien ilmaantumiseen ja terveyden edistämiseen. Sairauksien ja tervey-

den sukupolvien välinen luonne on ollut tavalla tai toisella esillä yksittäisten ajattelijoiden näkemyksissä vuosisatojen ajan, mutta se ei ole pystynyt kyseenalaistamaan vallitsevia lääketieteellisiä näkemyksiä ennen siirtymistä 2000-luvulle. Viimeisen kahden vuosikymmenen aikana elämänkulun ja terveyden visio "Life Course Health Development" on tuonut yhteen useita sektoreita, kuten sateenvarjo.

Avainsanat: kehitys, sukupolvet, terveys, elämänkulku

Introduction

Life course and health -thinking that goes beyond health promotion is not a new vision. Simply put, it tends toward the intergenerational shaping of disease and health. There is talk in the world of 'Life Course Health Development (LCHD)'. In the background in the late 1980s, the so-called Barker's hypothesis (1986) stated that factors influencing many public diseases are formed at a very early stage of fetal development. The findings of the Barker working group were the impetus for a broad new research trend: 'Developmental Origins of Health and Disease' (DOHaD) (Wadhwa et al. 2009).

Globally, in recent decades, chronic diseases have become leading causes of death and disability. LCHD seems to be a fruitful perspective that expands health promotion to understand the formation of disease and health. It is believed that this new kind of understanding would have the potential to take healthcare to a whole new level, as it e.g. combines different trends in traditional clinical medicine and public health as well as connects numerous research trends in various disciplines, such as psychology, sociology, education, biology, genetic research, etc. (Hafron et al. 2018)

Understanding of diseases and health determinants

The starting point for the activities of health care personnel has always been based on beliefs about the causes of diseases and health determinants. It is possible to show the development of how the foundations of action have expanded from the time of Hippocrates to the present day.

The most common and, depending on the time, the more or less strongest view of the nature of disease in the history of mankind has been related in one way or another to the spirit; to an evil spirit, to the gods, or to God. Because diseases have been understood as anomalies and evils, being able to “communicate with the pathogen” and even “control” the diseases have given the person capable of communication a special unique power and respect in their community.

Another, historically much younger view in the West, only less than 2 500 years old, is based on the idea that diseases are basically somehow material and not driven by any supernatural spirit or sin. Hippocrates (460–377 BC) built the body of the first Western medical theory by Western medical theory by Pythagorean thinking of harmony and Empedocle’s (492–432 BC) conception of the four elements.

Aristotle (384–322 BC) added to it an understanding of the four basic features, and Galenos (c. 201–130 BC) developed the theory in the form in which it moved to the Middle Ages to gradually become the official conception of disease in the Church. (Vuori 1979.) Simplifying the theory, the starting point was four fluids of life – blood, mucus, black bile, and yellow bile. Health was the normal mixture and balance of these life fluids. Fluid imbalances lead to pain and illness.

At the beginning of industrialization in the 18th and 18th centuries, another notable theory of medicine prevailed, the Miasma theory. The theory was based on a simple assumption that diseases were caused by changes in air concentration; diseases occur where there is dirt. Thus, all diseases are caused by bad air, which in turn is caused by rotting waste, dirt, etc. The Miasma theory led to effective environmental hygiene measures. It was the “scientific” basis and rationale for the 19th century public health movement.

Towards the end of the 19th century, the theory of the specific etiology of diseases intensified; each disease has its own and only a specific cause. Pasteur (1822–1895) and Koch (1843–1910) identified bacteria as pathogens. Although the Miasma theory and the humoral pathology it represented were a misconception, it emphasized the importance of the individual and his environment in the pathogenesis of disease. The specific etiology changed this perception as well as the research based on it. Despite the fact that, according to Vuori (1979), the theory of specific etiology can be considered perhaps the most important doctrine influencing the development of medicine, it resulted in a biological mindset that forgets social aspects and pushes the sick person into a trivial side role.

The shock of the First World War and the clinical findings of the Second World War e.g. war psychosis led to a reassessment of the origins of the disease, which was crystallized in the WHO definition (1946) “health is the perfect state of physical, mental and social well-being and not merely the absence of disease or infirmity”. Even if the definition were to be agreed upon, there was still controversy as to which health care system or extracurricular activity, e.g. people’s own activities, had a more important part in disease prevention and health determinants.

After the Second World War, health care systems were strongly developed everywhere, but in the 1970s it was possible to show that public health is affected by many factors outside health care and that influencing them is more effective than health care. (Melkas 2013.) Blum (1983) suggested that health is a broad concept understood as a state of balance between all the forces that guide human action and behavior. The key influences, he said, are the environment, heredity, lifestyles and the health care system.

The 1986 WHO Ottawa meeting proclaimed 'Health for All by the Year 2000' and beyond (WHO n.d.). At that time, the main lines of health promotion were defined, one of the main new emphases of which was that health promotion is not just a matter for the individual and the health sector, but for cooperation between different sectors of society as a whole for health. The declaration believed that health promotion is a process that allows people to increase health management and improve their health.

Despite the fact that health, its care and promotion were seen as diverse individual and societal activities, health problems associated with many non-communicable diseases, such as childhood obesity, inevitably increased in the population as we approached the turn of the millennium. Although attention had already been paid to the link between diseases and the life course in the early 20th century, scholars have not been interested in this perspective. Especially after World War II, the weight of adulthood factors such as behavior as an explanatory factor for disease increased. According to Kuh and Smith (1997), research conducted by the Norwegian Forsdahl in the 1970s re-emerged the hypothesis based on life course. His research showed an ecological link between childhood living conditions and deaths related to cardiovascular disease. At the same time, assumptions began to be made that, in the prevention of certain chronic

diseases, influencing lifestyles does not lead to significant results, but the diseases originate from an older period.

As early as the turn of the 1990s, research found new explanations for health formation: “You are not what you eat, but what your parents and grandparents ate.” Robinson (1992) spoke of a paradigm shift from lifestyle to life course. It can be said that the understanding of diseases and health determinants has evolved over the centuries from a simple and mechanistic model through many stages to an increasingly complex and dynamic view. Researchers (European... 2019), however, acknowledge that how to concretize e.g. health care activities on the basis of the life course thinking model is still limited.

In the 2010s, the WHO has begun to pay increasing attention to the life course perspective as a key factor in promoting and strengthening health (e.g. Health 2020; Glossary of life-course terms 2015; The Minsk Declaration 2016; WHO 2018):

Investing in health through a life-course approach and empowering people is the first priority area for policy action in Health 2020. Life-course principles also underpin the other three mutually supportive action areas of Health 2020, which focus on: Non-communicable diseases and communicable diseases; people-centered health systems, public health capacity and emergency preparedness, surveillance and response; and resilient communities and supportive environments. (WHO 2018.)

Life course health development (LCHD) -thinking

Although LCHD -thinking can be considered a relatively new view of health, for example, the titles and contents of various chapters in Bäckman’s (1987) book identify many key research trends in life course thinking such as critical life events, non-specific etiology, life cycle, etc., as early as the 60s. Today, there is a lot of international research on LCHD. Halfon and Forrest (2018)

see LCHD as a synthesis of a biomedical and biopsychosocial model influenced by many research traditions and new research trends, such as epigenetics (= gene readiness / operational readiness).

Simply put, LCHD is about intergenerational modification of disease and health. The groundbreaker of this kind of thinking was the so-called Barker's hypothesis (Barker et al. 1986).

According to it, factors influencing many public diseases are formed at a very early stage of fetal development. The first study by Bygren et al. (2001) showed that grandchildren of men, who were malnourished at a young age, die less than others from cardiovascular disease. A further study confirmed the finding that male grandchildren of men who spent their childhood in abundance and female grandchildren of women who lived in similar conditions had a higher-than-normal risk of developing diabetes (Kaati et al. 2002). These results can be interpreted in a way that today's childhood obesity epidemic is not only due to what children eat, but also to what their parents ate in the 1990s and 2000s, but also with what the children's grandparents ate in the 1970s and 1980s.

Another example relates to the fact that the semen quality of European men has deteriorated over the last thirty years. Not all reasons for this are known, but it is known that smoking damages the sperm of the unborn child (Anttila 2008; Li et al. 2011).

The future is 20 to 40 years away, but the previous generation is shaping it in advance. It could be said that the importance of LCHD -perspective to the work of health care actors is fundamental: to realize the intergenerational transformation of disease and health. In this case, the basics of action, such as individual health promotion, are understood not only as affecting the individual, but also as influencing the health of future generations.

Ontologically, the LCHD -perspective is related to human existence, not primarily to chronological age. The possibility to examine chronological age is not prohibited, as e.g. human development and life course are periodized by chronologically with age. Nevertheless, a person's experience of his or her own life is understood to be more meaningful than age rating. When a chronological age review is used, it is done consciously, not as given. From this perspective, basically, human development and aging are continuous processes through life, where the perspective and experiences of the individual operating in the world are at the core of his choices and actions, also in relation to health. In all communities and societies, life course is divided into life stages characterized by transitions, non-continuity, and discontinuity of continuity. These always change in some way, how we experience ourselves and how others experience us.

Halfon and Forrest (2018) summarize the LCHD -framework into seven principles:

1) Development: Health development integrates the concepts of health and developmental processes into a unified whole

Health-related traits can be thought of as “assets” that are desirable, acquired, optimized, and maintained over a lifetime, enabling an individual to grow, survive, and adapt to diverse environments. In this context, development refers to the processes by which health-affecting properties change. If health is understood as a set of characteristics that manifest at the level of the whole individual, development means the evolutionary processes by which these characteristics enable adaptation to changing social and environmental conditions. Health is “what” (what changes) and development is “how” (how health-related characteristics change over time).

2) Unfolding: Health development unfolds continuously over the lifespan, from conception to death, and is shaped by prior experiences and environmental interactions

Adaptation means that health development is neither linear, passive, nor static; rather, it is adaptive, self-organizing, and autocatalytic.

3) Complexity: Health development results from adaptive, multilevel, and reciprocal interactions between individuals and their physical, natural, and social environments

Complexity suggests that health development takes place in living systems that are not only adaptive, self-organizing, and autocatalytic, but also complex and hierarchically organized. The development of health cannot be fully understood from a traditional medical approach. Health development is based on the hierarchical relational relationships of biological and behavioral subsystems and their individual and collective relationships, as well as on various interconnected external systems such as the family, socio-cultural and ecological relationships.

4) Timing: Health development is sensitive to the timing and social structuring of environmental exposures and experiences

Timing means that the development of health is due to nonlinear interactions that are both time-specific and time-dependent. For example, there are sensitive periods in a child's life when the effect of certain exposures may be greater than during other periods.

5) Plasticity: Health development phenotypes are systematically malleable and enabled and constrained by evolution to enhance adaptability to diverse environments

Plasticity suggests that genes do not directly determine health, but that epigenetic processes control gene function.

To put it simply, heredity determines the boundaries within which an individual's traits can change, but the habitat modifies traits within those boundaries.

6) Thriving: Optimal health development promotes survival, enhances well-being, and protects against disease

Health modification allows individual resources to pursue goals and success. Thus, the qualities that develop during an individual's life course allow him or her to achieve goals and live a long life.

7) Harmony: Health development results from the balanced interactions of molecular, physiological, behavioral, cultural, and evolutionary processes

The balanced synchronization of human biological and physiological, on the one hand, and social and cultural processes, on the other, produces the "rhythms" and variations that characterize health modification. Loss of coordination of these processes leads to negative consequences in the human system.

In summary, LCHD-perspective combines health and development into a single structure (Principle 1) that opens "agilely" throughout life (Principle 2) according to the principles of complex adaptive systems (Principle 3). The change in health development is due to time-specific processes (Principle 4) that affect different human systems during sensitive periods (Principle 5) and the balance of different processes (Principle 7). Health development provides tools for individuals and populations to achieve desired experiences (Principle 6). Principles should not be understood as static, independent claims, but should be seen as a kind of set of nodes that are closely interconnected. (Halfon & Forrest 2018.)

Health formation over the life course

Perhaps the most attractive and obvious finding in favor of LCHD-perspective is found in epidemiological studies of childhood obesity, which show how childhood growth and obesity can affect many middle-aged health problems such as diabetes and cardiovascular disease outbreaks. On the other hand, it can be shown that the weight of the mother before and during pregnancy affects the course of childbirth, the probability of both infant obesity and lifelong obesity, and the possible consequences of obesity. (Hawkins et al. 2018.) According to Fleur et al. (2016), animal modeling is constantly providing more evidence that epigenetic processes can affect future generations and their health. According to them, there is a lot of evidence that this could also be the case for humans, for example, stressful events may affect childbirth for generations.

The theory of biological “programming”, based on the findings of the Barker group, emphasizes the importance of the fetal stage, while the theory of social “programming” (Kuh et al. 1997) emphasizes the study of biological development, growth and aging with living standards and living conditions, and social hierarchies change over time. Based on the so-called Barker’s hypothesis, fetal “programming” theory, a broader perspective on the emergence of chronic diseases and non-communicable diseases has been developed. It looks at the emergence of diseases against the whole course of life. This perspective combines biological, psychological, and sociological models and theories. In very simple words for example maternal nutritional status and health behaviors both before and during pregnancy affect fetal growth and development, but the contribution of health care workers also has an effect. This entity, in turn, has long-term effects on the health of both mother and child.

WHO sets out the key principles of the life-course approach and an agenda for action according to them in the Minsk Declaration (2016) in the Context of Health 2020. According to it the essentials of life course approach means:

- recognizing that all stages of a person's life are intricately intertwined with each other, with the lives of other people in society, and with past and future generations of their families;
- understanding that health and well-being depend on interactions between risk and protective factors throughout people's lives;
- taking action:
 - early to ensure the best start in life;
 - appropriately to protect and promote health during life's transition periods;
 - together, as a whole society, to create healthy environments, improve conditions of daily life, and strengthen people-centered health systems. (The Minsk Declaration 2016; WHO 2018.)

Acting from life-course perspective is the best way to health promotion

Over the past decade, genetic engineering and health technology have shifted attention to technologically and genetically engineered health. As health determinants, genes (genetic engineering) have begun to become more prominent in health speeches. On the other hand, the impact of environmental factors (eco-social public health paradigm) has, in recent years, brought to the debate the fundamental importance of environmental

factors as health determinants through environmental problems and disasters. LCHD-perspective connects this new mainstream from human behavior and does not forget to promote health. Against the background of LCHD, preconception health and care has taken on a whole new meaning: The roots of risk pregnancy and childbirth and life health status are most often found in the time before pregnancy, and perhaps in the choices of parents or even grandparents. Research is producing ever-increasing information on how and in what way chronic diseases and perhaps many other diseases, as well as health in particular, are intergenerational processes. In health care operations, this means understanding the past of the future: What we do today is the past of the future.

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What do we mean by preconception care and why do we need preconception care?

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Abstract

Preconception health is a relative new concept and the content of it is not always clear for healthcare professionals let alone for the public. In the introduction we will look at the key definitions of preconception health. Furthermore, we will sketch a brief history of preconception care and emphasize the importance of preconception care for the health and well-being of the (future) mother and her child.

Keywords: preconception care, interconception care, Barker hypothesis, DoHad, lifestyle, primary health care

Abstract

Preconceptiezorg is een relatief nieuw concept en het begrip is nog niet zo breed gekend, noch bij zorgverleners als bij zorgontvangers. In de inleiding van dit hoofdstuk wordt het concept preconceptiezorg gedefinieerd. Daarna wordt een korte geschiedenis van preconceptiezorg geschetst en wordt het belang van preconceptiezorg onderlijnd voor de gezondheid en welzijn van de (toekomstige) moeder en haar kind.

Trefwoorden: preconceptiezorg, interconceptiezorg, Barker-hypothese, DoHad, levensstijl, eerstelijnsgezondheidszorg

Introduction

Preconception care is defined as “ a set of interventions and / or programs that aims to identify and enable informed decision-making to modify biomedical, behavioral, and (psycho) social risks to parental health and the health of their future child, through counselling, prevention and management, emphasizing those factors that must be acted on before conception and in early pregnancy, to have maximal impact and / or choice” (Posner et al. 2006). Interconception care (ICC) is a particular kind of preconception care and is defined as the care for women in between two pregnancies (from the conception of one pregnancy to the conception of the next pregnancy). This can be part of routine antenatal or postnatal care (Sijpkens et al., 2019). It is recommended to use only the term preconception care (PCC), which is also used by the WHO, but ICC offers the advantage that a specific target population can be addressed (women who have been pregnant) and that risk factors from prior pregnancies can be taken into account.

If couples have sufficient knowledge about factors with a negative impact on fertility and pregnancy outcome, they can take initiative to adapt their lifestyle and stop smoking, avoid alcohol already before pregnancy, maintain a healthy weight and optimize their diet, including the intake of folic acid (for women). However, most people are not aware of these important measures and as such, they may profit from preconception care. Preconception care is useful for everybody, but particularly for people with a less optimal lifestyle or particular medical conditions. Not everyone is familiar with the concept of preconception care or conscious about the possibility to have a preconception visit; therefore, it is recommended that health care providers address preconception issues within every healthcare encounter with people of reproductive age (see chapter ‘the reproductive life plan’). As

such, a large number of topics may already be addressed at the time people think of starting a family and people can take more informed decisions.

A brief history of preconception care

It is only since the last two decades that 'Preconception care' (PCC) emerged in the scientific literature. Nonetheless, the concept of being as healthy as possible at the time of conception is known for much longer. Already in the Bible (Old Testament), the following is mentioned: "Behold, you are barren and have not borne children, but you shall conceive and bear a son. Therefore be careful and drink no wine or strong drink, and eat nothing unclean, ...". Within scientific literature the importance of preconception care was obviously imminent with the results of the MRC Vitamin Study, which proved that preconceptional intake of folic acid was important for the prevention of neural tube defects (MRC Vitamin Study Research Group, 1991). In 2006, another important study was published with recommendations from the CDC to improve preconception care (Johnson et al. 2006). Since then, the number of publications in the field of preconception care has increased substantially. In 2010, the first European Congress on Preconception Care and Health was organised in Brussels and since that time, researchers in the field of preconception care meet every two years and exchange their study results. In 2015, Shawe et al. published a multiple cited paper on preconception care policy, guidelines, recommendations and services across six European countries (Shawe et al. 2015) and the Lancet published a series of three papers in 2018 in order to highlight the importance of preconception health for future generations (Barker et al. 2018; Fleming et al. 2018; Stephenson et al. 2018).

Why do we need preconception care?

The introduction of antenatal care around 1960 had an important impact on perinatal outcomes. Maternal and infant mortality rates decreased substantially between 1960 and 1980 (Atrash et al. 2006). However, since 1995, we see no further decline in perinatal mortality and morbidity. On the contrary, rates of preterm birth and low birth weight are increasing again in some countries. Next to that, there is an evolution in leading causes of infant mortality. In 1960, asphyxia, immaturity, congenital anomalies, pneumonia and birth injuries were the most common causes of infant deaths; in 1980, complications of pregnancy emerged in the top 5 of causes and in 2002, these complications were the third most important cause of death in American children (Atrash et al., 2006). Zylbersztejn et al. (2018) found that child mortality was double as high in the United Kingdom when compared to Sweden. This difference may be explained by the higher incidence of teenage pregnancies in the UK, the higher amount of women who smoke during pregnancy and the higher prevalence of obesity. These findings indicate that the largest profits in perinatal care can be gained by optimizing health of women at the start of pregnancy and preferably, before pregnancy.

With the increase of maternal age, the epidemic of obesity, the increase of chronic diseases and social inequalities, new challenges occur in perinatal medicine for which adequate antenatal medicine is still required but falls short.

The first trimester of pregnancy is too late to address lifestyle issues, because the first weeks of pregnancy are very important in embryonic development. An embryo is very vulnerable in the first trimester of pregnancy, because of the intensive growth and development of organ systems. As such, the pregnancy should start in optimal conditions. Next to that, an increasing number

of studies support the hypothesis that environmental influences at a young age (also prenatal influences on the embryo) may affect the health of this embryo in later life (Fleming et al. 2018; Seonghoon et al. 2014). This hypothesis is known as the Barker hypothesis (Barker 1998). Foetal adaptations as a response to adverse environmental influences may have a lasting effect on the function of organs. The preconceptional period is as such a critical period for the health of the future child and even for next generations. The WHO defines the preconception period as an important opportunity for the prevention of unwanted pregnancies, pregnancy complications, infertility, birth defects, low birth weight and lower risk of diabetes type 2 in later life, as well as lower risk of cardiovascular disease in later life. As a consequence, it is important that as many people as possible are aware about the effect of a healthy lifestyle on future offspring and preconception care is an important instrument to achieve this goal. Preconception care should not be seen as a one-time visit with a general practitioner, midwife or obstetrician; but rather as a common thread through healthcare encounters with people of reproductive age. As nutritional habits may be at risk in adolescence, this life stage is an appropriate era to respond with tailored campaigns on healthy nutrition, etc. Of course, informing people is not enough to achieve a change in healthy behaviour. Also the social environment and authorities have a responsibility to support future parents in their intentions with a supportive climate and actionable strategies. When health care providers share information on preconception care, they should bear in mind that some people don't have the capacities to follow such instructions or they may feel revolting when they are told to act different than the way they do. The information should be given in a way that empowers people, rather than to blame future parents or to make them feel guilty (Verbiest 2020).

Conclusion

After antenatal care, preconception care is an important health care supply which can have an important effect on perinatal outcome. The first trimester of pregnancy is a very important time frame with opportunities to improve health of the future child, not only after birth, but also in later life. As not a lot of people take initiatives to seek preconception care, health care providers should address relevant topics at every health care encounter with people of reproductive age. As such, preconception care can be imbedded in regular health care and a larger amount of stakeholders can be reached.

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Part II;
Understanding
reproduction

Age and fertility

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Abstract

Delayed parenthood is a rapidly increasing phenomenon during recent decades both in Europe and with economic development around the world. Having children is timed later and later. The average age of first-time mothers in Europe begins to exceed 30 years.

The most significant factor affecting fertility is age. It is an incontestable factor. Every person will inevitably age, and no one can influence this process. Studies show that women, and especially men, underestimate the effect of age on fertility and overestimate both their own fertility and the potential of fertility treatments to help overcome the decline in fertility brought by age. The increase in the age of a man and a woman has a decreasing effect on fertility. Fertility treatments can only overcome age-related problems to a limited extent. Especially if there is an expectation of natural pregnancy, or more children, it is advisable to start to build a family earlier.

Plans for having children and the number of children are private and sensitive issues. Even if dreams of a child are postponed, young adults need to know the facts about the subject, because the media creates false images of the unlimited opportunities to have children. Reproductive choices should be based on correct information and it is the responsibility of healthcare professionals to bring this issue up, even when clients do not know how to ask.

Keywords: age, fertility, delayed parenthood

Tiivistelmä

Viivästetty vanhemmuus on nopeasti lisääntynyt ilmiö viime vuosikymmeninä Euroopassa ja lisääntyy taloudellisen kehityksen myötä koko maailmassa. Lasten saaminen ajoitetaan yhä

myöhemmäksi. Ensisynnyttäjien ikä Euroopassa on ylittämässä 30-vuoden iän. Tärkein hedelmällisyyteen vaikuttava tekijä on ikä. Se on lahjomaton ihmisen biologiseen vanhenemisprosessin liittyvä tekijä. Tutkimusten mukaan naiset ja erityisesti miehet aliarvioivat iän vaikutuksen hedelmällisyyteen, ja yliarvioivat sekä omaa hedelmällisyyttään että hedelmällisyshoitojen mahdollisuuksia voittaa iän tuoma hedelmällisyyden lasku. Miehen ja naisen iän karttuminen vähentää hedelmällisyyttä. Hedelmällisyshoidoilla ei voida voittaa iän tuomia ongelmia kuin rajallisesti. Erityisesti, jos toiveissa on luonnollisesti alkanut raskaus, tai useampi lapsi, on syytä aloittaa perheen perustaminen jo aikaisemmin.

Suunnitelmat lasten haluamisesta, ajankohdasta ja lapsiluvusta ovat yksityisiä ja sensitiivisiä aiheita. Vaikka haaveet lapsesta siirretään myöhemmäksi, on nuorten aikuisten saatava tietää faktat aiheesta, koska media luo valheellisia mielikuvia rajattomista mahdollisuuksista saada lapsia. Lisääntymiseen liittyvien valintojen pitäisi perustua oikeaan tietoon ja terveydenhuollon ammattilaisen vastuulla on kertoa, silloinkin, kun ei osata kysyä.

Avainsanat: ikä, hedelmällisyys, viivästynyt vanhemmuus

Introduction

There are several factors that affect both female and male fertility. A person's own choices can influence most of these factors. The most significant factor affecting fertility is age. It is an incorruptible factor in the biological aging process of men and women. Every person will inevitably age, and no one can influence this process. Human physiology has not changed to serve the general trend of postponing parenthood. The youthful appearance says little about the condition of the gametes. Beauty has no age, fertility has. (Pedro et al. 2018; Fritz & Jindahl 2018.)

Delayed parenthood is a trend in Europe and is increasing with economic development around the world. Having children is timed later and later. In Finland 2019 mean age of primiparas was 29,5 years. Men become fathers first time in the age of 31,4 years.

Of all parturient, 24,4 per cent were over the age of 35. During the last years, the only age group in Finland, whose fertility rate has risen, are women aged 40–45 years (Statistical Report 48/2020.) The mother's age of the first child is approaching 30 years in developed countries, and now it is over 30 years in 28 European countries.

Ancient experience-based fact is that older women do not get pregnant. Researches verifies this fact. There is no natural way to conceive after menopause. Just a few decades back, we were openly talking about the 'biological clock ticking', when a woman became 30 years old and did not have children. Men's fertility decline has not been as clear, because there have always been fathers in older age. If they are biological fathers of their children, remains a secret.

Female fertility declines after the age of 30, and it is even more pronounced after the age of 35. The older the woman is, the greater are the risks of negative pregnancy outcomes. The latter may include a miscarriage, premature birth, gestational diabetes, or high blood pressure. Additionally, advanced maternal age can pose greater risks for the fetus, such as low birth weight or chromosome disorders. The consequences of ageing in fertility of men is far less studied than that of women, and the results are more contradictory. Results of the studies as to the commencement of the critical years of male fertility are inconsistent; some authors claim that male fertility can be affected already after the age of 30, still others are convinced that the fertility age limit begins at the age of 40. It is important to note that men's ageing will affect not only the pregnancy and the fetus, but also the child.

At the time of postponing the pregnancy, many risk factors for future pregnancies, such as the effects of being overweight (more

than 40% of Finnish mothers are overweight) increase with age; mothers and their partners are getting older and sicker. Not to mention environmental risks. And all these risk factors will cumulate during the postponing years.

The importance of age and its effect on fertility is by no means a new research finding. The facts are extensively researched and known. The latest research only adds to the amount of concern. Deteriorating male fertility and the multiple negative effects of the environment, both chemical and socioeconomic, combined with delayed parenting, produce only a positive cash flow to infertility treatment clinics.

Several studies around the world have found, that people do not have enough information about things that affect fertility, or the information is incorrect. Women, and especially men, underestimate the effect of age on fertility, i.e., the ability to have children. The potential of fertility treatments and technology to help overcome the age-related decline in fertility, in turn, is overestimated. (Hammarberg et al. 2017; Holton et al. 2016; Petersen 2016; Fritz & Jindahl 2018; Pedro & al. 2018.)

Misinformation, social media models and wishful thinking have blurred the ancient common understanding of fertile years. This false information is very powerful, and people easily skip all correct information that does not encourage to postpone having children. For example: We know that the amount of fertility treatments is increasing rapidly; This long process is costing a lot of money and it can be very unpleasant, full of hope and sorrow; Infertility treatments were developed to help couples, who had medical problems to conceive, not for aged people; It is not a secret that these treatments are not successful when a woman is older. Even in the case when an older womb can carry a fetus,

the egg cells are usually donated; also a man's age is affecting the results; Widely we have read that young men's semen quality is on a worrying level in Europe; There is a lot of knowledge about older men's children's possible risks; Age increases risks in pregnancy, and so on.

Everyone has the right to learn the facts about the impact of ageing on fertility and conception especially considering one's own gametes. Information should be clear and based on research because media is picturing a false image of endless possibilities. The best time for counselling about age-related fertility is early before a couple is planning to start a family. Later it is more difficult to discuss this very sensitive and private issue. It has been recommended that knowledge should be given in schools, in primary care, in contraceptive counselling and in health promotion, to reduce the risk of infertility. (Hammarberg et al. 2017; Pedro et al. 2018.)

The starting point for counselling is that the professional has the correct information on the topic, based on the latest research. This article brings together key age- and fertility-related themes in line with current knowledge to support guidance. The article is based on a narrative literature review, conducted first in 2019, that focused on the topic of age and fertility. In addition, the latest statistics and studies were used. The information was themed and crystallized from the perspective of practical guidance, the focus was on the synthesis of reliable guidance information on the topic of age and fertility.

It is challenging to bring up facts about the effect of age on fertility and reproductive health

Several researchers, all over the world, share the concerns of impaired fertility, and ways how to influence it are widely discussed. There is a long way to go from the researcher's desk to the client's guidance. Fertility counselling for "healthy" citizens before and around the age of 30 is not specifically anyone's responsibility. At least in such a way that the guidance meets all those who need it equally, and its content is in line with international recommendations. It has therefore been stated that every health professional should have the readiness and desire to inform every woman and man of childbearing age in different encounters, including the factors and risks affecting fertility. It is everyone's job to raise the issue of the prevention of unintentional infertility and the protection of fertility. Unfortunately, it often happens that everyone's job is not anyone's job.

Family planning and parenthood issues are intimate, personal subjects. When we asked young adults, if it is possible to ask and talk about timing of pregnancies, without hurting someone – the answer was NO. There is no more sensitive question than: "Do you want to have children in the future?" Maybe that is the reason, why we do not ask it. Although having children is a private and super sensitive area to discuss, young men and women should know the facts. Nobody should sleepwalk into infertility and ask: "Why were we not informed? We could have started earlier if we knew." These sentences were quoted from an interview with a specialist in a fertility clinic when she described a typical reaction in the situation when involuntary infertility is revealed. Women and men are often alone when considering raising a family. The matter is private and easily becomes a source of tension also between the couple.

Fertility is an individual trait and the age averages of the studies are only averages. For example, the onset of menopause can vary by 5 years without any disorder. Two men or women of the same age may be at a completely different stage of the fertility (descending) arc and in relation to each other, respectively. A young partner can partially compensate for the declining fertility.

Fertility figures usually show, for example, how many women in a given age group become pregnant in one year. The statistics do not indicate that a certain (%) amount would not become pregnant at all, but that fertilization may take more and more time from year to year. On the other hand, getting pregnant may be successful as soon as you are given the opportunity, regardless of the age of the couple. The surprise of natural fertility is a challenge for exact family planning and guidance.

Even a man's fertility decreases with age – not everyone is like Picasso

Picasso had his youngest child at the age of 67, probably naturally. Social media tells of family happiness of fathers in retirement age, but less often of the path that led to paternity. Fertility treatments can to some extent correct the effect of age on male fertility. Even one healthy sperm cell may be enough for artificial insemination.

The consequences of aging in fertility of men are far less studied than that of women, and the results are more contradictory and inconsistent. The decline in male fertility with age seems to be even a silenced or obscured subject. Results of the studies as to the commencement of the critical years of male fertility are inconsistent; some authors claim that it can be affected already after the age of 30, still others are convinced that the fertility age decline begins at the age of 35 or after 40. All agree that at least in the age of 40 a man has passed the best fertile years.

Male infertility is associated with the inability of sperm to fertilize an egg and the changes in sperm chromatin. Deviations in sperm count, quality, and motility cause infertility. Aging lowers the total number of sperm cells in semen, and after 30 years of age men begin to produce more abnormal changes in sperm shape and motility. When we add to this natural age-related deterioration the knowledge about recent findings of European sperm loss, (the worrying shortage of capable sperm in young men), we can summarize that the fertility of men does not improve with age, but vice versa. The number of viable sperm in young Finnish men decreased later than in the rest of Europe, but those born in the 1980s and 1990s achieved as bad results as other young European men. The amount of sperm has decreased almost 60% during the last 40 years in Europe. Male sperm production continues for a long time, but the sperm production capacity, received by the boy at birth, does not improve, only decreases with age. The quantitative capacity reached at the age of 19 is no longer increasing, but the quality and motility of sperm may still improve slightly in young adults. (Perheentupa et al. 2016.)

The worst situation in Europe is in Switzerland, where a study (Rahban et al. 2019), found that among young men, only 38% had sperm count, motility, and morphology in semen analysis above the WHO recommended value for a fertile man. The phenomenon is probably due to environmental changes. The study found a significant association with maternal smoking during pregnancy. As a consequence of this poor situation, it can be predicted that, if pregnancy is desired, it may take longer before the pregnancy begins, and the amount of fertility treatments will also increase. (Rahban et al. 2019.)

A man's aging may affect conception, pregnancy, fetus, and the future health of the infant. Children of fathers over the age of 45 have more learning disabilities, autism, schizophrenia, and

some cancers (Pedro et al. 2018). There is clear evidence of a link between a man's older age and sperm count, motility, and morphology; the aging of a man significantly increases genetic and epigenetic sperm damage. The association of male aging with miscarriages in early pregnancy that are not dependent on a woman's age is known, as is the poorer success of becoming pregnant naturally and with intrauterine insemination. (Petersen 2016.)

At a younger age (25–30), the man has mobile and best quality sperm, as well as the best individual number of sperm cells to fertilize a partner. The impact of lifestyle may improve or degrade fertility, but baseline production capacity cannot be increased. In artificial fertilization, the best sperm can be selected for a petri dish (IVF, in vitro fertilization) or it can be injected directly into an ovum (ICSI, intracytoplasmic sperm injection). This can correct sperm problems, both quantitative and qualitative, and thus bypass the effect of age on fertility decline. Although a significant decrease in success of IVF treatments has been observed in the later stages of blastocyst development when sperm from a man over 55 years of age are used, the association of paternal age with the success of IVF and ICSI treatments has not been demonstrated (Petersen 2016).

Men's fertility awareness is on lower level than women's. In addition, men seriously underestimate female and male natural age-related fertility decline, especially if the couple is healthy and fit. They overestimate the possibilities of fertility treatments to overcome age-related infertility. Because men play an important role in family planning, they need more specific information aimed at them. If a man wants to become a father of a healthy child, he shouldn't wait too long. (Hammarberg et al. 2017; Pedro et al. 2018.)

The most fertile age of a woman is 20–30 years

Female fertility declines after the age of 30, and it is even more pronounced after the age of 35. The older the woman, the greater are the risks of negative pregnancy outcomes, among other more miscarriages or premature births, more gestational diabetes, or high blood pressure. Additionally, advanced maternal age can pose greater risks for the fetus, such as low birth weight or chromosome disorders.

Female infertility is often caused by poor egg quality. Egg cells are as old as the woman is. Best egg cells are used first. A woman is carrying (and nourishing, well or poorly) her egg cells throughout her fertile life. The amount and the quality of eggs are decreasing by the years. By the time a woman is 30, she has lost 88% of her eggs, and by the time she is 40 she has lost 97% of her eggs. In addition to the decrease in number, the quality of oocytes deteriorates with age and the number of chromosomal aberrations increases rapidly after the age of 35 years. The gradual aging of the ovaries as well as the loss of quality eggs occurs even if a woman takes good care of her health. (Fritz & Jindahl 2018.)

In Denmark (Rothman et al. 2013) it was shown that the fertility of a woman, who has not given birth (nullipara) begins to decline as early as in age 30 and accelerates rapidly after 35 years. Having delivered earlier (multipara) delays and alleviates the decline in fertility a few years later. Multipara have, between the ages of 20 and 40, the same chance of conception and show a clear spike at the age of 29–30. In the group of nullipara, there is little increase in fertility, and the decline begins as early as the age of 28, i.e. earlier and is steeper. In men, the decline is slower and begins after the age of 30. It can be concluded that the fertility of a couple of the same age at the age of 40 is half of what it was at the age of 30. (Rothman et al. 2013.) In several studies, a clear decline

in female fertility is timed to begin at about 34 years of age. (Rothman et al. 2013; Wesselink et al. 2017.)

The issue has been further studied, for example in North America, with partly similar results. Wesselink and his partners (2017) showed that, when the effect of a woman's age and other factors was standardized, a man's age would not be a strongly influencing factor in the decline in fertility, at least before the age of 45 years. In the same study, when the curve describing the calculation of female fertility was standardized, the result was a linear decrease after 21–24 years, with no increase at 30 years of age. The positive effect of childbirth on the preservation of fertility was also found in this study. (Wesselink et al. 2017.)

The curve of the decline in female fertility follows the curve of increasing age, and the decline is accelerating, according to several sources, at the age of 34 years. Childbirth postpones and slows the decline in fertility. The decline in male fertility occurs a little later. It should be noted in the guidance, that fertility statistics show, how many women in a certain age conceive in a year when pregnancy is desired. The later you try to get pregnant, the more likely it is, that it will take longer. On the one hand, closer to the age of 30, there is no reason to rush to start infertility treatment, if the couple is healthy and conditions for pregnancy are good, even if the pregnancy is not successful during the first year. On the other hand, it is a good idea to start early enough, so that the couple is suddenly not in a situation where you are no longer likely to become pregnant, even when assisted. When starting a family, it is advisable to consult the fertility specialist, who can do more detailed examinations if necessary.

Postponing the timing of the first child can lead to smaller families than the couples hoped for

If the couple's desire is to have more than one child, it is advisable to start early. Postponing the moment to conceive can result in smaller families than originally desired. The decline in fertility of women, who have not given birth, has already been described above. If the pregnancy is postponed for a long time, the chances of having the desired number of children are reduced.

Habbema et al (2015) showed, that if 90% success is desired, and the couple hopes to achieve pregnancy naturally, without fertility treatments, and they are aiming for one child, they can begin at age 32. If they wish to have two children naturally, it would be a good idea to start trying to conceive when a woman is 27 years old. When more children are desired, better to start already at the age of 23. If the couple is ready for fertility treatments, the pregnancy can be postponed a little later.

Table 1. Maximum female age at which couples should start building a 1-, 2- or 3- child family in natural way or by using IVF (Habbema et al. 2015).

Desired family size	1-child family	2-child family	3-child family
Chance of realization without IVF	female age	female age	female age
50%	41	38	35
75%	37	34	31
90%	32	27	23
Chance of realization with IVF			
50%	42	39	36
75%	39	35	33
90%	35	31	28

Infertility treatments cannot overcome and cure age-related infertility

The success rate of in vitro fertilization (IVF) using a woman's own eggs, drops dramatically after the age of 35. IVF successes decrease by about 10% in 2 years, which corresponds to a woman's natural decline in fertility. After the age of 43, successes with own eggs are rare. With donated eggs and sperm, fertilization may be more successful. (Fritz & Jindahl 2018.)

In regions, where law or religious beliefs prevent using donated gametes, the only way is to continue IVF-treatments over new cycles if the cost is not the barrier. Patients older than 40 to 42 years are less likely to conceive with repeated cycles. (Khalife et al. 2020.)

Egg freezing, developed for the problem of egg aging, is becoming a trendy phenomenon. The possibility of freezing eggs will help women, who due to cancer treatments or other illness, will no longer have their own healthy eggs available later. As a remedy for aging, the realization of pregnancy corresponds to the process of donated eggs, but the number of successes is lower. (Fritz & Jindahl 2018.) The method is new, and the discussion of results is ongoing. If something can be done, it does not mean it is a recommendation.

As mentioned above, some male-induced causes of infertility, such as the problem of low sperm count, can be overcome by infertility treatment methods, but it must be remembered that sperm quality begins to deteriorate after the age of 30, and at some point may require donations of sperm to succeed. From a guidance perspective, this information is very relevant to some couples. Consideration needs to be given to whether potential children are wanted with the couple's own gametes or whether they are also willing to use donated gametes.

Fertility treatments were not primarily developed to correct the effect of age, but to remove other barriers. The limitations of freezing sperm and eggs should be recognized. Older women have a harder time getting the pregnancy to continue, even if fertilization has been achieved. With donated egg cells and sperm, the success is better.

Older age is related to complications during pregnancy and childbirth

The term *Primipara Vetula*, was earlier used for first-time mothers over 30 years of age. It was intended to emphasize the increased risks associated with age and to highlight the need for closer monitoring during pregnancy and childbirth. The physiology and reproductive health of a woman have not changed, although it is no longer appropriate to call the current norm-aged mother old.

The older a woman is, the more risks there are in pregnancy. Even, if the woman gets pregnant after 40 years, the possibility of miscarriage and pregnancy complications are more likely. After the age of 40, miscarriages multiply and premature births, low birth weight, gestational diabetes, placental problems, and high blood pressure, will double compared with women aged 25–29 years. The association between fetal chromosomal aberrations and genetic abnormalities and maternal age has long been known. Cesarean section or other obstetric procedures are more common as a method of childbirth, and perinatal complications are more common in the aged women. (Klemetti 2017; Pedro et al. 2018; Fritz & Jindal 2018.)

Conclusion

Several factors, positive or negative, affect both female and male fertility. Lifestyle risks are cumulative and will be increasing during the years couples postpone the pregnancy. Lifestyle risks contribute to increase the risks during pregnancy and childbirth. A person's own choices can influence these factors.

There is a lack of sufficient fertility awareness within the reproductive-age population. The youth and young adults have the right to learn the facts about the impact of ageing on fertility and conception especially considering one's own gametes.

Information should be clear and based on evidence-based facts about the reproductive lifespan, because social media is picturing a false image of endless possibilities. Even in the case when an older womb can carry a fetus, the egg cells are usually donated. The best time for counselling about age-related fertility is long before a couple is planning to start a family. Later it is more difficult to discuss this very sensitive and private issue. It is also good to remember that when we are talking about getting pregnant and having children, individual differences are significant, and there is always a chance for miracles.

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Exploring fertility in the context of culture

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Abstract

Culture plays a very important part in sexual and reproductive behaviors and motivations. Understanding culture's role as a background factor, one can understand fertility better. For most cultures, little girls are expected to become mothers, little boys as future fathers and their offspring as protection from support against the ailments of old age. Nowadays, the survival instinct has superseded the reproductive instinct in many cultures and the current generation is opting out of the prospect of child rearing because of the lack of security and poor outlook of the future. It is known that events in the world history and the development of different cultures has formed peoples view on sexual and reproductive health, specially fertility. With time, cultures and paradigms change. It is time to start planning for and implementing sustainable fertility. Actions to safeguard reproduction health must be put into place not only for better health but also to better include cultural and societal factors in fertility education.

Keywords: culture, society, fertility, birth rate

Tiivistelmä

Kulttuurilla on erittäin tärkeä rooli seksuaali- ja lisääntymiskäyttäytymisessä ja motivaatioissa. Kulttuurin roolin ymmärtäminen taustatekijänä, voidaan hedelmällisyyttä ymmärtää paremmin. Useimmissa kulttuureissa pikkutyttöistä odotetaan tulevan äitejä, pikkupojista isiä ja heidän jälkeläisistään suojaa vanhuuden vaivoilta. Nykyään selviytymisvaisto on ohittanut lisääntymisvaiston monissa kulttuureissa ja nykysukupolvi jättäytyy pois lasten hankinnan mahdollisuudesta turvallisuuden puutteen ja tulevaisuuden huonojen näkymien vuoksi. Tiedetään, että maailmanhistorian tapahtumat ja eri kulttuurien kehittyminen ovat muovanneet ihmisten ajatuksia seksuaali- ja lisääntymisterveydestä, erityisesti hedelmällisyydestä. Ajan myötä kulttuurit ja paradigmat muuttuvat. On aika alkaa suunnitella ja toteuttaa kestävää hedelmällisyyttä. Lisääntymisterveyden turvaamistoimia on otettava käyttöön, eikä ainoastaan terveyden edistämiseksi vaan myös kulttuuristen ja yhteiskunnallisten tekijöiden mukaan ottamiseksi ohjaukseen ja opetukseen.

Avainsanat: kulttuuri, yhteiskunta, hedelmällisyys, syntyvyys

Introduction

Fertility is an integral part of the human condition. Although it is a concrete biological concept, a means for the human species to ensure its survival through the transfer of genetic information from one generation to the next, fertility is very much intertwined with abstract human concepts such as culture and history. The interplay of these two has profound and far-reaching consequences to the lives of each one of us today, to those who came before us and the lives of succeeding generations. To have a better understanding of this, we need not look further than 70 years ago, in the aftermath of the deadliest crisis in human history: World War II. Following the horrors of two global wars and the Great Depression during the first half of the 20th century, the post war era was characterized by rebuilding and optimism.

A new global culture was born, with the United States at the forefront. (Greenwood, Seshadri & Vandembroucke 2005.)

Economies from Asia to Europe were rising literally from the ashes and these brought forth wealth and a burgeoning middle class. Because of newfound wealth and optimism, along with the advances in technology and health care, couples were getting married and having children earlier, their new circumstances allowed them to be stable enough to support multiple children. The widespread phenomenon and the unprecedented rise in fertility after the greatest crisis in human history led to the generation of our parents, the so-called baby boomers (Greenwood et al. 2005). This is the generation that is leading the world today and in turn they have shaped modern culture and politics. Their collective actions, decisions and behaviors as a generation had a ripple effect to us -their children. They gave precedence to our contemporary culture and to the belief systems we have now, and their influence can be seen in how we ourselves explore fertility. The excesses of the previous decades have caught up with us, unfortunately.

Accelerated climate change, a shrinking middle class, and stagnant wages characterize our times which is a far cry from the bright and optimistic times post-war. In effect, we have as a generation a more cynical culture and more pessimistic view on the future, leading many couples to put off getting married, let alone have children. Birth rates are falling in many industrialized nations and governments are supplementing this with immigration (Alho 2008). Like knots in a gigantic proverbial ball, we find our economics, politics and culture tangled up to the mess we are witnessing in the world right now. However, we often neglect to see the driving force behind it all – fertility.

Female fertility through changing times

The broad definition of fertility according to Britannica (2019) “is the ability of an individual or couple to reproduce through normal sexual activity. Normal fertility requires enough healthy sperm by the male and viable healthy eggs by the female, successful passage of the sperm through open ducts from the male testes to the fallopian tubes, penetration of a healthy egg, and implantation of the fertilized egg in the lining of the uterus.” Any interference in the process interrupts the fertilization process.

It is inherent for every species to have the biological need to reproduce to ensure its survival. This was more evident for most part of human history when most cultures were agrarian. Before the industrial revolution, infant mortality was higher and life expectancy was generally lower and consequently, families needed to have more offspring to inherit and look after the land. Women’s roles were completely different as opposed to the situation we have now. Women were limited to perform mainly domestic duties at home. A woman unable to conceive at the time was looked at with pity and concern. In some cultures, if a couple was unable to have children, initially the woman was divorced, or the husband took a second wife if the culture permitted polygamy (WHO 2015). Reproductive health was also unheard of during those times and nearly everything was governed by superstition and beliefs imposed by the doctrines of the time. Fertility during that era was seen like the land itself, the very thing that ensured life and survival. A fertile land meant more food and prosperity. Fertility goddesses were even worshipped in certain cultures to ensure a good harvest. Womanhood and the land were perceived interchangeably. Here we see how fertility and culture have an equal effect on one another. And this continues to hold true even in the modern era.

With time, cultures and paradigms change. Alongside the development of technology and safe healthcare, also came the rise of progressive ideas such as feminism and freedom of choice. Women, for the last 100 years, have been able to forge their own careers and the conventional views regarding motherhood has become increasingly obsolete, especially in the western world. Developing countries however still maintain a traditional view on fertility and womanhood, as seen in cultures in Asia and Africa.

Today, Africa remains among the highest in fertility rates with an average of 5 children per woman throughout their lifespan, compared to an average of 2.5 children per woman globally. Research has shown that the democratic transition in terms of high fertility and mortality rates to lower fertility and mortality rates, has a proceeding difference as compared to other regions in developing world. Based on research, countries like Sub-Saharan Africa, experienced a much later onset of transition, in addition, the transition pace was slower. There was a decline of fertility rates by 37 percent between 1960 and 2005 which was a lower percentage compared to the 61 percent decline in Asia and Latin America over the same period. Despite the decline of fertility rates between 1960 and 2005 in Sub-Saharan Africa, it's evident that the fertility rate is higher compared to the resources available to meet the demands of the growing population at the desired pace. In turn these are having a toll on economic development, living standards, education attainments and health care resources (Mueni 2016).

Cultural Paradigms and Fertility

The word culture has been given different definitions throughout the centuries based on different contexts and settings. However, the anthropologists approach its definition from a different angle. Culture is a shared set of (implicit and explicit) values,

ideas, concepts, and rules of behavior that allow a social group to function and perpetuate itself. Rather than simply the presence or absence of a particular attribute, culture is understood as the dynamic and evolving socially constructed reality that exists in the minds of social group members. It is the 'normative glue' that allows group members to communicate and work effectively together. (Hudleson 2004.)

The most extreme example of cultural shift from the traditional agrarian culture to the modern era is most evident in Japan. The same may also be said for the United States and Europe but this phenomenon is more accelerated in Japan and has happened only within the last 70 years post-war. For thousands of years, Japan held a very traditional view on fertility, it being an agrarian society for centuries. However, to rebuild the society after the war, a collective shift occurred in Japanese society in a sense that women were to become an integral part of the workforce (Makoto 2001). For decades this has worked to help the Japanese in building the ultramodern nation we know of today. Most Japanese families during this era were nuclear- meaning for most households, where only the children and their parents lived. Both parents usually worked in demanding office jobs while the children were at school. This was vastly different from the traditional Japanese household in a rural setting where generations lived under one roof and women were at home tending to their children.

The effect of this new familial set up comes with a price, however. No one has foreseen that the work and productivity culture Japan has built for itself would lead to an unintended consequence; the nation now has the lowest fertility rate in the world. Women are putting off pregnancy and working on their office careers and families are opting for less children. The population is aging, and this has exacerbated the infertility issue as the younger workforce

is under pressure to maintain Japan's highly developed economy by working the longest working hours in the world. Younger people have put off being married and having children altogether. With current trends, the population of Japan is expected to drop from the peak of 120 million today to 100 million in 2050. This sheer drop could potentially have major economic and social consequences for the country. Solutions to the current situation has yet to be identified as Japan is known to be averse to mass immigration. Being the innovators that they are, they would much rather look to robotics to maintain and sustain the population than to immigration. Based on a research conducted in Japan in 2013, it was confirmed that Japan had the world's oldest population with a median age of 46 years, an average lifespan of 84, and a quarter of the population over 65. The population have declined by a quarter of a million in the fifth consecutive year. As a result, falling birth rates have put Japan's fertility at 1.4 children per woman. (Pearce 2014.) This raises questions as to what the future holds for the country?

On the opposite end of the spectrum is Nigeria. Nigeria has one of the highest fertility rates in the world. By 2050, Nigeria is expected to be the third most populous country, overtaking the United States. Lagos is expected to be one of the largest future megacities on the planet. With its recent oil boom and a semi agrarian culture that holds traditional views on fertility and womanhood, families are encouraged to have more children. Nigeria also has a developing health care system which in turn has decreased infant mortality rates and increased overall life expectancy. It is also established that East Africa (Rwanda, Uganda, Tanzania, Zambia, and Ethiopia) has the highest fertility rate globally with one woman having an average of 5 children. The total fertility rate ranges from 3.8 to 6.3 children per woman. Despite the high fertility booming rate in these countries, gender

attitude research show that males between the ages of 15–24, want 0.2–0.7 more children. Some of them believe that the husband has ultimate decision-making authority in a household and therefore always have the right to have sex. (International Perspectives on Sexual & Reproductive Health 2013.)

These facts raises questions as to why this is the case whereby, on the other side of the globe there's a crisis and worry about population depletion while on the other side there are high fertility rates and large population which affects the country's economics with high strain due to lack of basic amenities to maintain the growing population.

Health consequences of high fertility rate remain a threat to the health of women and children to a worrying extent. Women are at a higher risk of dying from maternal causes due to a higher birth rate. According to WHO, in 2015 303 000 maternal deaths occurred globally of which 300 000 were in low and middle-income countries. An average ratio of maternal deaths was 242:100 000 live births. With these ratios, it was found that the higher the number of children the woman had, the higher was the chance of dying from maternal causes. The risk of maternal death increased in Sub-Saharan Africa by almost 5% for women with many children and for women of older ages who still have children. (WHO 2015.) It's therefore beneficial and essential for these women to have enough knowledge regarding family planning to avoid the high-risk pregnancies and births. While culture and industrial factors play a big role regarding human fertility, it's possible to achieve reproductive health by correct means. Actions to safeguard reproduction health must be considered and put in place and not only for better health but also should involve and include cultural and societal factors in fertility education (Stover et al. 2016).

Human Instinct and Fertility

It has been stipulated that the human desire to have children albeit driven by biological processes, is not a basic drive at par with the need for food, water, and shelter (Lorimer 1954). On the contrary, reproduction is viewed as a motive, controlled by social rewards and punishments. Childbearing behaviors are observed to be affected by promises of security, happiness, and approval from the immediate social environment. For most cultures, little girls are expected to become mothers, little boys as future fathers and their offspring as protection from support against the maladies of old age (Lorimer 1954).

The drive for reproduction is not a basic survival instinct. The need for food, water and shelter are all driven by biological processes but the need for reproduction although necessary for the continuation of our species, is driven by societal contexts. Hence culture plays a very important part in reproductive behaviors. This explains the phenomenon occurring in many industrialized countries with falling fertility rates. The survival instinct has superseded the reproductive instinct in these cultures and the current generation are opting out of the prospect of child rearing because of the lack of security and poor outlook for the future. Many households in the West need both parents nowadays to have a stable and sufficient income to support the daily upkeep of looking after children. Stagnant wages, poor job prospects and rising costs have put young people of today into survival mode and have pushed aside societal expectations of having children in order for them just to have a roof over their heads and food on the table. The consequences of these current trends are still way ahead at some point in the future but with great probability, they would be negative if no long-term solutions are found.

So, one might ask, what would explain the rising birth rates and positive attitudes to fertility and child rearing in developing countries? For one, many of these cultures still uphold the traditional views of men and women. Women play a less substantial part of the workforce and for many, child rearing and domestic duties at home comprise the woman's family life (Nahar & Mengo 2019). Social norms dictate that a woman must perform a certain role which is in the opposite of the accepted view in the West where women are more empowered, have more choice and have greater leverage against what the society dictates is expected of them.

Reproductive health and education as well as family planning methods are also lacking in many developing countries with rising birth rates. Contraception may even be viewed as against the doctrines of the prevailing religion in these societies. Many catholic countries are averse to the use of condoms and IUDs since it goes against the dogma of the Church. According to the research conducted in South Asia and Sub-Saharan Africa, women have no voice, and their autonomy does not taken into consideration their sexual and reproductive health in issues like childbearing, contraceptives, marriage and abortion due to the societal norms and cultural restrictions in the society and immediate community (Nahar & Mengo 2019).

Research has also been done on what motivates reproductive behaviors to help give light to the cultural phenomena attributed to fertility in the examples above. Several studies have been done to explain human behavior and culture as it correlates to fertility and the drive for reproduction. Many of them are based on the following theories. The first of which is the Attachment Fertility theory which states that human beings are set apart from other species in terms of fertility and reproduction in general as we tend to only have one mating and reproductive partner as opposed to

other animal species that have several partners and short mating behaviors. (McAllister et al. 2016.) In the case for humans, strong and enduring relationships according to this theory motivate us to reproduce. This can be seen in our contemporary culture where most people would aim for a long and stable relationship with someone before setting the stage for familial life.

Another premise used by the research done by McAllister et al. (2016) is the Life-History theory, which suggests that we make trade-offs in the road to achieving needs in life due to our finite time and limited resources (McAllister et al. 2016). This explains the economic factors as it relates to fertility and why there have been periods of high fertility during times of plenty but lower rates of childbirth during periods of history marked by hardship. Humans have the tendency to put off fertility to meet the needs necessary for survival.

The third theory in McAllister's research (2016), is the Terror Management theory which explains the psychological conflict we have as a species that our mortality induces in us a fear of death that we alleviate by reproduction as it ensures that something from us is passed on.

The theory of Planned Behavior is also an important premise as it suggests that societal expectations influence individual decision making as it relates to reproduction. From here we can draw out that a person's culture and other learned behaviors from that cultural context influence whether a person decides to have children or not and how many offspring they intend to have. McAllister et al. (2016) also points out that surrounding macro environment like government policies and economic crises also affect individual decision making. This is important in shaping legislature affecting people's reproductive health and well-being.

The transmission competition hypotheses explain well the phenomenon in high income countries in which the fertility rates are below-replacement fertility levels as in the extreme cases in Japan, Korea and Europe which has been discussed beforehand. It correlates with the thought mentioned earlier suggested by the Terror management theory that our fear of mortality drives us to reproductive behaviors to ensure a sense of legacy. In the case of highly developed countries, instead of having children as a form of legacy, many people are driven to have career achievement and wealth accumulation which in a sense gives an individual a feeling of fulfilling something within the limits of finite time and passing on something to the next generation.

Conclusions

To understand high human fertility rates in developing countries and threatening population depletion in developed countries, cultural and industrial factors affecting human fertility must be identified and amended. While current studies show population depletion globally, overpopulation remains a global challenge (World Economic Forum 2021).

Culture is an important aspect in understanding the fluctuating fertility rates globally. The values of culture and religion are to be taken into consideration while trying to modify sexual activities in relation to reproductive sexual health. Subjects of sexual activities and reproductive sex are to be addressed without feeling of shame or fear of cultural retributions. Some societies still hold strict taboos against open discussion of sexual related subjects and education while others bare no restriction. There still begs for more reliable and educative information to the society and community. This dilemma of lack of informative, evidence-based information regarding fertility and population still leaves unanswered questions. According to Jennings (1970), despite

the developed and sophisticated methods of communication, a pool of reliable information, and the effectiveness of inexpensive contraceptives; why are the birth rates still high in developing countries? Why do parents in some cultures continue to have large families despite the privation and starvation confronting them? What influences affect women and cause them to bear unwanted children? What has the government done to initiate successful educative and control measures regarding fertility? What role does cultural norms and religious values play in affecting the fertility rates? An understanding is needed in these areas to be able to effectively develop measures that will help control the fertility rates. (Jennings 1970.)

We have also discussed some important theories that help to explain our motivation for reproduction. Each culture is different and have different perspectives to life and mortality but the one thing that ties everyone together is our mortality and that we have a finite time on earth. Knowing this, we react and have the primal desire to leave a mark on this earth before passing on. Most cultures ensure this sense of “immortality” in the form of children while other cultures emphasize achievement and prosperity which is a deterrent to fertility replacement rates. Other theories purport how our environment influences mating behaviors. Humans tend to have positive attitudes to childbearing and reproduction during periods of rapid economic development, but we also have the tendency to put aside reproduction in times of hardship to ensure our survival by meeting other basic needs.

To improve reproductive health, its essential to pay attention to the cultural and societal norms, as well as environmental factors affecting fertility. It’s important to recognize and reinforce correct intervention measures and educative programs in the needed areas. Educative programs about reproductive health and fertility, will help people make better and more effective future choices.

The legislative bodies of each country must be aware of the context of their contemporary cultures before passing any form of directive on reproduction and studies must be made on how these affects everyone's decision making on an individual level.

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Fertility awareness; what a woman (and men) needs to know

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Abstract

Fertility awareness-based methods (FABMs) of natural family planning adopt several approaches to detect the fertility phase of the menstrual cycle and the time of the ovulation. For decades, this knowledge was the focus of attention for avoiding pregnancy. Thereafter, this knowledge was used to help couples to enhance their chance for having a baby. In 2015, the American College of Obstetrics and Gynecologists shed another light on this subject and emphasized to use the menstrual cycle as a “vital sign” (reaffirmed 2017). It is not important to know for what purpose a woman wants to use the knowledge about monthly sexual cycles, this knowledge, however, provides her the opportunity to be connected to her sexuality, to manage her sexual life and to be a competent supervisor of her health.

Keywords: ovulation signs, menstrual cycle, fertility window, symptothermal methods

Zusammenfassung

Methoden zur natürlichen Familienplanung beruhen auf Bestimmung der fruchtbaren und unfruchtbaren Tage Menstruationszyklus und den Eisprung. Tage Jahrzehntlang diente dieses Wissen für die Verhütung einer Schwangerschaft. Später fanden diese Ansätze aber auch in Familienplanung für Paare für gewollte Schwangerschaften ihren Stellenwert. Im Jahr 2015 warf das American College für Geburtshelfer und Gynäkologen ein neues Licht die Thematik und

betont den Menstruationszyklus als „vital Zeichen“ zu bezeichnen. Ob sich eine Frau ihr Wissen über den monatlichen Zyklus zur Familienplanung oder Schwangerschaftsverhütung aneignet ist in Zusammenhang mit präkonzeptioneller Gesundheit und Prävention nicht von Bedeutung. Wesentlich ist, dass jede Frau genug Wissen hat um ihr Sexualleben zu managen und kompetent genug ist, ihre Gesundheit als gebärfähige Frau zu erhalten.

Stichwörter: Eisprung Anzeichen, Menstruationszyklus, Fruchtbarkeitsfenster, symptothermale Methode

Introduction

Complex interactions in hypothalamus-pituitary–ovarian axis regulate female monthly sexual cycles (Hall 2015) (or less accurate menstrual cycle). The events of a normal menstrual cycle lead to the preparation of the ovum for fertilization and the uterus to receive the zygote. The sequence of events occurring in one ovary (or the other) during a menstrual cycle is known as the ovarian cycle. The ovarian cycle is characterized in three phases: follicular phase, ovulation phase and luteal phase. The results of the ovarian cycle are follicular development and maturation as well as the production of ovarian sex hormones. The preparation of the uterus for implantation of the zygote is called the uterine/endometrial cycle. It involves three phases including menstruation, proliferative and secretory phase. (Cunningham et al. 2018; Marshall & Raynor 2020)

A normal menstrual cycle has three distinguished characteristics. It is a combination of the periodic and regular events. The initiation of menstrual bleeding ends a cycle and starts the next at the same time. This is a noticeable sign providing opportunity to follow up the events of a cycle. Female capacity to conceive a baby is limited to fertile days of each cycle known as fertility window. These characteristics constitutes a framework for investigating menstrual events.

The fundamental knowledge about menstrual cycles involves menstrual patterns and signs indicating the occurrence of ovulation.

Menstrual patterns

Menstrual bleeding is the noticeable characteristic of female monthly sexual cycles and subsequent to the endometrial response to declination of progesterone in the absence of pregnancy. Progesterone withdrawal activates the production of prostaglandins. Prostaglandins are responsible for vasoconstriction, myometrial contractions, and decrease in the blood flow of the endometrium, tissue breakdown and initiation of menstruation. (Cunningham et al. 2018)

Menstruation extends from menarche to menopause. Menarche is the first menstrual bleeding (Marshall & Raynor 2020) and takes place within 2 to 3 years after the onset of the breast development (Hillard 2013). This can be anytime between ages 9 to 15 by average 12.8. The onset of menarche depends on several factors including heredity, physical body, nutrition etc. Menopause is normally the termination of reproductive age and the cease of menstrual cycles. It occurs around age 50. The patterns of menstrual bleeding are definable by several parameters. While avoiding medical jargons, these parameters include frequency, regularity, duration, intervals and the volume of blood loss. The normal range for each parameter is age-dependent.

The frequency of the menstruation depends on the length of cycles. The length of menstrual cycles in adolescents is normally 21 to 45 days (Hillard 2014). The first menstrual cycles can be longer than the subsequent cycles. In adult, normal menstrual cycles range between 21 to 34 days long (Table 1). Menstrual cycles can be frequent, normal or infrequent. Regularity of

menstruation refers to cycle-to-cycle variation over 12 months in days. Regular variation is about ± 2 days to 20 (Table 1). Menstrual cycles can be irregular, regular or absent. Menstruation is irregular, if the cycle-to-cycle variations over 12 months are more than 20 days. Predictability of menstrual cycles is a sign of menstrual regularity. The duration of blood flow can be prolonged, shortened or normal. The normal duration of menstrual bleeding ranges approximately between 5 to 8 days in each menstrual cycle (Table 1).

The volume of blood loss can be heavy, normal or light. The normal range of blood loss in each menstrual cycle is 5 to 80 ml (Bahamondes & Moazzam 2015).

Table 1. Normal parameters of menstrual cycles in the middle of reproductive age (adapted from Bahamondes & Moazzam 2015)

Frequency	21–34
Regularity	± 2 days to 20 days variation in one year
Duration	5–8
Volume of blood loss	5–80 ml

A woman can assess her blood loss with more accuracy by using a pictogram. Pictograms (Fig. 1) offer measuring keys for assessment of blood on each feminine sanitary product and any extraneous blood loss (Dasharathy et al. 2011).












Feminine Pad	Type	Score	Tampon	Type	Score	Extraneous	Type	Score				
	Day	1 mL		Light	0.25 mL		Light	1 mL				
	Night	1 mL		Medium	0.5 mL							
	Day	2 mL			Heavy				1.0 mL		Moderate	3 mL
	Night	3 mL			Super				1.0 mL			
		Day	3 mL			Light	0.5 mL					
Night		6 mL	Medium	1.0 mL								
		Day	4 mL			Heavy	1.5 mL		Heavy			
	Night	10 mL	Super		2.0 mL							
		Day	4 mL			Light	3.0 mL					
		Night	10 mL			Medium	4.0 mL					
			Heavy	8.0 mL								
				Super	12.0 mL							

Figure 1. Assessment of menstrual blood loss by pictograms with blood equivalents. (Adopted from Dasharathy et al. 2011, by Wyatt, Dimmock, Walker et al. 2001. Determination of total menstrual blood loss. *Fertility and Sterility*, 76(1), 125–131)

Ovulation signs

Menstrual cycles may occur regularly but not be considered fertile. Ovulation signs are the prime signals of fertility status. The capacity of a woman for identification of ovulation signs is known as fertility awareness (Vigil, Blackwell & Cortés 2012) Fertility awareness enables a woman to monitor the events of a menstrual cycle with or without using smartphone-based approaches or home device technology for hormonal detection.

Natural family planning has used fertility awareness-based methods, known as the symptothermal method, for decades. Symptothermal method combines one or more ovulation signs including cervical mucus, the cervical texture, the cervical location or preovulatory opening of the endocervical canal (the cervical pupil sign) with the Basal Body Temperature (BBT) and/ or historical cycle data. For monitoring fertile and infertile phase of each menstrual cycle, a woman can use two signs for double check and confirmation (Pallone & Bergus 2009).

Fertile days of a normal menstrual cycle is calculated according to the capacity of ovum for fertilization and the ability of spermatozoa to survive in female genitalia tract. After ovulation, ovum loses its capacity for fertilization in 10 to 24 hours (Thijssen et al. 2014). Spermatozoa can survive maximum for five days within female reproductive tract (Pallone & Bergus 2009). Consequently, fertile days account for 5 days preceding ovulation and the day of ovulation itself (Thijssen et al. 2014). These days are known as fertility window, in which a woman has highly chance for getting pregnant. However, the studies have shown that the length of fertility window is not the same for every woman and every menstrual cycle. It varies from one to five days with average of three days for a normal menstrual cycle (Fehring & Schneider 2008).

The patterns of the cervical mucus

John and Evelyn Billings (1972) developed the understanding of the changes in the cervical secretion during a normal menstrual cycle to provide a practical method for natural family planning (Pallone & Bergus 2009). This knowledge constitutes the foundation of the Billings Ovulation Method. In this method, a woman can distinguish infertile and fertile days through self-observation of the cervical secretions during a menstrual cycle. The changes in cervical secretions occurs in response to the alteration of the ovarian sex hormones during a menstrual cycle (follicular, ovulation and secretory phase). Cervical secretions are categorized regarding sensation at vulva (dry, moist, wet, and slippery), appearance (white/ yellow, clear) and consistency (tacky, creamy, stretchy) of the mucus. (Ecochard et al. 2015) Rising estradiol in preovulatory phase triggers the production of E mucus by the endocervical glands. E mucus is identifiable as wet, slippery, clear and stretchy mucus. This type of mucus is necessary for the functional maturation of sperm, the transport

and survival of the spermatozoa. After ovulation, progesterone surge triggers the secretion of the second type of mucus known as G mucus. G mucus inhibits the transport of sperm because it is hostile to its motility. G mucus is dry, sticky, cloudy and without stretching ability (Vigil 2012; Thijssen et al. 2014; Ecochard et al. 2015).

It is recommended to check cervical mucus afternoon or / evening on the fingers, underwear, tissue paper or by sensation in or around the vagina (WHO 2018).

The cervical location and cervical texture

Before ovulation, the cervix is firm, low located and tilted. At ovulation, it is soft, straight and raised. Soon after ovulation, it returns to its preovulatory condition. (Fig. 2)

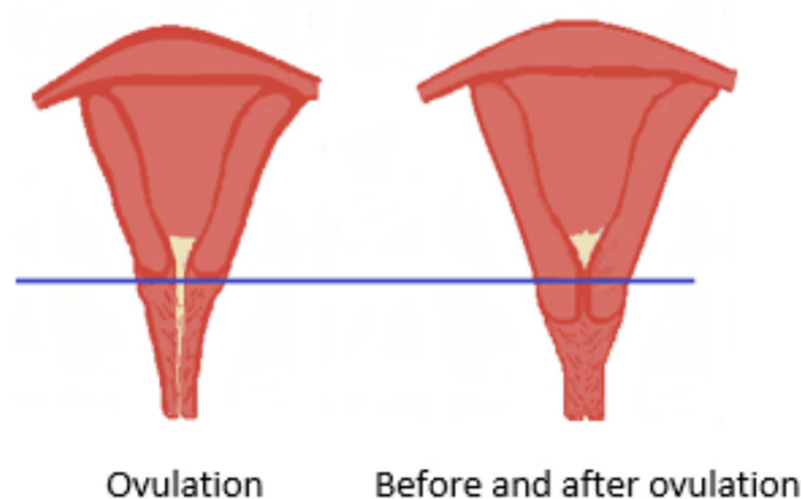


Figure 2. Change in the location of cervix during a normal menstrual cycle

The cervical pupil sign

The cervical pupil sign refers to the opening and widening of the endocervical canal about 3 mm before ovulation. The cervical pupil sign disappears within 6–24 hours after ovulation. (Fig. 3) This sign is identifiable by using a mirror and vaginal speculum for self-inspection of the cervix (Brosens et al. 2009).



Figure 3. Change in the cervical opening during a normal menstrual cycle

Basal Body Temperature (BBT)

Biphasic changes in the BBT occur during a normal menstrual cycle. Monitoring of the BBT during a cycle is simple but less accurate and requires a daily check. In this method, a woman checks her body temperature on awakening time before doing any activity. Oversleeping or late night, room temperature, disrupted sleep, alcohol consumption, fever, stress, travel, and shift work are some factors affecting the accuracy of the BBT measurements.

BBT remains low during follicular phase. Its lowest level (nadir) is almost one day before ovulation. A rise about 0.3 to 0.6°C (Pallone & Bergus 2009) takes place soon after ovulation and progesterone surge. The BBT keeps almost the same level (a plateau) during luteal phase. In the last days of a normal menstrual cycle, degeneration of corpus luteum leads to decrease in progesterone level, which brings the BBT back to its lower level one to two days before the initiation of the next menstrual bleeding. (Fig. 4) The biphasic pattern of the BBT chart is a retrospective evidence of ovulation and suggests the end of the fertile days. Coverline is one of the methods used for interpretation of the BBT chart. Coverline indicates the threshold temperature. The easiest way for calculation of the coverline is to add 0.15°F to the highest temperature during the first ten days of menstruation. The coverline crosses horizontally on the BBT chart and provides a visual guide for observation of the shift in body temperature. The increase in body temperature over the coverline is the sign of ovulation (Hsiu-Wei et al. 2017).

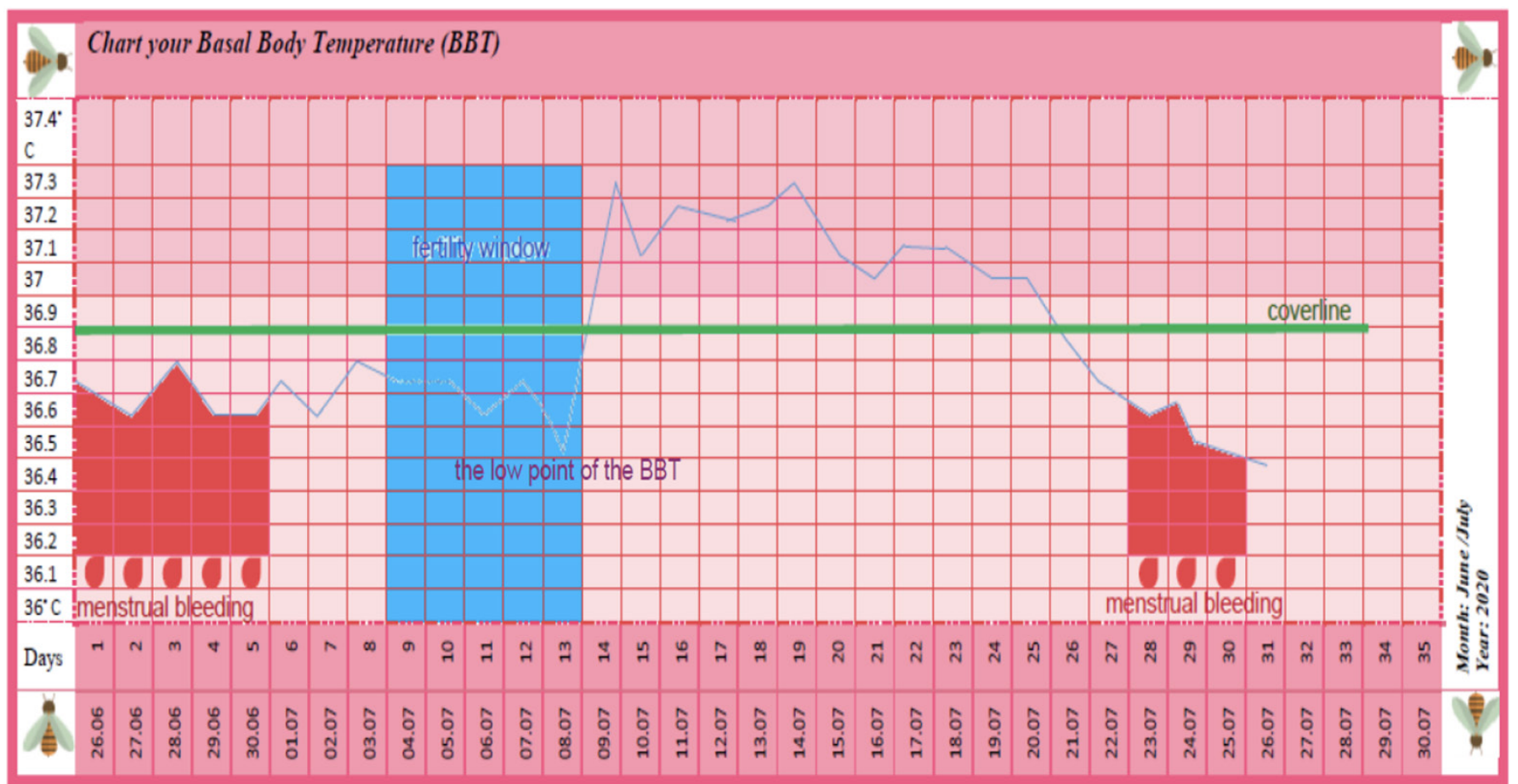


Figure 4. A biphasic pattern of the BBT during a normal menstrual cycle. The confirmation of ovulation is possible after a rise in BBT. Body temperature decreases before the initiation of the next menstruation.

Sum up

Fertility awareness provides useful understanding about female sexual cycles and contributes to her health. It is necessary to share this knowledge with all women and let them be an active agent in their health.

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Contraception and preconception health: scoping review

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Abstract

Sexual health may influence the potential for conception. The main aim of the scoping review was to establish an association between fertility and earlier termination of an unintended pregnancy and prolonged use of hormonal contraceptives.

The main medical databases were searched (Cochrane, Medline, CINAHL and PubMed) and other sources were used to find information. The inclusion criteria were: texts in English, publications from the last 10 years.

There is evidence that termination of pregnancy can affect fertility, especially if mechanical methods were used. Abortion may not be a method of contraception. Barrier contraception is the most effective method of preventing sexually transmitted infections, but the most commonly used is the oral hormonal method. It is claimed that long-term use of the pill can thin the lining of the uterus and reduce the chance of implantation of the fertilised egg, however, results of studies have not confirmed any harmful effects of long use of hormonal contraceptives on women's fertility.

Young adults should be counselled on safe sexual behaviour; including how to avoid unwanted pregnancies.

Keywords: fertility, preconception, contraceptives, pregnancy termination

Povzetek

Spolno zdravje posameznika vpliva na njegovo sposobnost koncepcije. Glavni namen pregleda literature je bil povezati plodnost s prekinitvijo nezaželene in nenačrtovane nosečnosti ter dolgotrajno rabo hormonskih kontraceptivov.

Pregledane so bile medicinske baze podatkov (Cochrane, Medline, CINAHL and PubMed) ter drugi relevantni viri. Vključitveni kriteriji za uporabljeno literaturo so bili starost publikacije manj kot 10 let, angleški jezik ter vsebinska primernost.

Trdni dokazi kažejo močno povezavo med plodnostjo in mehansko metodo prekinitve nosečnosti. Abortus ne smemo smatrati za metodo kontracepcije. Barierna kontracepcija je učinkovita metoda tudi za preprečevanje večine spolno prenosljivih infekcij. Najpogosteje uporabljana pa je oralna hormonska kontracepcija. Nekateri strokovnjaki trdijo da dolgotrajna raba hormonske kontracepcije lahko vpliva na kakovost endometrija ter na tak način vpliva na sposobnost ugnezditve oplojenega jajčeca, vendar študije dolgotrajne rabe hormonske kontracepcije niso povezale z neplodnostjo.

Mladim odraslim je potrebno zagotoviti svetovanje, ki jim bo omogočilo informirane varne odločitve o spolnosti; tudi v smislu preprečevanja neželene in nenačrtovane nosečnosti.

Ključne besede: plodnost, prednosečnostno obdobje, kontracepcija, prekinitvev nosečnosti

Introduction

Sexuality is closely connected to conception. The overall biological capacity of humans for procreation is in decline (WHO 2010; FertilitySA 2018), mainly because people decide to have children later in life (and given that fertility starts declining with age), due to environmental factors and life-style decisions. Many industrial societies have fertility rates below the level needed to sustain a stable population size (2.1 children per couple) (Brase 2016). However, we should not overlook the social changes brought

by new generations that show how young people are not as fascinated by sexual intercourse as the generations before them (Twenge, Sherman & Wells 2015). In addition to a decreased desire for sexual activity, studies reveal a decreased wish to have children; a complex desire that is triggered by many factors (Souza, Conroy-Beam & Buss 2016; Brase 2016).

Background

Humans have the evolutionary potential to recognize individuals with a high reproductive potential. Therefore, it can be claimed that we are subconsciously attracted to partners who have a greater ability to procreate (Wang et al. 2018). According to the newest research, these features of attractiveness change over time (Souza, Conroy-Beam & Buss 2016) and among different cultures (Atari & Jamali 2016) and even within the monthly cycle – men tend to perceive women as more attractive during the fertile period of the menstrual cycle (Gildersleeve et al. 2012). This implies that in every given situation we have inner abilities to select mates with higher chances for fertilization.

However, individual sexual decisions can have an impact on a person's long-term fertility. Some sexual decisions have a damaging effect on the potential for conception. The aim of the literature search was to find out whether the following factors influence the couples' capacity to conceive:

- long-term hormonal contraception use in women;
- termination of unplanned and unwanted pregnancies in women.

Methods

A scoping review of literature has been undertaken, searching the medical databases Cochrane, Medline, CINAHL, Science Direct and PubMed and other reliable sources in order to retrieve information on the topic. The keywords used were very broad – “sex”, “fertility / reproduction” AND “hormonal contracept*” OR “termination of pregnancy / abortion”. The inclusion criteria were: texts in English, literature from the past 10 years. The texts that reported problems of past sexual decisions on pregnancy and birth (not conception) were excluded as were also the studies that evaluated infertility treatments or reported results of experiments with mice. After elimination of the duplicates and content screening, 15 texts stayed to be analysed.

Results

Unplanned and unwanted pregnancies may result in decision for abortus. In case of pregnancy termination, complications of unprofessionally performed abortions can have detrimental consequences on a woman’s reproductive health. However, even when performed professionally, post-operative complications of abortion can damage the ovarian tubes; research authors found midcorrelation with the number of induced abortions and tubal damages (Ukweh, Okeke & Oku 2019). Findings imply that even a single procedure can impair a woman’s fertility. However, in a recent national Finnish study that used 10-years data from the national register and sought parallels among women who underwent IVF treatment and had aborted in the past, authors conclude that abortion is not associated with a higher need of future infertility treatments (Männistö et al. 2019). The underlying reason could be the method used for the termination of pregnancy. Namely, studies conclude that an abortion with misoprostol has fewer consequences on the reproductive health

of women than a surgically performed abortion (Bello, Fawole & Oluborode 2018; Irinyenikan et al. 2019).

In order to prevent unplanned and/or unwanted pregnancies, women are usually advised to use contraception. Oral contraceptives are said to be the most commonly prescribed medication among women (Taggart et al. 2018), therefore, we were interested how safe, in terms of preserving fertility, are different contraceptive methods – especially oral hormonal contraceptives and IUD (Intra Uterine Device).

Some studies quote that patients often report certain side effects of hormonal contraceptives that were not shown as significant in previous studies and reviews (like low mood, low libido, decreased lubrication etc.). Some of these symptoms can indirectly affect women's sexuality. Depression could for example impact her capacity for conception (Stevens 2018) by diminishing her interest in sexuality. Some experts report beneficial non-contraceptive effects of oral hormonal contraceptives such as greater mood stability and higher relationship satisfaction (Taggart et al. 2018) while some warn that the use of hormones in contraceptives might impact future pregnancies (Dinehart, Lathi & Aghajanova 2020). Yamamoto-Hanada et al. (2016) even report the connection between preconception use of contraceptive pills with asthma in children; an epigenetic effect that past studies did not take into the account.

Current scientific studies consistently agree that contraception methods do not directly affect women's fertility, as some past research claimed (Hassan & Killick 2004). In the latest review, Girum and Wasie (2018) proved that 83.1% of women who discontinued using contraceptives became pregnant within the first 12 months. There were no differences whether they were using oral contraceptives or IUD and the duration of use

of contraceptives did not significantly influence the return of fertility. However, as the authors report, the results on the effect of parity in the resumption of pregnancy following cessation of contraception were inconclusive. A limitation of the reviewed studies was that none were randomized control trials and most had small sample sizes and therefore a possible relationship between an extended use of hormonal contraception and the rate of resumption of pregnancy could not be clearly defined.

Namely, some authors claim that long-term pill use can thin the uterine lining and reduce the chance for nidation of the fertilized egg cell (Talukdar et al. 2012) and that synthetic hormones affect the physiological cervical mucus composition (Migeon 2017). It is similar with the return of fertility after a long-term use of IUD. Three quarters of women conceive in one year after cessation of contraception. In the light of these findings, the authors write that the infertility rate is actually double than the commonly quoted rate in the general population (15%). They conclude that more studies are needed to determine the impact of hormones on long-lasting endometrial atrophy (Dinehart, Lathi & Aghajanova 2020).

Discussion

With early sexual intercourse initiation, and an intention to have children that is nowadays later in individuals' lives, the time between the first sexual intercourse and conception is prolonged and the time frame of experimenting in sexuality is extended and possible number of partners is higher. So is the possibility for unplanned pregnancy. Therefore, it is crucial to counsel young people regarding the sexuality. This conversation should be introduced already in the early years of primary school. It is not enough to discuss just the physical aspects of safe sex (e.g. how to use different contraceptive methods); promotion of safe sexuality is much more about the relationship and self-acceptance.

The studies do reveal that youth is aware of the consequences of unprotected sexual intercourse; however, researchers claim that their knowledge does not necessarily underpin their actions. Many do not use condoms regularly (Castro 2016; Cabral et al. 2018), especially when they are in a longer-lasting relationship (Fairfortune et al. 2019).

An advantage of the latest hormonal contraceptives is that they use low doses of hormones and consequently cause fewer side effects as they did in the past. Fertility returns, but usually it takes months that synthetic hormones clear from the body, which results in a possible delay of conception (Barnhart & Schreiber 2009). In the conclusion of the latest review, authors expected a higher rate of pregnancy among multiparous women after cessation of oral contraceptives; however, the results were not in concordance with the expectations (Girum & Wasie 2018). A possible reason for this could be other contributing factors such as higher age of these women and a consequent naturally reduced capacity for conception. Resumption of pregnancy can also depend on prior reproductive health issues (polycystic ovaries and similar conditions can be an obstacle for conception). Some warn that women on the pill experience a reduction in the ovarian volume and the production of AMH (anti-mueller hormone) – a hormone that is tested to assess fertility (Grigg-Spall 2019). Similar results were reported also in connection to IUD that includes hormones (Dinehart, Lathi & Aghajanova 2020).

When counselling for oral contraception, women should be informed that the return of fertility can be slowed down after the omission of the pill, which means a delay in conception (Stacey 2018). The hormonal contraceptives do not cause infertility directly; however, some claim that they do impact long-term fertility by “silencing a woman’s biological clock for so long that, in some cases, they forget it’s ticking away” (Willett

2019). Some (Wershler 2015) strongly advise against hormonal contraception in teenagers, claiming that synthetic hormones reduce the natural ability of those young women to produce their own hormones. They suggest that teens should be offered other forms of contraceptives, namely such that provide more effective protection against STIs and do not contain hormones. Further studies should be conducted on fertility and contraception issues.

In case of an unwanted pregnancy, current evidence shows that abortion with medications is safer for preserving fertility than surgically performed termination of pregnancy (Irinienikan et al. 2019). However, we suggest that counselling for safe sexuality goes in the direction of preventing unplanned pregnancies rather than focusing on the best method of terminating them.

Conclusion

The fertility rate in the developed world is dropping. From the social perspective this trend has negative as well as positive aspects. Lower fertility rates correlate well with higher empowerment of women in the society, evaluating it from the population-rate level. But as Brase (2016) quotes, it is not known what shapes individual reproductive decisions. And if a couple wishes for a baby and cannot conceive, it can result in sexual dysfunctions that pose an additional barrier to successful fertilization.

On the basis of the scoping review and the data derived on the topic of hormonal contraception, results are complex, and counselling should also include objective information on how each selected contraceptive method affects physiological menstrual cycle and resumption of fertility. It should be stressed that cessation of hormonal contraception does not necessarily mean immediate pregnancy. However, in case of unplanned

and unwanted pregnancy, current results speak in favour of the medication abortion, while the surgical one can have major consequences for fertility.

It can be concluded that more methodologically strong studies are needed to evaluate the effect of hormonal contraceptives on women who use them for long periods of time.

The current trend in sexual counselling for youth and young adults should reach beyond bare promotion of safe sex in the physical sense. It should approach an individual or a couple holistically and moreover it should raise fertility awareness. Our ability to have children is not a curse, but a gift of nature that should be protected and cared for. With high rates of infertility and delayed family planning, fertility is becoming an endangered good that was once considered self-evident. The shift in mentality from “preventing the pregnancy above all” to “retaining the ability to conceive once” must be adopted also by the health professionals who counsel couples in the reproductive age.

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Part III;
Lifestyle choices

Nutrition for pregnant women and women who want to become pregnant.

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Abstract

Eating healthy is important for everyone, but particularly for women who are pregnant or want to become pregnant. Food supplements are generally not necessary when women eat a balanced diet, only a daily supplement of folic acid (400 μg a day) is very important from at least four weeks before pregnancy until week 12 in pregnancy in order to avoid neural tube defects.

Women with a vegetarian diet have to compensate the lack of iron and vitamin B12 with the consumption of more legumes, nuts and dairy products. As vegan women do not consume any animal product, there is a risk for shortage in certain vitamins and minerals. For these women, some supplements may be advised.

Keywords: folic acid, vegetarian, vegan, vitamin, mineral, protein, fat, food, carbohydrates, energy

Abstract

Gezonde voeding is voor iedereen aanbevolen, maar vooral voor zwangere vrouwen of vrouwen die zwanger willen worden. Supplementen zijn over het algemeen niet nodig als vrouwen gezond eten, enkel foliumzuur is sterk aanbevolen bij kinderwens. Ter

preventie van neurale buisdefecten is het heel belangrijk om dagelijks 400 μg foliumzuur in te nemen, bij voorkeur vanaf een maand voor de zwangerschap tot en met de 12de week van de zwangerschap.

Vrouwen met een vegetarisch dieet dienen meer peulvruchten, noten en zuivelproducten in te nemen om te compenseren voor ijzertekort en gebrek aan vitamine B12. Gezien vrouwen met een veganistisch dieet geen dierlijke producten consumeren, is er een grotere kans op ijzertekort en vitamine B12 tekort, die niet kan gecompenseerd worden met zuivelproducten. Voor deze vrouwen kunnen bepaalde supplementen aangewezen zijn, vooral tijdens de zwangerschap.

Sleutelwoorden: foliumzuur, vegetarisch, veganistisch, vitamine, mineraal, eiwit, vet, voeding, koolhydraten, energie

Introduction

The period before and during pregnancy is very important to adopt or maintain a healthy lifestyle. The first weeks of pregnancy are critical for embryonic, placental and organ development. David Barker was the first to find a correlation between fetal malnutrition and disease later in life (Barker 1998). His findings led to the Barker hypothesis which states that the fetus's organism adapts to malnutrition (programming) and that these modifications cause permanent changes which later lead to a number of disorders. The results of an increasing number of studies confirm this Barker hypothesis and underscore as such the importance of a healthy lifestyle during pregnancy (Arabin & Baschat 2017; Steegers & Geluk 2012a; 2012b).

Food recommendations for the general population

A large number of countries provide food recommendations. Below you can find an example of recommendations from Belgium (Vlaams Instituut Gezond Leven, n.d.).

In a healthy diet, there is no restriction to drink water. You should drink at least 2 liter a day, preferably plain water. It is

also recommended to eat plenty nutrients of the dark green zone (see figure 1): these are vegetables, fruit, legumes, whole grain products and vegetable oils. It is important to vary between products: different vegetables and fruits may provide for different vitamins. Try to consume products in their unprocessed appearance; orange juice or canned oranges for example, include more sugar per consumption (even when no extra sugar is added), than a plain orange. Moreover, eating an orange will provide a saturated feeling, while drinking a glass of orange juice not necessarily.

Food from the light green zone are nutrients from animal origin (fish, dairy products, poultry,...) which are recommended to consume only a couple of times a week.

Products from the orange zone (red meat, butter and oil high in saturated fats) should be eaten only occasionally, because they possibly have an unfavorable effect on our health. However, these products may contain some useful nutrients, for example iron in red meat or fat soluble vitamins in butter.

Food from the red dot should be avoided. It contains nutrients that you don't really need and which have an unfavorable effect on our health. These products are heavily processed products with a lot of sugar, fat and/or salt added. Examples of such food are processed meat, soda's, alcohol, candy, pastry, snacks and fast-food.

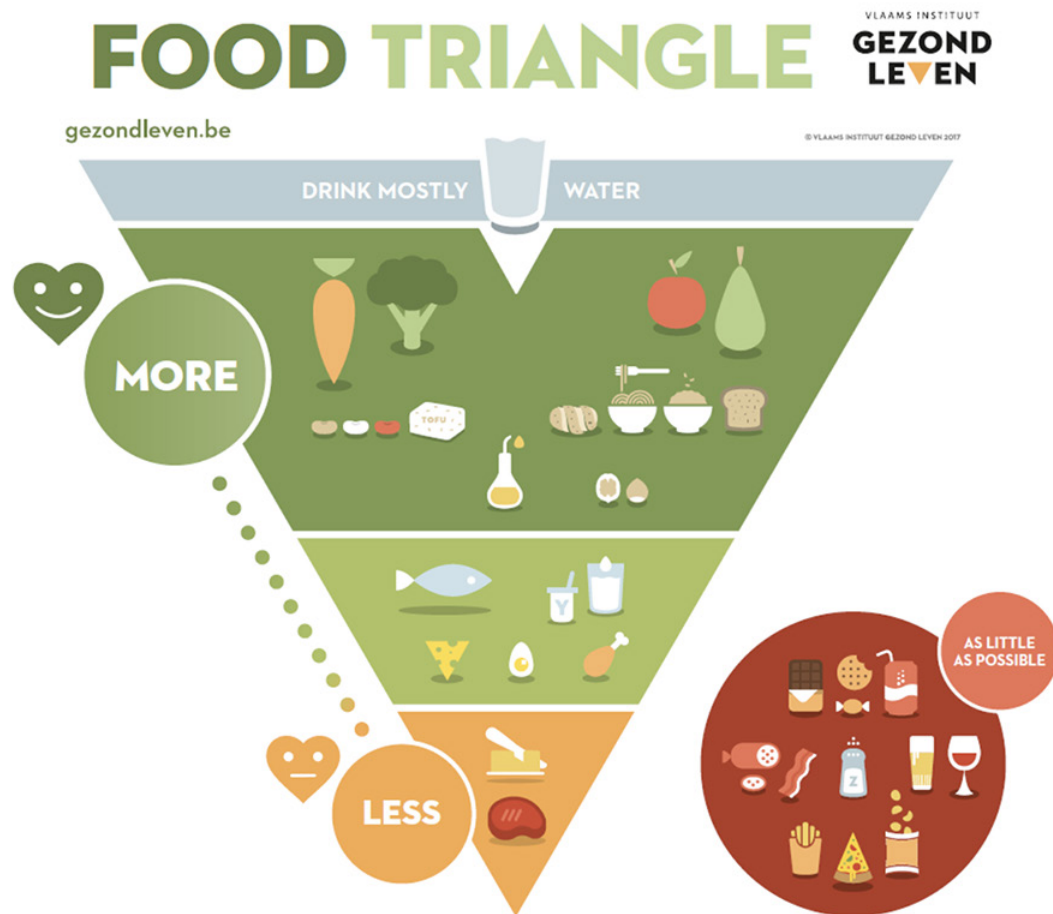


Figure 1. Food triangle (gezondleven.be)

Food recommendations for pregnant women

The above described food recommendations are developed for the general population. When you want to become pregnant, most of these advises are applicable as well, but there are some extra focusses. The intake of folic acid from at least four weeks before pregnancy until 12 weeks of pregnancy is the most important consideration, amongst other (see further).

Pregnancy increases energy needs because of an increased resting energy expenditure (REE) and because of the composition of new tissue and energy reserves. REE increases with 5% in the first trimester, with 10% in the second trimester and with 25% in the third trimester (De Belgische Voedingsmiddelentabel 2019).

Supplementary energy intake during pregnancy has to be adjusted to the stage of pregnancy, the pre pregnancy BMI and

the level of physical activity. Within the first trimester, average supplementary intake is 70 kcal per day; in the second trimester women can have a supplementary intake of 260 kcal per day and in the last trimester 500 kcal a day. While breastfeeding, this extra 500 kcal can be maintained in the first six months postpartum (De Belgische Voedingsmiddelentabel 2019).

Carbohydrates

Carbohydrates should make up over 30% of the diet. Examples of products rich in carbohydrates are potatoes, granola, noodles, oats, fruit and vegetables. Starchy food are important to provide in energy, vitamins and fibre. Instead of refined (white) starchy food, wholegrain options should be chosen, such as whole wheat pasta and bread or whole rice.

Fibre is present in the cell walls of vegetables, fruits, legumes and cereals. Fibre is only partly digestible, but helps for a good transition through the intestinal tract and provides longer saturation, which prevents for snacking in between (“Healthy diet in pregnancy - NHS”).

Proteins

Proteins are part of a healthy diet, also during pregnancy. Healthy protein-rich food are beans, legumes, fish, eggs, lean meat such as poultry and nuts (“Healthy diet in pregnancy - NHS”).

Fat

A small amount of fat, particularly unsaturated fat, is part of a healthy diet, in that it is a source of the essential fatty acids. Moreover, fat helps to absorb the fat-soluble vitamins A, D, E and K. All types of fat are high in energy and fat that is not used by the body's cells, is turned into body fat. In a healthy diet, food and drinks that are high in saturated fats should be avoided (meat

products, butter, cheese, cream, crackers, chocolate, biscuits, cake, palm oil and coconut oil) and replaced by unsaturated fats (olive oil, avocados, nuts, other vegetable oil than palm and coconut oil and oily fish). Even of unsaturated fats, women do not need more than 20g a day (“Healthy diet in pregnancy - NHS”).

Vitamins

Folic acid

Folic acid is known as vitamin B11 or vitamin B9 (in Germany, France and the USA). Folic acid is the most stable kind of folate, which does not occur in our diet. Folate (which has the same vitamin action as folic acid) does; we find folate mainly in green leafy vegetables (folium means ‘leaf’), in Brussels sprouts, broccoli, cabbage, asparagus, fruit (especially citrus fruits) and yeast. Liver and kidneys also contain folate. Foliates in food are quite unstable, they are sensitive to light, heat and oxygen. The absorption from food is therefore inefficient due to the high loss of folate during storage, processing and food preparation (up to 95% of the folate is destroyed during cooking). Folic acid in fortified foods is completely stable for months and sometimes even years (Akhter et al. 2020; Hoge Gezondheidsraad 2016).

Folic acid is important for the development of the foetus; the vitamin is crucial for the formation of cells and of particular importance for the development of brains and spinal cord. Because of the expansive growth of the foetus and development of the placenta, folic acid needs are highest in early pregnancy. Lack of folic acid at this term, increases the risk of neural tube defects in the foetus. About 30–50% of neural tube defects can be prevented by periconceptional folic acid intake. Next to lack of folic acid, other risk factors for neural tube defects are genetic or environmental determinants. Folic acid intake is also associated with a decrease in other birth defects, such as cleft lip and palate,

cardiovascular and heart diseases and limb defects, although these associations are often discussed (Lumley et al. 2001).

The need for folate doubles during pregnancy; the intake of folate to prevent neural tube defects (NTD) is appropriate, as this need is very difficult to cover by diet exclusively. A supplement of 400 μg is recommended from at least one month before conception to at least 12 weeks after conception. In this way, an increased need is met during periods of rapid development of the foetus. The neural tube closes permanently 28 days after conception (Hoge Gezondheidsraad 2016).

From the moment a woman wants to become pregnant until 10 weeks of pregnancy, daily intake of 400 μg folic acid (vitamin B9) is strongly recommended. Preferably, intake starts 4 weeks before conception. The maximal daily dose of folic acid is 1000 μg a day. However, some women with high risk to deliver a baby with neural tube defects are advised to take 4000 μg (4 mg) folic acid a day. This high dose should be prescribed only when necessary and for a short term. Women at high risk are: women with neural tube defects in (familial) history, intake of certain anti-epileptic drugs, having diabetes or obesity. High intakes of synthetic folic acid can correct anaemia caused by a vitamin B12 deficiency. Because this vitamin B12 deficiency is thus undetected, irreversible neurological damage can occur. For this reason, high doses of synthetic folic acid should only be administered on medical advice (Hoge Gezondheidsraad, 2016).

Vitamin A

Vitamin A consists of all natural components that possess the biological activity of retinol. In our food we mainly find provitamins A (carotene) which are converted into vitamin A after absorption in the body. Provitamin A is mainly found in carrots, vegetables and fruits (especially red and yellow vegetables and

fruits, such as mangoes, apricots and papayas). Vitamin A2 can be found in breast milk, whole milk, cream, butter, eggs, cheese and liver products. Conversion of carotene occurs mainly in the intestinal wall and the liver, however, this process is not that efficient and a lot of carotene is lost via the faeces (Hoge Gezondheidsraad 2016).

Vitamin A is important for growth (cell building), in the protection of the skin epithelium and in the reproduction and synthesis of adrenal cortex hormones. Furthermore, retinal (a form of vitamin A) is required for the formation of light-sensitive, rod-shaped photoreceptors of the eye. A deficiency of vitamin A can cause night blindness or other diseases of the eye. Other consequences of vitamin A deficiency are: skin and mucous membrane disorders, disturbed bone formation and growth in children and disturbed immunity.

While (becoming) pregnant, consumption of liver or liver products are advised against because of the high dose of vitamin A. Also intake of common multiple dietary supplements during pregnancy are discouraged for this reason. Notwithstanding a slightly higher need of vitamin A during pregnancy (700 μg a day for pregnant women versus 650 μg for non – pregnant women), the maximum dose of 3000 μg a day should not be exceeded in the first trimester of pregnancy, because of its teratogenicity (Hoge Gezondheidsraad, 2016).

Vitamin C

Vitamin C is an essential vitamin, so it must be consumed in order to supply our body with the necessary amount. Potatoes, leafy vegetables, kiwis, citrus fruit and many other fruits and vegetables are rich in vitamin C.

This vitamin plays a role in the metabolism of amino acids, in the absorption of iron by the intestinal wall and in the formation of haemoglobin, steroid hormones, glucoproteins and lipoproteins. Furthermore, this vitamin is an important antioxidant that causes scurvy (scurbutus) in case of a serious deficiency. More common effects of vitamin C – deficiency are fatigue, mucosa – and gum bleeding and anaemia. Milder deficiencies in vitamin C can manifest themselves through dry skin (Akhter et al. 2020; Hoge Gezondheidsraad 2016).

Vitamin C is oxidised using heat and light. The optimum temperature for oxidases is 50°C. It is therefore advisable to reach the boiling temperature as soon as possible when preparing food (e.g. potatoes and vegetables should not be added until the water is boiling) and to keep fruits, vegetables and fruit cool or consume them fresh. These measures help to stop vitamin loss (Stegeman 2017).

Vitamin C deficiency is particularly common in smokers, the elderly (especially men), chronic alcoholism and patients with cancer or a chronic disorder. Smokers who do not exercise and eat less than two pieces of fruit a day are at risk of vitamin C deficiency (Akhter et al. 2020; Hoge Gezondheidsraad 2016).

Pregnant woman are advised to consume 120 mg vitamin C through their diet, which is 10 mg more than non-pregnant people. Women who are breastfeeding should even consume 150 mg vitamin C on a daily basis. There is some discussion in scientific literature on the usefulness of vitamin C supplements during pregnancy (Rumbold, Ota, Nagata, Shahrook, & Crowther, 2015). A supplement of 10 mg is advised by some in order to compensate for the active transport of vitamin C through the placenta. More research is recommend on this issue though.

Vitamin B2

Vitamin B2 or riboflavin is very important in the metabolic conversion of fats, saccharides and proteins. Next to that, this vitamin has an important role in the regulation of thyroid activity and adrenal function. We find this vitamin mainly in milk, cheese, green leafy vegetables, fatty fish, yeast and almonds. The vitamin is very sensitive to light. A deficiency of vitamin B2 manifests in chapped or red lips, inflammation of the tongue and corners of the mouth, mouth ulcers, sore throat, dry and flaky skin, iron deficiency and red, watery eyes. Deficiency mainly occurs as a result of chronic alcohol abuse and malabsorption in intestinal diseases. Also people with a vegan lifestyle are at higher risk, although they can compensate with the consumption of fruits and vegetables rich in vitamin B2. Scarce studies have found a higher risk to develop preeclampsia in women with who are deficient for riboflavin (Wacker et al., 2000) and birth defects, such as congenital heart defects and limb malformations (Akhter et al. 2020; Robitaille, Carmichael, Shaw & Olney 2009; Smedts et al. 2008).

During pregnancy, demands for riboflavin are higher (1.5 mg/day instead of 1.2 mg/day), particularly during the third trimester of pregnancy, as the vitamin contributes to foetal growth and development.

Vitamin B12

Cobalamin or vitamin B12 is necessary for the production of red blood cells and plays a role in the production of nucleic acids and the metabolism of amino acids. Furthermore, cobalamin also participates in stimulating the formation of myelin (a casing of nerve impulses which accelerates the impulse conduction of the nerve) (Hoge Gezondheidsraad 2016).

Vitamin B12 is found in meat, fish and dairy products and is formed by intestinal flora. Under normal circumstances, there are no deficiencies, except in the case of a vegan diet. Some people lack the 'intrinsic factor' in the gastric juice, which prevents vitamin B12 from being absorbed by the intestine and causes disorders in the maturation of red blood cells. This causes a malignant form of anaemia (pernicious anaemia). A limited deficiency of vitamin B12 occurs in about 25% of people, especially the elderly and vegans (50%) (Hoge Gezondheidsraad 2016).

Vitamin D

Eggs, butter, milk, liver and fatty fish are the main sources of vitamin D. There are also many foods enriched with vitamin D3 (e.g. milk products and cereals). Vitamin D3 is obtained from UV radiation. Exposure to UV light is necessary to obtain a sufficient intake of vitamin D. Vitamin D deficiency is common in children and the elderly (ageing alters the skin, disrupting absorption of the vitamin), especially at the end of winter. Muscle cramps in children in early spring may indicate vitamin D deficiency. A deficiency during pregnancy may lead to delayed growth and skeletal abnormalities in the child and an increased risk of hip fractures at an older age (Hoge Gezondheidsraad 2016).

Breast milk does not provide enough vitamin D to meet the need for vitamin D in new born babies. A supplement of 10 μg is therefore necessary at birth.

Next to the dietary intake of vitamin D, the following groups are recommended to take supplements (Hoge Gezondheidsraad 2016):

- Supplementation of 10 μg or 400 IU/day for infants and children (20 to 25 μg /day for preterm infants in the first months after birth)
- 15 μg /day for adolescents up to the age of 18 years (depending on exposure to sunlight)
- 10 μg /day for adults, 15 μg /day for persons at risk of osteoporosis
- 20 μg /day for pregnant and lactating women
- 20 μg /day for elderly people

The maximum tolerable intake of vitamin D3 is 25 μg /day for children up to 11 years of age and 50 μg /day for persons over 11 years of age.

3.5 Minerals

Iodine

Iodine deficiency is one of the most common nutritional problems worldwide. Deficiency can manifest itself in goitre, cognitive growth retardation, cretinism, etc. Serious deficits with goitre and cretinism are rare in Western countries, but can still be observed in developing countries. Marginal shortages are sometimes prevented by enrichment of bread salt. Neonatal hypothyroidism is detected in all newborns by means of the Guthrie test (prevalence: 1 in 3800 newborns, TSH > 15 mU/l). The only function of iodine is to be part of the thyroid hormone triiodothyronine (T3) (Hoge Gezondheidsraad 2016).

The rain contains iodine and in the sea, this accumulates in marine organisms. Contrary to what was thought in the past, the proximity of the sea is not a determinant for a higher supply of iodine. On land, iodine occurs in plants (and thus also in herbivores). Milk is the most important nutrient for iodine supply (more than 50%), fish are responsible for 25% of our iodine requirement and eggs and cereals for about 5% each (Hoge Gezondheidsraad 2016).

The fortification of bread salt in Western countries ensures that the average population does not experience any deficiency in iodine, but the supply may not yet be optimal during pregnancy and breastfeeding. A supplement of 50–100 $\mu\text{g}/\text{day}$ may be appropriate here. The maximum authorised dose is 600 $\mu\text{g}/\text{day}$ for adults and 200 $\mu\text{g}/\text{day}$ for children aged 1 to 3 years (Hoge Gezondheidsraad 2016).

Calcium

Calcium is important for maintaining healthy bone mass and for the teeth, but it also plays a role in blood clotting, transmission of nerve impulses and muscle contractions.

It is important that children's diets are rich in calcium, in that the lifelong reserve is built up until the age of 18, when the maximum bone mineral density is reached. Until that age, bone formation (by osteoblasts) is greater than bone resorption (by osteoclasts). This is to prevent the rapid loss of bone mass after menopause. In women, bone resorption increases sharply after menopause. Calcium is extracted from the skeleton to stabilise blood concentrations. This causes a decrease in bone mineral density which can lead to osteoporosis. Osteoporosis is also increasingly diagnosed in men (Hoge Gezondheidsraad 2016).

In addition to good calcium absorption (through diet), physical activity increases bone mass as well. Vitamin D, in combination with calcium intake and exercise, has a beneficial effect on bone mass. Nutritional sources of calcium are cheese, milk and drinks enriched with calcium, mineral water and certain vegetable food sources such as green vegetables. For a non-pregnant person, about 1 g of calcium and 800 IU of vitamin D is recommended on a daily basis. This requirement is greater in adolescents. As such, at least 4 dairy products per day are recommended to meet calcium requirements.

During pregnancy, calcium will be extracted from the maternal organism to meet the foetus's calcium requirements (bone production and growth). It is therefore very important that the mother takes sufficient calcium during pregnancy (minimum of 4 dairy products).

In case of calcium deficiency, tiredness and muscle pain may be experienced. Bone fractures may be more common as well in the case of calcium deficiency.

Zinc

Zinc plays an important metabolic role, as this mineral is part of the active structure of more than 300 enzymes.

Children with a chronic zinc deficiency have a delayed growth and abnormalities of the immune system resulting in an increased risk of infections (especially intestinal infections). A number of studies show a possible relationship between zinc deficiency and fertility. Zinc is thought to have an influence on egg cell development and sperm quality. However, this should be investigated further. Prematures, breastfed babies, young children, pregnant women, lactating women, the elderly and vegetarians are at higher risk of zinc deficiency. Up to 10% of the

European population is zinc-deficient; this is even more common in disadvantaged regions of the world (Hoge Gezondheidsraad 2016).

Meat, crustaceans, beans, eggs, cereals, legumes, milk and nuts are rich in zinc. Availability may decrease in combination with proteins of vegetable origin and with minerals such as copper, calcium and iron. The absorption of zinc in combination with animal proteins is in turn stimulated.

Iron

We distinguish haem iron and non-haem iron. The bioavailability of haem iron is much higher than non-haem iron. Haem iron is of animal origin and is mainly found in meat, poultry and fish; non-haem iron can be found in vegetables, leguminous plants, cereals and fruit. Bread, meat, potatoes and breakfast cereals are the largest sources of iron in our diet.

Both iron deficiency and excess are associated with serious health problems. A deficiency is accompanied by fatigue, shortness of breath, heart palpitations and increased susceptibility to infections. Iron deficiency or anaemia has a prevalence of 20 to 40% and occurs most frequently in young children or in women of reproductive age (due to blood loss during menstruation). It is the most common deficiency worldwide (Hoge Gezondheidsraad, 2016).

Pregnant women need more iron due to the increased blood volume (to supply the foetus and placenta). In pregnant women, iron deficiency can lead to premature birth and disrupted foetal development. In growing children, iron deficiency can affect psychomotor development.

Intoxication with iron supplements is possible, especially in children under 6 years of age. This manifests in acute damage to gastrointestinal, liver, pancreas and heart tissue. A dose of 60 mg/kg body weight can be fatal.

In our body iron we distinguish functional Fe (more than 70%) that contributes to physiological processes (including oxygen transport), non-functional Fe that is stored as a reserve (about 25%) and transport Fe (less than 1%). The transport iron transports Fe bound to the protein transferrin through the body.

Children are born with an iron reserve of 50 to 75 mg/kg. This reserve is largely built up during the last weeks of pregnancy. Children born prematurely are at risk of iron deficiency and are given supplements under medical supervision from a few weeks after birth for 6 months.

The maximum dose that can be taken daily is 40 mg/day for children up to 14 years of age and 45 mg/day for people over 14 years of age.

Vegetarian or vegan lifestyle

Vegetarian lifestyle

Because of the impact on health, the environment and animal welfare, it is positive to decrease the intake of meat. Eating less meat can be done by following the recommendations of the food triangle (maximum 100 grams of meat per day) or by inserting a meatless day every week. Of course, you can also choose to withdraw meat completely from the diet.

A healthy vegetarian lifestyle is more than just omitting meat or fish out of the diet. Meat, poultry and fish contain a number of essential nutrients, such as high-quality proteins, vitamins (B12) and minerals (iron), which our body needs for growth, building

and repairing tissues. Simply removing these products from the diet can cause deficiencies. Iron and vitamin B12 deficiency in particular can be a problem before, during and after pregnancy. It is important to replace meat, poultry and fish with foods that also provide these essential nutrients. Tofu or soy cheese, tempé (a fermented soy product) and quorn, for example, are full-fledged meat substitutes. Pulses (rich in dietary fibre) and nuts also belong to this group.

However, it should be noted that vegetable foods do not provide vitamin B12 and are less good sources of iron. That is why it is best to combine several sources of vegetable protein in one day or eat them together with cereal and milk products. Good combinations are cereals (such as bread, rice and pasta) combined with legumes (beans, lentils, peas, ...), wheat combined with eggs or cereals combined with dairy products (VIGeZ 2017). Pre-packed and pre – cooked vegetable burgers as meat substitutes are placed in the residual group because of their high fat content.

Vegetarian women generally do not have to take supplements during pregnancy (except for folic acid, like all pregnant women), on condition that they follow a very balanced and healthy diet.

Veganism

Pregnant women with a vegan lifestyle, are one of the few groups who need food supplements during pregnancy. There is a greater risk of deficiencies in vitamin B12, vitamin D, iron, calcium and omega 3 acids, when no animal products are consumed.

Vegan women are recommended to consume more iron-rich products such as cereals, legumes, seeds and dark leafy vegetables. Iron absorption is promoted if consumed together with a source of vitamin C within the meal (e.g. an orange at breakfast with wholemeal bread).

Additional leafy vegetables, legumes and nuts can help reduce calcium deficiency; drinks enriched with calcium, such as soya milk and enriched fruit juice, can also be consumed.

Conclusion

During pregnancy, a balanced diet is not only important for the future mother, but also for the developing fetus. For the general population, eating according to general food recommendations is enough to maintain good health. Only folic acid supplementation is strongly recommended for women who want to become pregnant until 12 weeks of pregnancy. Women with a vegetarian lifestyle can compensate for the lack of iron and vitamin B12 with other food products. For women with a vegan lifestyle, some supplements are recommended, particularly during pregnancy.

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Why is body mass index important in preconception period?

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Abstract

Deviations of body mass index, such as overnutrition and obesity as well as undernutrition and malnutrition influence the health of women and men in their reproductive period. As the levels of overweight and obese population are rising all over the world, obesity is becoming a major global health problem, affecting individuals' fertility and preconception health. The aim of this review is to examine how the BMI influences the fertility / fecundity of both, men and women, in the preconception period. A review of professional as well as scientific literature was undertaken. The literature was searched through different databases and included articles in English language. There is a growing amount of evidence that obese individuals are at increased risk for many health problems in the preconception period that have an effect on their fertility. Not surprisingly, more evidence is related to for the overweight or obese population, whereas less studies have oriented in the undernutrition or malnutrition. Alterations in body mass index affect men and women. As the numbers of obesity are rising globally, greater awareness regarding this metabolic syndrome is crucial.

Keywords: body mass index, preconception care, overnutrition and obesity, undernutrition and malnutrition, fertility

Povzetek

Odstopanja indeksa telesne mase, kot sta prekomerna prehranjenost in debelost ter podhranjenost, vplivajo na zdravje žensk in moških v njihovem reproduktivnem obdobju. Raven populacije s prekomerno telesno težo narašča po vsem svetu, debelost pa postaja glavni svetovni zdravstveni problem, ki vpliva na plodnost in zdravje ljudi pred zanositvijo. Cilj tega pregleda literature je preučiti, kako ITM vpliva na plodnost moških in žensk v obdobju pred spočetjem. Opravljen je bil pregled strokovne in znanstvene literature. Iskanje literature je potekalo po različnih podatkovnih zbirkah, vključeni pa so bili članki v angleškem jeziku. Vse več je dokazov, da imajo posamezniki s prekomerno telesno težo v obdobju pred spočetjem večje tveganje za številne zdravstvene težave, ki vplivajo na njihovo plodnost. Ni presenetljivo, da je več dokazov povezanih s populacijo s prekomerno telesno težo ali debelostjo, medtem ko je manj študij usmerjenih v podhranjenost. Spremembe indeksa telesne mase vplivajo tako na moški kot tudi ženski del populacije. Ker število debelosti po vsem svetu narašča, je ključnega pomena večja ozaveščenost o tem metaboličnem sindromu.

Ključne besede: indeks telesne mase, predkonceptijsko zdravje, prekomerna prehranjenost in debelost, podhranjenost, plodnost

Introduction

Deviations of body mass index, such as overnutrition and obesity as well as undernutrition and malnutrition influence the health of women and men in their reproductive period. As the levels of overweight and obese population are rising all over the world, obesity is becoming a major global health problem, affecting individuals' fertility and preconception health.

However, the awareness of those risks in the preconception period remains poor among population. The aim of this review is to examine how the alterations of body mass index (BMI) influence the reproductive health of both, men and women, in the preconception period.

Background

Body mass index (BMI) is a calculation tool that predicts adult's individual nutritional status. Its calculation varies among different countries. World Health Organization (WHO 2019) defines it can be used for adults aged over 20 years and is classified into categories as shown in Table 1.

Table 1: The classification of BMI (WHO 2019)

BMI	Nutritional status
Below 18.5	Underweight
18.5 – 24.9	Normal weight
25.0 – 29.9	Pre-obesity
30.0 – 34.9	Obesity class I
35.0 – 39.9	Obesity class II
Above 40	Obesity class III

Despite some limitations such as not taking into account individuals age or sex (Brazier 2018), BMI is still an important risk tool that may help us predict individual's disease (WHO 2019). Both, overweight as well as underweight, are associated with many risk factors that impede the reproductive ability (Imterat et al. 2019; Stephenson et al. 2018). Obesity is becoming a major health problem on a global perspective and may also affect the preconception health. The numbers for the year 2016 show that 39% of adults aged 18 years and more were overweight, whereas approximately 13% of the world's adult population were obese (WHO 2020).

Apart from that the obesity itself causes several health-related problems in pregnancy and during birth, it may also leave consequences on the health of the newborn baby. Obese women have an increased risk for gestational diabetes and type 2 diabetes due to insulin resistance (Kim 2010) and face increased risk for hypertensive disorders, pre-eclampsia (Badran et al. 2014; Paden & Avery 2012) and hypothyroidism (Ornaghi et al. 2018). The risks during birth include increased rates for induction of labour, longer labour (NHS 2011), obstetric interventions (Vinturache et al. 2014), caesarean section, increased rates in operative morbidity and mortality, including anaesthesia complications, excessive blood loss, postoperative infections and wound breakdown, postpartum thrombophlebitis. Women whose BMI is classified as obese are more likely to suffer from infertility, spontaneous miscarriage, stillbirth and preterm birth (Leddy et al. 2008; Paden & Avery 2012). Above that, newborns of obese women are more often macrosomic, putting them in higher risk for shoulder dystocia which can lead to the injuries of cervical plexus, clavical fracture, foetal hypoxia with or without neurological damage and even foetal death (Baxley & Gobbo 2004; Hemond et al. 2016). Complications of shoulder dystocia from the maternal side include postpartum haemorrhage, severe perineal lacerations, episiotomy, rectovaginal fistula, uterine rupture (Baxley & Gobbo 2004). Foetal anomalies are shown more frequently in obese mothers, including higher risk for neural tube defects, ventral wall defects, heart defects and facial defects (Nuthalapaty & Rouse 2004). Moreover, ultrasound diagnostics is more difficult in obese women, as it is especially more difficult to scan foetal heart, diaphragm, kidneys, spine and umbilical cord (Hendler et al. 2005). Newborns of obese mothers more often face breathing difficulties after birth (NHS 2011).

On the other hand, low BMI levels (such as anorexia nervosa) and undernutrition may lead to serious consequences on the reproductive health of the woman and later on, the fetus (Imterat et al. 2019). WHO (2000) estimates there are approximately 2 billion people that are facing micronutrients deficiency, acknowledging women are facing an increased risk due to menstruation cycle and higher metabolic demands of pregnancy. Undernutrition may result in fetal growth restriction as well as deficiencies of vitamins and micronutrients. There are differences in the undernutrition of adolescent girls and women in their reproductive period who are coming from the low and middle income countries or high income countries. Women and girls from low and middle income countries are especially facing dietary deficiencies, resulting in the lack of iron, vitamin A, zinc and calcium (Caulfield & Arlington 2015). Due to different dietary intake of women and girls in high income countries, they are also facing a lack of several important nutrients, including magnesium, iodine, calcium and vitamin D (Bath et al. 2013).

Methods

A review of professional as well as scientific literature was conducted. The literature was searched through different databases. All the included articles were in the English language. Scientific and professional literature was searched based on the following key words: BMI in preconception period, fertility and BMI, male and female BMI in preconception.

Results

There is an increasing amount of literature indicating that overnutrition and obesity, as well as malnutrition and underweight causes problems in the preconception period, affecting the reproductive health of men and women. The summary of the results is shown below.

Malnutrition and undernutrition in men and women

When considering the lower BMI (underweight) levels, it should be acknowledged that minimum BMI levels are required for women in order to be able to maintain regular menses. When the levels of BMI are below this level, individual's body is not able to use the energy for the cellular processes, growth and reproduction, effectively. In women who are suffering from the anorexia nervosa, less energy intake is available for the health maintenance, which include the reproductive processes (Imterat et al. 2019).

Low BMI levels, together with excessive exercise and psychogenic stress are the main factors influencing the functional hypothalamic failure, resulting in shortened luteal phase, anovulatory menstrual cycles and sometimes even amenorrhea. Moreover, low BMI may indicate non-sufficient energy intake which may impact the concentration of gonadotropin, follicle growth and the quality of oocytes. As leptin has a very important role in the regulation of the hypothalamic hormonal axes and oocyte implantation time, its low expressions in the endometrium are associated with increased rates of implantation failures, leading to infertility. Women being underweight also face an increased risk for miscarriage (Imterat et al. 2019). In their review, Imterat et al. (2019) reported lower BMI levels are also associated with reduced fecundity in women receiving ART.

Changes and unhealthy dietary habits may influence fertility of male population as well. Recent studies show this is especially related to the increased intake of saturated and monosaturated fatty acids, as it has been shown that the energy derived from fat has an adverse effect on the semen quality, sperm concentration and other parameters. The increased intake of red meat and processed meat affects the lower sperm count and

causes abnormalities in abnormal sperm morphology. Sperm morphology is also negatively affected by the intake of whole-fat dairy products. An increased intake of sugars negatively impacts the sperm motility. Moreover, genetically modified organisms present a potential risk on reproduction due to their influence on endocrine metabolism (Çekici 2018).

Overnutrition and obesity

According to Du Plessis et al. (2010), the numbers of obese population are rising as the consequence of unhealthy dietary habits and increased sedentary lifestyle. It is well known that higher BMI levels are associated with several risk factors, such as diabetes mellitus type 2 and dyslipidemia, which have an indirect impact on the individual's fertility (Imterat et al. 2019).

Overnutrition and obesity in women

Menstrual cycle changes

Obesity may result in young girls already in puberty and may result at the earlier onset of puberty (Souter et al. 2011). This might be the consequence of the fat tissue and leptin hormone which concentration rise with increasing adiposity and may trigger the menarche. Earlier sexual development may results in different psychosocial strains of girls and their families and is a risk factor for self-reported depression in adolescence. Obesity furthermore negatively impacts the menstrual cycle and may result in dysfunctional uterine bleeding. This is a consequence of hormonal imbalance due to peripheral conversion of androgens to estrogens and changes in estrogen-progesterone ratios. Estrogen is the hormone that causes the proliferation of the endometrial tissue which results in the overgrowth of the endometrium and bleeding at irregular time. Weight loss results in regular menstrual cycle as it decreases the aromatization of androgen hormones into

estrogens in the adiposity tissue. Another factor that influences the irregular bleeding in obese women is the insulin resistance that might cause the dysfunctional uterine bleeding (Lash & Armstrong 2009; Souter et al. 2011).

Contraception

Many methods of steroid contraceptives, such as oral contraceptive pills, progestin-only pills, transdermal patches and vaginal ring, have been shown as less effective in obese women. This is mainly the consequence of altered steroid metabolism and distribution in obese women. Despite that, overweight and obese women need to be offered a reliable form of birth control. One of the few reliable contraceptives that is not affected with the individual's BMI is the intrauterine device (IUD). Despite being less effective, hormonal contraception may help regulate the menstruation in obese women as well as positively impact on the minimal prevention of endometrial and ovarian cancer risk. When taking the oral contraceptives, obese women are also at greater risk for thrombosis (Lash & Armstrong 2009).

Fertility

Obesity might cause anovulation, subfecundity and may increase the risk of miscarriage (Imterat et al. 2019; Lash & Armstrong 2009). Therefore, the time for conception is prolonged (Pandey et al. 2010). Obese women often face increase levels of estrogen and low levels of progesterone. Furthermore, they are often hyperinsulinemic, often polycystic ovarian syndrome (PCOS) (Imterat et al. 2019; Lash & Armstrong 2009; Zain and Norman 2008). PCOS may feature in oligo or anovulation, hyperandrogenism, irregular menstrual cycle and subfertility (Pandey et al. 2010; Moussa et al. 2016). Increased rates of infertility in obese women are a consequence of anovulation and alterations in the leptin concentrations (Imterat et al. 2019; Lash

& Armstrong 2009). Obesity is a factor that increases spontaneous abortions (Lash & Armstrong 2009; Pandey et al. 2010). Many theories that support this claim have been proposed. As the insulin resistance impedes the release of progesterone this may inhibit the normal function of the corpus luteum. Another theory is related to low leptin levels that might influence the early embryo development and impair the invasion of the trophoblast tissue (Lash & Armstrong 2009). One theory also claims that obesity itself causes damage on the uterine endometrium in terms of its receptivity of the embryo implantation and further growth (Imterat et al. 2019; Lash & Armstrong 2009).

Increased BMI decreases the possibility to conceive with the use of assisted reproduction techniques (ART) (Lash & Armstrong 2009). Moreover, the induction of ovulation using clomiphene citrate is less successful in obese women and even if successful, pregnancy rates are lower in obese individuals (Pandey et al. 2010).

Overnutrition and obesity in men

Similarly, male obesity has a negative effect on the male reproductive potential. Studies have shown that even in couples where a woman had a normal BMI and the partner was obese, the conception was prolonged in comparison to couples where both had a normal BMI (Palmer et al. 2012). Male obesity is also tightly linked with infertility due to several reasons (Sallmen et al. 2006).

Firstly, the quality and concentration of sperm is reduced in obese men. Moreover, the molecular structure of the germ cells in testes is altered (Du Plessis et al. 2010; Hajshafiha et al. 2013; Palmer et al. 2012). The altered molecular structure and content of the sperm is equally important as reduced sperm concentration, to the possibility of a sperm to generate a healthy term pregnancy. There is a correlation between obesity and reduced sperm DNA integrity, which is important for successful

fertilization and the normal development of the embryo. The spermatogenesis is a complex process where sperm cells are continually produced from the onset of puberty and depend on the sex steroids. The hormonal imbalance in obese men may be contributed to increased white adipose tissue that may result in increased conversion of androgens to estrogens. Leptin is another hormone that has an important role in the energy intake and is produced by the white adipose tissue. As the production of leptin is increased this leads to a decreased production of testosterone. Furthermore, the increase in the scrotum adiposity increases the heat in the gonads. The increase in scrotal temperature directly affects a process of spermatogenesis (by reducing the sperm motility) that is highly sensitive to the temperature (Chambers & Anderson 2015; Du Plessis et al. 2010; Palmer et al. 2012). High levels BMI in men have a negative impact on the quality of produced embryos in the IVF procedures (Anifandis et al. 2013). It has also been shown that parental lifestyle before conception, including nutritional status, can adversely influence the risk of offspring for the cardiovascular, immune, neurological and metabolic morbidity and may have implications on the growth and development of the offspring (Barker et al. 2018; Fleming et al. 2018).

Conclusion

Several studies have raised the importance of the awareness of the healthy lifestyle in the preconception period as it may influence the individuals future reproduction as well as the health of future generations. This review provides evidence from a number of studies, that links alterations in female and male BMI levels with several negative effects on the individual's reproductive health. Health professionals should stress the importance of the healthy lifestyle in the preconception period with focus on public health

awareness. Girls and boys of young age should be encouraged to maintain healthy weight as well as younger adults, whereas counselling for overweight and obese individuals should be offered also in relation to the future effect on the reproduction. They should also be offered weight loss programmes with the emphasis on the healthy lifestyle changes, dietary restrictions and sufficient physical activity. Health professionals have to promote normal BMI in the preconception period and share the awareness among wider population.

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Physical activity and preconception health

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Abstract

Adopting a lifestyle during the preconception period which involves regular physical activity presents a special challenge to every individual. Due to its proven health benefits, the effect of physical activity on preconception health is generally still recognised as a strong predictor of health in the preconception period. While the increasing global prevalence of overweight and obesity represents a complex and chronic public health challenge, regular physical activity offers an effective approach for the control and reduction of obesity. Improving the health of women before pregnancy is an important strategy for reducing adverse pregnancy outcomes for both the mother and the foetus. During pregnancy, the impacts on foetal health have already been established and it may therefore already be too late to influence certain health behaviours. Physical activity on the other hand is also important factor in men's reproductive health. Therefore, preconception health promotion strategies are urgently required. The main role of healthcare professionals is to design and implement those strategies, including physical activity programmes, which take due account of specific behavioural characteristics.

Keywords: preconception, physical activity, health, benefits, lifestyle

Povzetek

Vzpostavitev življenjskega sloga v predkonceptijskem obdobju, ki vključuje redno telesno dejavnost, predstavlja poseben izziv za vsakega posameznika. Zaradi prepoznanih koristi za zdravje, je telesna dejavnost tudi z vidika reproduktivnega zdravja na splošno prepoznana kot močan pokazatelj zdravja. Medtem ko globalno povečanje prevalence prekomerne telesne teže in debelosti predstavlja kompleksen in kroničen javnozdravstveni problem, redna telesna dejavnost ponuja učinkovit pristop za nadzor in zmanjševanje debelosti. Skrb za zdravje žensk pred nosečnostjo je pomembna strategija za zmanjševanje neželenih izidov v nosečnosti tako za mater kot za plod. Med nosečnostjo je namreč marsikdaj prepozno vplivati na nezdrave vzorce vedenja. Telesna dejavnost pa je po drugi strani tudi pomemben element reproduktivnega zdravja moških. Zatorej so strategije promocije reproduktivnega zdravja nujne. Glavna vloga zdravstvenih delavcev je oblikovanje in implementiranje teh strategij, vključno s programi telesne dejavnosti, ki ustrezno upoštevajo specifične vedenjske značilnosti.

Ključne besede: predkonceptija, fizična aktivnost, zdravje, koristi, življenjski slog

Introduction

Regular physical activity is of fundamental importance for health and well-being and offers protective benefits across the life cycle of every human being. Practically anyone can benefit from being regularly physical active. There is overwhelming evidence that regular physical activity reduces the risk of premature mortality and morbidity, especially in terms of noncommunicable diseases. Despite the fact that the health benefits of being physically active have been associated with pregnancy and birth outcomes, they have not been as thoroughly investigated when it comes to preconception health and fertility. Consequently, debates persist over the influence of physical activity on the preconception health of women and men. Nevertheless, due to its proven health

benefits in general, physical activity is still recognised as a strong predictor of health in this period. Preconception, pregnancy and the early postpartum period represent opportune windows for engaging women in regular physical activity so as to optimize their health and prevent weight gain, which carries an added potential of the behaviour change being transferred more broadly to children and families (Figure 1). At the same time, the preconception period is a key public health and clinical opportunity for obesity prevention (Hill et al. 2019).

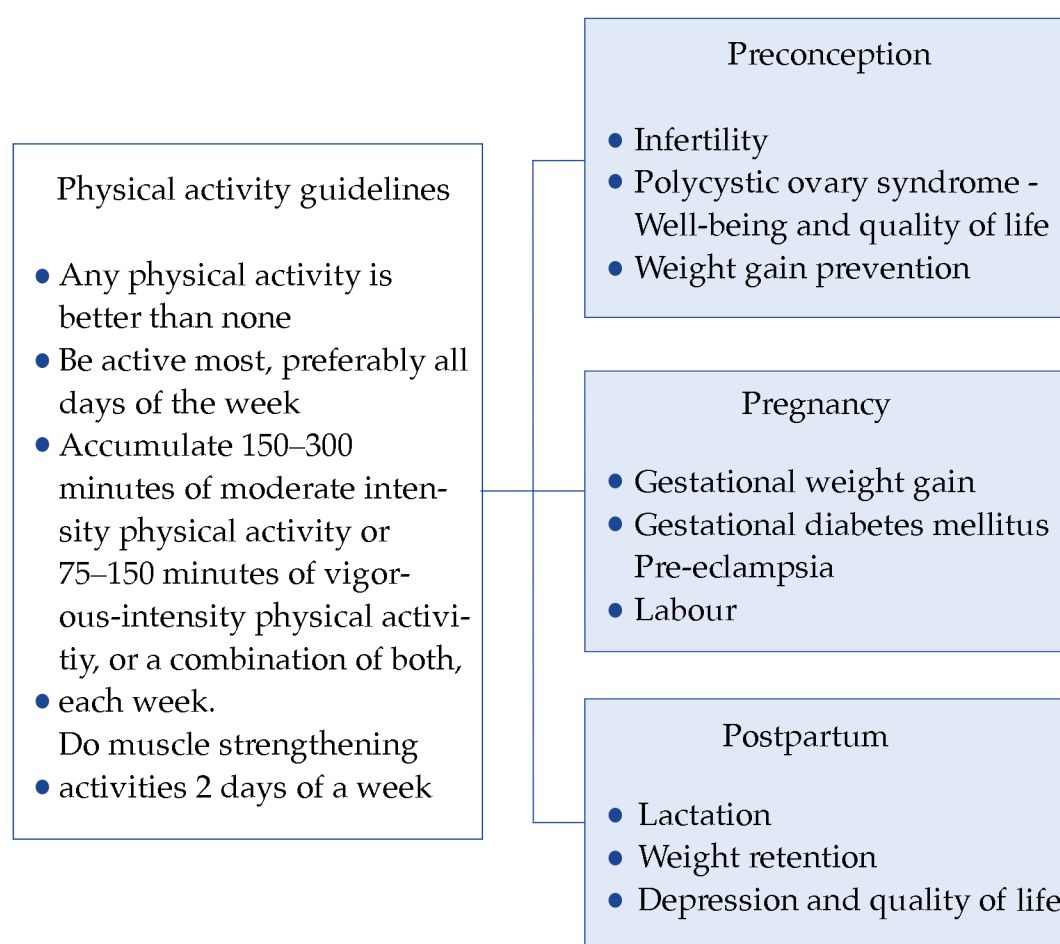


Figure 1: Adult physical activity recommendations and the association of physical activity with preconception, pregnancy and postpartum health (Harrison et al. 2016)

In studies exploring the impact of physical activity in preconception period, men’s preconception health behaviour is often overlooked despite compelling evidence of its importance for men’s health. Healthcare professionals should therefore also consider gender issues in preconception care. Hill et al. (2019)

proposes four overarching principles of preconception health: (a) the context of broader preconception/antenatal care priorities; (b) social determinants of health; (c) health of families; and (d) cultural considerations.

Physical activity recommendations and evidence for preconception health

Most research conducted to date suggests that women with intended pregnancies are more likely to engage in health-promotion behaviours prior to conception with the intent to change their lifestyle and, by doing that, to try to create the conditions that would ensure a healthy development of the foetus. Indeed, pregnancy is a period where every mother will try to do as much as humanly possible to ensure the health of her offspring. A similar perspective should be adopted when promoting preconception health issues to young people; however, the factors surrounding their current lifestyle and the triggers of behavioural changes in their youth also need to be closely examined.

The increasing global prevalence of overweight and obesity represents a complex and chronic public health challenge, which also affects preconception health. Trends demonstrate that overweight and obesity affect the population at a younger age, with the most rapid rate of weight gain reported between 20 and 40 years of age. According to a cross-sectional analysis (Ng et al. 2014), women are at the highest risk, with a higher conversion to overweight and obesity as compared to men. Women also represent a high-risk group for weight gain with associated metabolic, cardiovascular, reproductive and psychological health impacts (Harrison et al. 2016). In these studies, there is a lack of commonality in the physical activity terminology. Moreover, different forms of physical activity are considered, ranging from unstructured daily activities, occupational physical activity,

leisure time physical activity to structured physical activity (e.g., exercise and competitive sports) with the most relevant parameters of physical activity, such as frequency (e.g., daily, weekly, monthly), duration (e.g., total time of activity, rest intervals), and intensity (e.g., low, moderate, moderate-vigorous, vigorous, maximal efforts) (Condello et al. 2017).

Regular physical activity represents an effective approach for controlling and reducing obesity. In the context of daily, family, and community activities, the recommended levels of physical activity for adults aged 18 to 64 years (World Health Organization 2018) include leisure-time physical activity (e.g., walking, dancing, gardening, hiking, swimming), transportation (e.g., walking or cycling), occupational (i.e. work) activities, household chores, play, games, sports or planned exercise. In order to improve cardiorespiratory and muscular fitness, bone health, and reduce the risk of noncommunicable diseases (NCDs), obesity and depression, the World Health Organization recommends: (i) engaging in at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or doing at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity; (ii) that aerobic activity be performed in bouts of at least 10 minutes duration; (iii) that, for additional health benefits, adults increase their moderate-intensity aerobic physical activity to 300 minutes per week, or engage in 150 minutes of vigorous-intensity aerobic physical activity per week or an equivalent combination of moderate- and vigorous-intensity activity (Figure 2), and (iv) that muscle-strengthening activities be done involving the major muscle groups on 2 or more days a week.

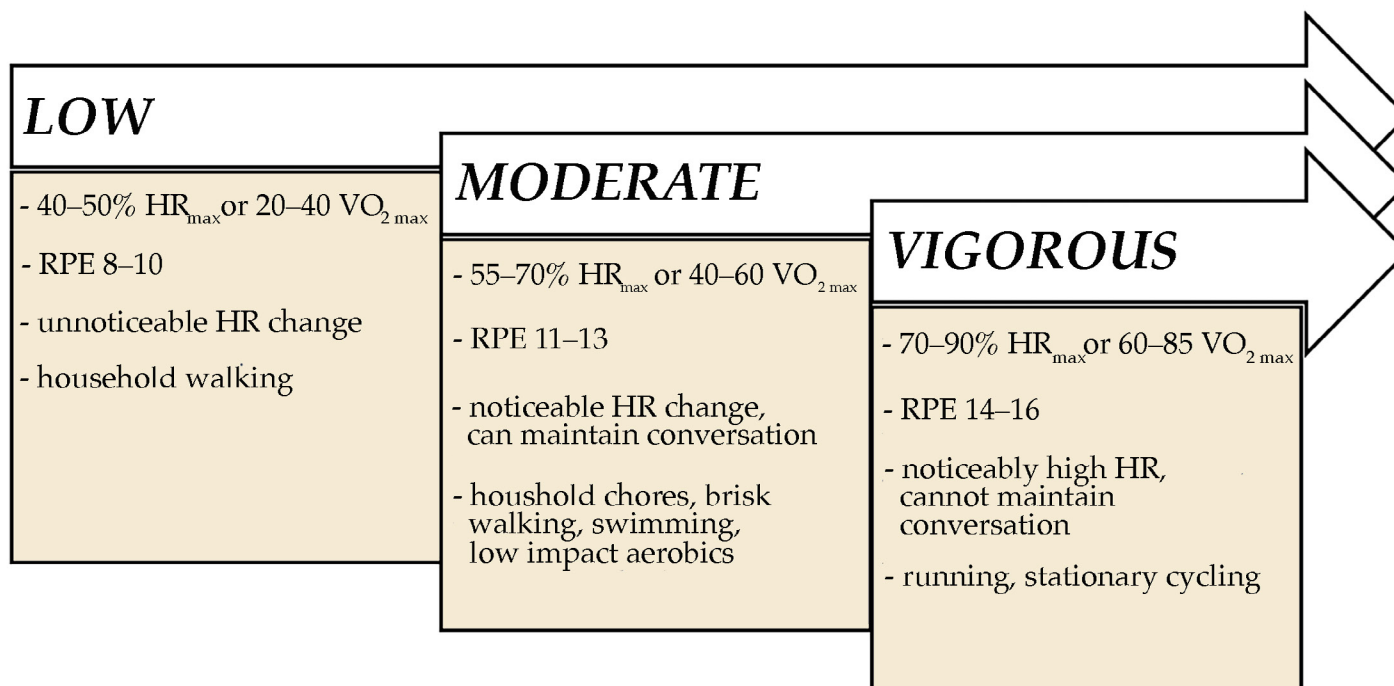


Figure 2: Physical activity intensity terminology and corresponding Rating of Perceived Exertion Scores (Harrison et al. 2016)

These recommendations are relevant to all healthy adults aged 18 to 64 unless indicated otherwise by their specific medical conditions. Pregnant and postpartum women and persons with cardiac events may need to take extra precautions and seek medical advice before striving to achieve the recommended levels of physical activity for this age group (Piercy et al. 2018; World Health Organization 2018). Well known international guidelines for physical activity are also summarised by the American Society for Reproductive Medicine and American College of Obstetricians and Gynecologists (2019). The described levels of exercise are recommended for prepregnancy, pregnancy and in postpartum periods. Dietary modifications in concert with exercise produce greater weight loss than exercise alone. Compared with their nonathlete peers, competitive athletes require frequent and closer supervision as they tend to maintain a more strenuous training schedule throughout pregnancy and resume high-intensity postpartum training sooner. Competitive athletes should pay particular attention to avoiding hyperthermia, maintaining proper hydration, and sustaining adequate caloric intake to prevent

weight loss, which may adversely affect foetal growth (American Society for Reproductive Medicine and American College of Obstetricians and Gynecologists' Committee on Gynecologic Practice 2019)

Establishing a lifestyle in preconception period which involves regular physical activity represents a challenge to every individual, which is why motivation from healthcare professionals as well as self-motivation for engagement in physical activity remain the key factors in health promotion. A paradigm shift is needed to focus more broadly on promoting physical activity before, during and after pregnancy. Studies indicate that women who meet the physical activity guidelines during the preconception period have reduced odds of excessive pregnancy weight gain. Also, women who became pregnant after participating in the pre- and interconception behavioural intervention (including a physical activity component promoting physical activity guidelines) had lower weight and a lower body mass index, as well as more appropriate gestational weight gain during pregnancy compared to controls (Downs, Chasan-Taber, Evenson et al. 2012). Despite the fact that recommendations suggest that women be counselled prior to conception and encouraged to adopt lifestyle changes to minimise pregnancy issues, few studies have examined the impact of preconception physical activity interventions and clinical recommendations on maternal and infant outcomes (Entin & Munhall 2006).

Physical activity is closely associated with positive and negative emotions (Alemdag, Alemdag, & Bora Ozkara 2016). This association may be either in the form of reducing the level of negative emotions (depression, anxiety and anger) or may emerge in the form of increasing the level of positive emotions. The quality of life reflects positive health and is multidimensional, subjective and integrative. It is also quite clear that physical

activity contributes to all aspects of the quality of life – not just the physical component (Gill et al. 2013). The meaning of quality of life and physical activity contributions varies across people and contexts.

What does a healthcare professional need to know about physical activity in preconception health education and counselling?

The main role of healthcare professionals is to design and to promote strategies which take into account specific behavioural characteristics, which also stem from culture or other socio-demographic characteristics. In studies where socio-demographic and socio-economic characteristics showed a strong correlation with the intention to change preconception health behaviour, the level of education was by far the most powerful one. For example, in a study conducted by Donahue et al. (2010), women with 12 years of education were more likely to be inactive prior to pregnancy than women with over 12 years of education. The same study also established that the prevalence of self-reported inactivity prior to pregnancy was highest for non-Hispanic black women (49.5% inactive) as compared to other races, multiparous women in comparison with those with fewer previous births (49.3%), and underweight women (51.2%). The prevalence of pre-pregnancy physical inactivity was also greater in women younger than 25, non-white women, women who were not married, women who had children prior to the current pregnancy, women with annual income of less than USD 25,000, lower levels of educational attainment, women who were underweight or obese, women who smoked prior to pregnancy, women whose pregnancy was unintended, and women who experienced three or more stressful life events in the year prior to childbirth (Donahue et al. 2010). In another study conducted by Vamos et al.

(2015), it was also established that women will more likely engage in physical activity in the preconception period when living in higher population densities and with median annual household income over USD 50,001.

The World Health Organization and Health in Preconception, Pregnancy, and Postpartum (HiPPP) Global Alliance have identified five preconception research priorities, which also reach into the field of physical activity. Physical activity ranked third on the list of priorities requiring future research to enhance our knowledge of both the physical activity of preconception women as well as the ways of its optimisation. This is pertinent given the declining levels of physical activity in women of reproductive age and a further decline observed during pregnancy (Hill et al. 2019).

Improving the health of women before pregnancy is an important strategy for reducing adverse pregnancy outcomes for the mother as well as the child. Hillemeier et al. (2008) collaborated in a study where they designed a randomised trial pretest-posttest intervention. Nonpregnant women in pre- and interconception period aged 18–35 were recruited in 15 low-income rural communities (n=692). Women were randomised in a ratio of 2-to-1 to the intervention and control groups; participants received a baseline and follow-up health risk assessment at 14 weeks and completed questionnaires to assess behavioural variables. Outcomes include the measures of attitudinal and health-related behavioural change. Women in the intervention group were significantly more likely than controls to report higher self-efficacy for eating healthy food and to perceive higher preconception control of birth outcomes; they showed greater intent to eat healthy foods and be more physically active, and greater frequency of reading food labels, engaging in physical activity consistent with recommended levels, and taking multivitamins with folic acid on a daily basis. The attitudinal and

behavioural changes attributable to the intervention were related primarily to nutrition and physical activity. These results of the study showed that these topics can be successfully addressed with women in the pre- and interconception period outside the clinical setting in community-based interventions.

In current times, maintaining a healthy lifestyle can be somewhat challenging, especially if we frame our daily physical activity within these guidelines. The threshold-centred physical activity messaging, which implies that health benefits can only be accrued at volumes of physical activity consistent with international guidelines, is not evidence-based and may present a significant barrier to those who would benefit greatly from simply becoming more physically active. When creating evidence-based and effective lifestyle recommendations, healthcare professionals should therefore avoid threshold-based physical activity guidelines and take due account of the unique features of each individual. In addition, effective lifestyle interventions should take an integrated approach to health, so as to further motivate individuals and promote the importance of engaging in healthy lifestyle behaviours (reducing sedentary time, increasing physical activity, healthy nutrition, smoking cessation, stress management, alcohol abuse, and other risk factors that are related to an unhealthy lifestyle) (Warburton & Bredin 2017).

Weisman et al. (2010) examined the preconception (pre-pregnancy) predictors of pregnancy weight gain in a prospective study, in which a total of 1,420 women were interviewed at baseline and 2 years later. Preconception maternal weight category as well as health behaviours, psychosocial stress, parity, and age were examined as predictors of pregnancy weight gain. Preconception overweight (BMI = 25–29.9) increased the odds of excessive pregnancy weight gain by nearly threefold, whereas preconception physical activity levels based on activity guidelines

reduced the odds of excessive weight gain. They concluded that although future research examining the role of physical activity in relation to pregnancy weight gain is needed, preconception overweight and physical activity levels are the prime targets for interventions to avoid excessive pregnancy weight gain.

Conclusion

Recent recommendations to improve preconception health and health care have inspired calls for innovative approaches to reduce adverse pregnancy outcomes, including strategies for improving women's health before they become pregnant. The majority of recommendations suggest a multipronged strategy for improving women's health before pregnancy through greater access to health care, community-based health promotion and a focus on individuals' health-related behaviour and cultural characteristics. The importance of regular physical activity is validated by its beneficial outcomes, yet the key methodological gaps highlight the need for more extensive, high-quality studies to clarify the optimal type, frequency, duration and intensity of physical activity required for beneficial health outcomes during preconception, pregnancy and postpartum. Preconception health promotion strategies are required, as during pregnancy it may already be too late to influence some health behaviours, as the impacts on foetal health have already been established.

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Effects of young men's and boys' eating disorders on sexuality and fertility

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Abstract

This study aimed to distribute knowledge of young men's and boys' eating disorders and the effects on their sexuality and fertility. Based on the literature, it became clear that boys' eating disorders manifest in different ways than girls' ones. Maybe this is the reason that boys' eating disorders are poorly identified in health care. Boys emphasize compulsive and copious exercise. Other features of their eating disorder behaviour include body and muscle dissatisfaction, striving for perfection, compulsive thoughts and activities, and very strict weight loss or exercise diets. The use of supplements or anabolic steroids may also be a symptom of boys' eating disorders. Eating disorders also pose a serious risk to young men's and boys' sexual and reproductive health, as being overweight and underweight affects testosterone and sperm production and can cause erectile dysfunction.

Keywords: boys, eating disorders, sexuality, fertility

Tiivistelmä

Artikkelissa tarkastellaan, miten syömishäiriöt vaikuttavat nuorten miesten ja poikien seksuaalisuuteen, ja miten ne vaikuttavat poikien hedelmällisyyteen. Kirjallisuuden pohjalta selvisi, että poikien syömishäiriöt ilmenevät eri tavoin kuin tyttöjen. Ehkä tämän vuoksi terveydenhuollossa poikien syömishäiriöt tunnistetaan huonosti. Pojilla korostuu pakonomainen ja runsas liikkuminen. Heidän syömishäiriökäyttäytymisensä muita piirteitä ovat esimerkiksi vartalo- ja lihassytyttömyys, pyrkimys täydellisyyteen, pakonomaiset ajatukset ja toiminnat sekä erittäin tiukat laihdutus- tai treenausruokavaliot. Myös lisäravinteiden tai anabolisten steroidien käyttö voi kuulua poikien syömishäiriöoireiluun. Syömishäiriöt vaarantavat myös nuorten miesten ja poikien seksuaali- ja lisääntymisterveyttä vakavasti, sillä ylipainolla ja alipainolla on vaikutusta testosteronin ja siittiöiden tuotantoon sekä ne voivat aiheuttaa erektiohäiriöitä.

Avaisanat: pojat, syömishäiriöt, seksuaalisuus, hedelmällisyys

Introduction

Eating disorders are often thought to be female diseases, but the eating disorder symptom in boys and men has increased. About 10% of boys and men have an eating disorder. It is therefore important that boys identify their potential symptoms of an eating disorder so that they can seek help. Getting help is important, because eating disorders can be cured and with help it is easier to succeed. The earlier you seek help, the easier it will be to treat an eating disorder. In boys, eating disorders can be associated with a variety of shame feelings, as eating disorders are still often perceived as a disease of only girls. This can make it even more difficult to seek for help. It would therefore be important for young people, but also for health professionals, to be more aware of the incidence of eating disorders in boys and their symptoms and effects, so that the threshold for seeking help is lowered.

In the article we will examine, how eating disorders affect young men's and boys' sexuality and fertility. The article is based on a traditional literature review in which information is extracted from literature broadly. The material in this article is mostly based on Finnish literature. We use term boys to refer to young men and boys in this article.

Eating disorders

The causes of eating disorders are not known exactly. Factors predisposing and triggering eating disorders can be biological, psychological, and culturally related. The biological factor is often genetic susceptibility. Psychological factors can include stress, emotional difficulties, and self-esteem problems. A culture-related factor can be an environment that glorifies weight loss. Anyhow, eating disorders are the sum of many factors.

Disruption of a normal eating behaviour occurs when food or related thoughts dominate or limit life. Eating or not eating is the main content of life, at which point it begins to disturb relationships, work, study, and hobbies. In the mind of a person with an eating disorder, the knowledge about healthy and sensible eating, is distorted. In such a case, the proportions of eating and healthy flexibility, are lost. Eating is governed by rules, rituals, and the pursuit of control. Disrupted eating behaviour is not an eating disorder, but it is still detrimental to physical and mental health. The boundary between disturbed eating behaviour and eating disorder is blurred. (Hasan et al. 2018.) Eating disorders are most common in young and young adult women, but boys and men also develop eating disorders. Eating disorders often occur at a young age between the ages of 12 and 24.

Eating disorders may manifest differently in male than female. Therefore, the current diagnostic criteria for eating disorders are

ill-suited for boys and men. Male eating disorders may involve the use of supplements or anabolic hormones, increasing muscle mass, and regimens aimed at reducing fat, even if weight loss is not aimed for.

Types of eating disorders

When talking about eating disorders, it is good to distinguish disturbed eating (DEB) from eating disorders. DEB is underestimated and rather common among young men (> 10 %), especially among overweight men. There are four DEB profiles, which are: compulsive thinking of dieting, eating in secret, being concerned about eating control, and mild disordered eating. The DEB behavior is associated with less physical activity, higher sedentary leisure time, and especially body-related motives to exercise. (Nurkkala 2021.)

The most well-known eating disorders are anorexia nervosa, bulimia nervosa, BED or binge eating disorder, and other specified feeding or eating disorder (OSFED). The latter ones are the most common eating disorders.

Anorexia nervosa:

includes trying to control weight by not eating enough food, exercising too much, or doing both (NHS n.d.).

Bulimia:

includes losing control over how much to eat and then taking drastic action to not put on weight (NHS n.d.).

Binge eating disorder (BED):

includes eating large portions of food until feeling uncomfortably full (NHS nd.).

Other specified feeding or eating disorder (OSFED):

a disorder that does not include typical diagnostic criteria for a weight loss disorder, binge eating disorder, or other defined eating disorder (NHS n.d.).

Orthorexia:

a diet where eating is as healthy as possible (Hanganu-Bresch 2020).

There are also other eating and feeding disorders or problems such as avoidant/restrictive food intake disorder (AFRID; avoiding certain foods, limiting how much to eat, or both), rumination disorder (food is brought back up from the stomach either rechewed, reswallowed, or spit out), and pica (a compulsive eating disorder where non-food items are eaten). (Beat Eating Disorders n.d.) Belief about weight or body shape are not reasons why people develop AFRID, rumination disorder or pica. (NHS n.d.)

Body and muscle dissatisfaction and muscle dysmorphism in boys

Young men are often dissatisfied with being underweight. They are also often dissatisfied with not having enough muscle mass. It is common for teenage boys to be dissatisfied with the size, shape, and distinctiveness of their muscles. At the extreme end of muscle dissatisfaction, is a severely disturbed perception of muscles, or muscle dysmorphia. Muscle dissatisfaction and muscle dysmorphia may be associated with the use of muscle-building supplements and anabolic steroids. A statistical association between muscle dissatisfaction and the use of muscle mass enhancers has been observed. However, not everyone who grows their muscles with different methods are dissatisfied with their muscles. In boys, even leanness or overweight clearly increases

body dissatisfaction and the risk of bodily and eating disorders. Boys may experience disturbed eating, which may manifest as skipping or substituting meals, strict diets, and alternating between starvation and binge eating. (Raevuori n.d.)

Concern about appearance or muscularity does not automatically mean there is an eating disorder. An eating disorder, muscle dysmorphia, or other bodily disorders usually develops only when the concern for appearance or muscularity becomes the centre of life and begins to interfere with normal everyday life, relationships, studies, or work. (Keski-Rahkonen et al. 2010.)

Boys' eating disorder behaviour

Eating disorders often occur in male differently than in female. Women have a greater emphasis on limiting total energy intake, while boys and men emphasize on compulsive and copious exercise. It is more common to aim for a muscular and lean body than a slim and lean body. For example, as many as a third of young Finnish men are dissatisfied with their own muscles. However, this has not been found to be related to weight. In modern society, the pursuit of muscularity is easily perceived as normal. It can be difficult to determine when healthy physical fitness becomes a compulsive control of the body. (Nurkkala et al. 2017.)

Diagnosis criteria for eating disorders have been developed strongly from a female perspective. Because eating disorders in boys and men often manifests as extreme pursuit of muscularity rather than leanness, it can be difficult to identify it as an eating disorder. In health care, the eating disorders of boys are poorly recognized. In health care, not all diagnoses of eating disorders can be utilized, and the criteria for the diagnoses used are strict or not specific to boys' symptoms. In addition, boys may conceal

their eating disorder symptoms because they are perceived as female symptoms. Particular attention should be paid to disturbed eating associated with overweight and obesity.

Boys' eating disorder behaviours include a variety of traits, such as a disturbed body image, perfection striving, demandingness, compulsive exercise, compulsive thoughts and activities, and constant mirroring, measuring, or weighing the body. In addition, some traits are also disturbed and rigid eating, such as the constant alternation of starvation and binge eating or very strict dieting or training diets. These same features also occur in muscle dysmorphism and dysmorphic body image disorder.

The use of supplements and anabolic steroids may be associated with boys' eating disorders. Boys may also alternate fat-reducing diets with supplements and anabolic steroids (Tarnanen, Suokas & Vuorela 2015). It is quite common for boys and men with an eating disorder to also suffer from many other mental problems such as depression, substance abuse, and obsessive-compulsive disorders. (Keski-Rahkonen et al. 2010.)

Effects of eating disorders on boys' sexuality

Eating disorders can be associated with sexuality problems as sexuality is part of basic functions of the body. In adulthood, there may be a conscious or unconscious fear of sexuality. This can manifest as a struggle against body change. Natural sexuality can be problematic if the body awakens mostly feelings of contempt and shame. The body is seen as wrong and, until it meets certain requirements, sex or sexuality cannot be enjoyed. Poor self-image and emotional problems are a difficult starting point for sexuality. There may be a need to suppress sexual needs and redirect sexual energy elsewhere, such as body modification, other eating symptoms, and performance. (Heimo & Sailola 2014.)

Eating disorders have often a negative effect on sexuality. People with an eating disorder are more likely to have a decreased sexual desire and problems related to their relationships and sexual interaction than people without eating disorders. They are also more likely to live without a relationship compared to those without an eating disorder. (Syömishäiriöt; Käypä hoito-suositus 2014.)

It has been discovered that the lower the BMI is in anorexia nervosa, the more difficulties there are regarding sexuality (Morin-Papunen 2014). Anorexia also reduces sexual function in boys and men. The acute phase of anorexia is often associated with a decrease in sexual interest. It also causes infertility due to weight loss and dramatic changes in hormonal balance (Keski-Rahkonen 2010).

Overweight caused by bulimia nervosa may cause physical and self-harm. Being overweight can cause metabolic syndrome and testosterone deficiency, both of which can cause erectile dysfunction. Regular and healthy exercise and activity can protect against erectile dysfunction. (Ritamo, Ryttyläinen-Korhonen & Saarinen 2011.)

Eating disorders in boys may be associated with the use of supplements or anabolic steroids. The long-term effects of anabolic steroids are unknown. Anabolic steroids and their non-medical substitution treatments are associated with sexual dysfunction as one of the health hazards. (Seppälä 2010.) The use of anabolic steroids to build muscle may initially increase sexual desire, but later the libido may begin to decline which can lead to impotence and sexual reluctance. Discontinuation of anabolic steroids can also cause impotence. Hormone activity returns to normal in about 3 to 12 months after cessation. (Mustajoki 2020.) Anabolic steroids can also cause prostate hyperplasia and increase the risk for prostate cancer. (Tuovinen 2020.)

Eating disorders and a problematic relationship with food and the body are often also reflected in some way to relationships and sexuality. An eating disorder is often accompanied by the challenge of allowing yourself nice things or pleasure. Negative thoughts about one's own body often also inevitably affect sexual desire. Pleasure can feel strange and something that isn't allowed. Low self-esteem can bring thoughts of unworthiness of intimacy. Intimacy with another person can also seem demanding. Being aware of the effects of eating disorders on sexuality and interpersonal relationships helps to address these challenges. The body image of someone recovering from an eating disorder recovers much slower than, for example, the weight. On average, the body image normalization occurs about 5 to 10 years after reaching normal weight. However, not everyone who has otherwise recovered from an eating disorder, may ever recover from their broken body image. (Keski-Rahkonen 2010.)

Effects of eating disorders on boys' fertility

Eating disorders pose serious threats to sexual and reproductive health. Lifestyle factors affect fertility, most notably weight. Being overweight and underweight impairs boys' fertility. Obesity predisposes to a wide range of diseases that also have effects on fertility. The body's glucose tolerance is reduced, which predisposes to hormonal imbalances, metabolic problems, cardiovascular diseases, and diabetes.

Being overweight is detrimental to both female and male fertility. For example, malnutrition can cause overweight due to excessive energy intake. Being overweight has been found to alter the body's hormonal balance, which impairs fertility and may cause infertility. Being overweight reduces testosterone production in men. It also impairs sperm production. Being overweight can also be associated with high levels of insulin, which can be a cause of

infertility. Increased insulin secretion creates a similar condition in men as anorexia creates in women.

Being overweight is associated with low semen volume, low sperm density, and low total sperm count. The circumference of the waist is related to the total number of sperm. The larger the waist circumference, the lower the total number of sperm. (Eisenberg et al. 2014, 195.) In addition, being overweight reduces sperm motility and causes DNA disturbances in sperm. Being overweight also causes erectile dysfunction. Adipose tissue in the inner thighs and groin warms the testicles and impairs sperm production. Higher estrogen levels have also been found in overweight people than in normal weight people. In men, too much estrogen increases feminine traits and impairs sexual ability and semen quality. If a pregnancy is wished for, it is good to remember that even a man's overweight affects the development of the embryo, the course of the pregnancy, and even the body fat composition of the growing child.

Underweight also impairs boys' fertility. Underweight has been linked to an increased number of abnormal sperm. It is also suspected that underweight has a lowering effect on semen density.

Boys may use anabolic steroids to increase muscle mass. Anabolic steroids reduce sperm quality. Testosterone, taken from outside the body, suppresses your testosterone production in the testicles. The use of anabolic steroids can reduce the production of one's own sex hormones or even stop its production altogether. Prolonged use of anabolic steroids can lead to testicular atrophy. Even short use can lead to azoospermia. Anabolic steroids can cause permanent damage to sperm production, especially in teenage users (Perheentupa 2019).

The use of anabolic steroids also has side effects that indirectly affect reproductive health. These side effects include psychiatric symptoms and severe mood disorders such as hyperactivity, irritability, aggression, impaired concentration, reckless behaviour, and psychotic symptoms such as suicidal thoughts and actions.

Conclusion

Male eating disorders manifest differently than female, and therefore health professionals may not necessarily recognize boys' eating disorders. Eating disorders are often still thought of as female diseases. Attitudes about eating disorders can cause boys to feel ashamed of their eating disorders. Therefore, discussion and awareness about boys' eating disorders and their manifestations should be increased. Also, about how they differ from girls' eating disorder symptoms. For example, boys' eating disorders could be highlighted in schools as a problem in a similar fashion as girls' ones. This means that attitudes could change. In this way, boys could also have the courage to seek help. Boys' eating disorders may be associated with a disrupted body image, and the pursuit of a muscular body and perfection. Therefore, it would be important to discuss body image with boys, for example, in schools during a lesson or at a school nurse visit. It would be important to find ways to increase the appreciation and acceptance of the individual male body.

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The effect of alcohol on preconception health and fertility

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Abstract

Prenatal care often starts too late considering the fact that modifiable risk factors like for example consumption of alcohol negatively effect female and male fertility and also pregnancy outcomes. Although evidence partly is scarce alcohol has a negative effect for female and for male fertility. Whereas women can have impaired menstrual cycles and therefore need longer to conceive, men can have lower sperm quality and hormone status. A threshold amount of alcohol beyond which the risk increases has not yet been determined. Therefore, the recommendations can only be decreasing the amount of drinking and stop drinking when wanting to conceive to prevent negative effects of alcohol consumption on your and your family's health.

Keywords: female fertility, male fertility, preconception health, alcohol, negative effects

Zusammenfassung

Bedenkt man, dass beeinflussbare Risikofaktoren, wie beispielsweise Alkoholkonsum sowohl die männliche und weibliche Fertilität als auch das Schwangerschaftsoutcome negativ beeinflussen, wird oft zu spät mit der prä-konzeptionellen Gesundheitsvorsorge begonnen. Auch wenn die Studienlage bezüglich Alkohol und dem Einfluss auf die Fertilität teilweise spärlich und auch kontrovers ist, kann gesagt werden, dass Alkohol einen negativen Effekt sowohl für die weibliche als auch für die männliche Fertilität mit sich bringt.

Während Alkoholkonsum der Frau den Menstruationszyklus beeinflusst und damit die Empfängnis erschwert wird, hat schwerer Alkoholkonsum bei Männern eine verringerte Spermienqualität und einen beeinträchtigten Hormonstatus zur Folge. Eine genaue Menge, ab wann Schädigungen eintreten kann bisher nicht genau genannt werden. Daher kann es nur eine Empfehlung bezüglich Alkohol und prä-konzeptioneller Gesundheitsvorsorge geben: eine Einschränkung des Alkoholkonsums bei Männern und eine Aufgabe des Alkoholkonsums bei Frauen sobald sie schwanger werden möchten.

Schlüsselwörter: weibliche Fertilität, männliche Fertilität, präkonzeptionelle Gesundheitsvorsorge, Alkohol, Auswirkungen

Introduction

Prenatal care is often too late for a good maternal and child outcome because many risks occur before women get into prenatal counselling. Therefore, it is important that interventions start as early in preconception period as possible. Especially as it is known that “fetal programming” influences the rest of a child’s life. Preconception care wants to promote health of reproductive aged individuals to have better pregnancy and birth outcomes. The World Health Organization (WHO) defines preconception care as carrying out biomedical, behavioural and social health interventions before conception occurs. The benefit is highest, when preconception focuses on health over the whole life span because people often are not aware which effects lifestyle factors can have on their fertility (WHO 2013; Hurst & Linton 2015; Goeckenjan 2017; Thompson 2017).

Many studies show the beneficial effect of changing modifiable risk factors which are responsible for adverse birth outcomes but knowledge about this topic in reproductive aged individuals is scarce. In many countries no specific information about preconception health topics are available for the public. That’s why our Honeycomb Model should spread the world. To bring

preconception health topics to reproductive aged men and women, so they have all information needed for really making an informed decision about their family plan. Furthermore, men and women should know what they can do to have the best possible outcome for their offspring. The Honeycomb Model of Preconception Health not only contains lifestyle choices but also other important factors regarding the topic, e.g. age and fertility, environmental factors and many more. All of them are important concerning the topic preconception health. This article especially will deal with the topic alcohol as a modifiable risk factor for preconception health. Aim is to show the effects of alcohol on preconception health and fertility of men and women which maybe aren't known in the broad public.

Alcohol and its adverse effects on preconception health and fertility

Looking on Austrian statistics, they clearly show a high content of the Austrian population drinking alcohol. With 12,2 litres pure alcohol per capita in the population aged 15+ Austria is on the second position compared with the other European countries mentioned in the OECD statistics. Whereas the amount of alcohol, which is drunken, is relative constant over all age groups in the female population it increases in the male population. The critical amount of 40g for women and 60g for men is exceeded by one quarter of the male and female population at least once a month (OECD 2018). Considering this statistics information about alcohol and its effects on preconception health and fertility should be given to men and women. Therefore, the following chapter contains information concerning alcohol and its effects on preconception health, fertility and birth outcomes for both genders.

Female perspective on alcohol and its effects on fertility, preconception health and birth outcomes

Most people are aware that drinking alcohol can have negative impact on pregnancy outcomes. Although evidence partly is controversial, there are more studies with substantial evidence that heavy alcohol consumption is correlated with preterm birth, low birth weight and the occurrence of the Fetal Alcohol Disorder Syndrome. Alcohol is teratogen and its degradation is slower in fetal cycle than in the maternal cycle. Heavy alcohol consumption and binge drinking can cause serious health restrictions like prenatal or postnatal growth restriction, neurodevelopmental deficits including mental retardation, facial dysmorphism and brain damage. A range of effects which create lifelong challenges for individuals and substantial costs to the society are results from alcohol consumption in pregnancy. The more drinking in pregnancy occurs (especially binge drinking) the more minor anomalies are detected in children and the poorer are their performances on cognitive and behavioural measures. Children have to face reductions in child intelligence and effects on its behaviour like hyperactivity, impulsivity, distraction, risky behaviour, infantilism and disorders in social maturity. The more alcohol is consumed the anomalies mentioned increase. Considering this fact and that until now no safe level of alcohol consumption in pregnancy could have been significantly proven no recommendation concerning low dose alcohol consumption in pregnancy can be made (Floyd et al. 2008; Fertig & Watson 2009; Ingersoll et al. 2011; May et al. 2016; Carson et al. 2017; Koletzko et al. 2018).

Knowing all this we are criticising women drinking during pregnancy, saying things like: “These women shouldn’t have babies at all. So many women try getting pregnant without success whereas those women don’t know how lucky they are!”

Why aren't we that strict with women drinking alcohol when they aren't pregnant? Because they only harm themselves? Or because we don't know about the harmful effects alcohol can have on women's fertility?

Even though the body of evidence on the impact of alcohol on female fertility isn't that strong than it is for alcohol consumption on pregnancy outcomes female fertility can be affected through alcohol consumption. Studies describe a negative impact of alcohol consumption on the menstrual cycle and on the fertility but no exact amount can be mentioned. Problems in clearly describing the effects also occur because there is no standard drink or comparative way to measure alcohol consumption. But isn't the fact that fertility can be impaired by drinking alcohol information enough not to drink when we want to conceive? Would we risk our babies lives when we don't know exactly if something is dangerous for them? Research suggests that it takes longer to conceive if women drink alcohol in preconception period. Furthermore, alcohol use can promote excess free radical production which could negatively affect fertility (Agarwal et al. 2012). Knowing this the only recommendation health professional can give to women is avoid drinking alcohol when trying to conceive. Especially if the fact is considered that no safe amount of alcohol is known until now and that high amounts of alcohol and binge drinking can negatively affect pregnancy outcomes.

Male perspective on alcohol and its effects on fertility, preconception health and birth outcomes

Mostly men aren't involved in lifestyle choices during pregnancy because they don't think that their choices have any impact on the baby during pregnancy. Some maybe think that while babies are safe in the mother's womb they cannot do anything for the baby. "Being part of the act of procreation and supporting my

girlfriend/wife is the only thing I can do for our family planning until the baby is born.” But this attitude simply is wrong. Men can take responsibility much earlier namely in the preconception period. Here they can do everything possible to stay healthy and ensure their chance for having a baby, a healthy pregnancy and a healthy child outcome.

One way to ensure these things is to think over and change modifiable risk factors. Drinking alcohol is one of them. Although the results in literature are divergent about effects of alcohol consumption on male fertility especially heavy drinking negatively affects male fertility. There is a significant association between alcohol intake and lower semen volume and sperm morphology. How alcohol affects the male reproductive function depends on the consumed amount of alcohol. A threshold amount of alcohol beyond which the risk of male infertility increases has not yet been determined. Also potential DNA damage due to alcohol consumption is discussed in the literature. Data on heavy drinking are clearer. Here studies show significant results that testosterone level, semen volume, sperm count and the number of sperms with normal morphology and motility are lower among alcoholic than non-alcoholic men. Also, sexual dysfunction is a result because men aren't able to have effective intercourse when consuming a high amount of alcohol. The effect of moderate alcohol use on male fertility is still under debate on the one hand because the mechanisms underlying the damage on fertility are not yet fully clarified on the other hand because studies point out no statistically significant evidence for moderate alcohol consumption on male reproductive function, for example the semen parameters (Frey 2010; McBride & Johnson 2016; van Heertum & Rossi 2017; Sansone et al. 2018).

It could be imagined that only maternal alcohol exposure in pregnancy results in negative outcomes for the offspring but also alcohol consume of men can have negative impact on the unborn child. Direct and indirect effects of paternal drinking are mentioned in literature. While men who drank 10 or more drinks per week had a two to five times increased risk of spontaneous abortion, they also affect fetal and infant health through carrying out social influence on their female partner. The likelihood for women to quit drinking during pregnancy if the partner is drinking is much lower than if the partner wouldn't drink. Other mentioned outcomes are developmental and behavioural alterations in offspring of alcohol consuming fathers. Alcohol consumption even can influence the outcomes of In Vitro Fertilization Treatments. There is a lower rate of live births when men drink alcohol (van Heertum & Rossi 2017).

So, what can we tell men now considering alcohol and preconception health? High amounts of alcohol can influence the testosterone level, semen volume, sperm count and the number of sperms with normal morphology and motility. All these factors are lower than in men who don't drink high amounts of alcohol. So, drinking high amounts of alcohol should clearly be avoided. There is no statistical evidence that moderate alcohol consume impacts male fertility therefore the recommendation for men is to decrease alcohol consumption. Because alcohol consumption can also negatively impact the outcome of IVF treatments men should avoid alcohol at least one week before giving their sperm for the treatment. Considering other factors mentioned above men should generally avoid alcohol before they try to conceive.

Conclusion

There are many modifiable risk factors, which can be changed to improve maternal, child and paternal health. Hence, it is necessary to focus the interventions on both genders to get an optimal outcome. Taking into account the situation that preconception isn't part of the governmental health policies in many countries it is very important to broaden the mind of the population considering fertility and to give the population the opportunity to make healthy fertility decisions. Here health professionals and teachers are asked to take responsibility. What we do to our fertility and to our offspring has to be brought in mind of all people within reproductive age. Health providers in the field but also health professionals in educational settings can be an important source for spreading this information.

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Smoking as adverse effect on preconception health and fertility

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Abstract

Women and men postpone having children for different reasons, which sometimes has negative effects on their fertility. Life threatening risk factors such as unhealthy diet, smoking or alcohol have additionally negative impact on generations to come. Health professionals should counsel couples about preconception health and their abilities to have a safe pregnancy and better child outcome. This article provides science-based information or research-based information how smoking can affect health in general and fertility in particular in both women and men. Furthermore, it can help to make the right recommendations concerning smoking and preconception health. Smoking negatively affects women and men in their ability to have a healthy baby through impairing oogenesis, hormonal status, semen quality and DNA structure of the semen. Concerning this evidence, there is one recommendation only, namely quit smoking as soon as possible to prevent the negative effects of tobacco consumption on your health.

Keywords: female fertility, male fertility, preconception health, smoking, impairments

Zusammenfassung

Die verspätete Entscheidung von Frauen und Männern Nachwuchs zu bekommen, kann deren Fertilität negativ beeinflussen. Speziell, wenn beide Geschlechter zusätzlich Risikofaktoren wie ungesundem Essen, Rauchen, Alkohol usw. ausgesetzt sind. Diese veränderbaren Faktoren beeinflussen die Fertilität zusätzlich. Der Artikel bietet wissenschaftliche Informationen, wie Rauchen die prä-konzeptionelle Gesundheit und Fertilität beider Geschlechter beeinflusst. Zusätzlich soll er Expert*innen im Gesundheitswesen unterstützen, die richtigen Empfehlungen zum Thema Rauchen und prä-konzeptionelle Gesundheit zu geben. Rauchen beeinflusst die Fähigkeit ein gesundes Baby zur Welt zu bringen. Diese negativen Auswirkungen betreffen beide Geschlechter. Veränderungen in der Follikulogenese, im weiblichen und männlichen Hormonstatus, in der Spermienqualität und in der DNA Struktur der Spermien konnten nachgewiesen werden. Wissenschaftliche Erkenntnisse in Betracht ziehend, kann nur folgende Empfehlung abgegeben werden, nämlich so schnell als möglich mit dem Rauchen aufzuhören oder den Konsum zumindest deutlich einzuschränken um die Fertilität nicht weiter einzuschränken und ein optimales Schwangerschaftsoutcome zu erreichen.

Schlüsselwörter: weibliche Fertilität, männliche Fertilität, prä-konzeptionelle Gesundheit, Rauchen, Einschränkungen

Introduction

Women and men postpone having children for various reasons. Career, waiting for Mr. or Ms. Right, travelling around the world or experiencing new things before settling down is made some excuses for postponing childbirth. Statistics in Austria show that the average age of women when giving birth to their first child had been 27.5, whereas it rose up to 29.7 in 2018. In the same period of time the number of women in age of 35 or older when giving birth to their first child rose from 19.1% in 2008 to 23.1% in 2018 (Statistik Austria 2020). Information was circulated (or transferred) by media and influencers including actors and other famous people have supported this trend, because there is a

false hope that medicine can overcome all limits given by nature. Only little information has leaked to the public if fertilization treatments do not succeed and that infertility treatments cannot guarantee 100 percent the chance of pregnancy. Furthermore, the myth of the biological clock that is only ticking for women remains in the head of people persistently. A few know that the number of men capable of having a child also has been decreasing over the years. Health professionals are important partners to transfer correct information to overcome those myths. Information is a crucial tool for making informed decisions whether to become a parent in young ages or whether to postpone it. One approach is to modify life threatening habits such as smoking, alcohol consumption, drug abuse, disposing to environmental hazards and many more mentioned in our Honeycomb Model, which is described earlier in this handbook, as soon as possible to have the best chance (or the better chances) for a good maternal and child outcome.

The currently problem which led to the project is the fact that many health care systems all around the world offer prenatal care, when it is often too late for a good maternal and child outcome. Because these programs set on prenatal care and not on the time before pregnancy.

Problems occur which could be inhibited if there was counselling in the preconception period. Many risks occur before women get into prenatal counselling and many factors, which influence a women's ability for getting pregnant, occur even earlier. Namely, before they even want to get pregnant. Preconception care wants to set by promoting health of reproductive aged individuals to have better pregnancy and birth outcomes. The World Health Organization (WHO) defines preconception care as carrying out biomedical, behavioural and social health interventions before conception occurs. The benefit is the highest when preconception

care focuses on health over the whole life span because people often are not aware which factors affect their fertility. Even though it is considered that, the “fetal programming” influences the rest of a child’s life. Not only women should be informed in a proper way, also men should be part of preconception health programs. More and more studies show that planning reproductive life is as important for the male population as female, by considering the fact that some modifiable risk factors have negative impact on the spermatozoa and their offspring (Barron 2013a; WHO 2013; Bodin et al. 2017; Goeckenjan 2017; Thompson et al. 2017). Despite this clear information, there is a lack of accommodation with preconception care in many countries. Nationwide interventions considering preconception health care for the population are missing, modifiable risk factors are analysed and targeted separately but there are no coherent interventions focusing on the topic preconception health.

As mentioned before, the Honeycomb Model of Preconception Health suggests many different factors, which are important regarding this topic. Lifestyle choices are one of them. The focus of this article will be smoking as a modifiable risk factor for preconception health. Aim is to describe the effects of smoking on preconception health and fertility of men and women, which are not spoken before and are unknown for a large number of people. For gathering information, a scoping literature review has been conducted by the author of this chapter, identifying studies describing the effects of smoking on preconception health. The literature review has been conducted in the electronic databases Medline, CINAHL Plus with Full Text, PubMed, Science Direct and Cochrane from October 2018 until February 2019. At the end of the review, 61 different sources were integrated in the review summarizing the most important and newest information on the topic smoking and preconceptional health.

Smoking and its impact on fertility, preconception health and birth outcomes

Preconception has to be taken into account by both men and women. Therefore, the following chapter is divided into sections about the effects of smoking on preconception health and fertility for both genders. Furthermore, also information is given about smoking and its effects on birth outcomes.

What does smoking do to preconception health, fertility and what does it mean for the birth outcome of the children – female perspective

Information on effects of smoking are widespread and not new. The negative effects of smoking on unborn babies does not account for a scientific breakthrough at all. The societies know about this information and women can be criticized, if they smoke in public when they are pregnant. Smoking during pregnancy results in a lower birth weight, fetal growth restriction, increasing risk of preterm delivery and early neonatal morbidity. There is a linear correlation between the number of cigarettes smoked per day and the birth weight of new-borns. In addition, second hand smoke shows the same negative pregnancy outcomes. Not only the human perspective but also the economical aspect clearly points out that exposing pregnant woman to tobacco through either consumption or breathing tobacco in the air results in higher costs for the healthcare systems (Anderka et al. 2010; Burstyn, Kapur & Cherry 2010; Dean et al. 2013). Even if people do not know all this information, they at least know that smoking harms their own health and the health of an unborn baby. Therefore, we are criticizing women who smoke in pregnancy while asking ourselves “What is she doing? Doesn’t she know what she is doing to her baby?” Nevertheless, we are not looking strictly to a not pregnant woman when she smokes, right? Why are not the societies that much strict in this case? That is the crux

of the matter. The ignorance about the adverse effects of cigarette smoking on female and male fertility keeps us quiet and no information about these topics come to our societies.

Female fertility can be seriously inhibited through smoking. Menstrual cycles, the physiological function of the ovaries and the hormone levels are impaired by the consumption of cigarettes. Smoking at least one pack of cigarettes per day or (daily) can shorten the length of menstrual cycles and women who smoke half of a pack per day show more variations in menstrual phases and menstrual length rather than non-smoking women. It is a challenge for getting pregnant, by considering the fact that many women do not know their natural cycle length even without different impairments by modifiable risk factors. Additional burden for female fertility associating with smoking is the physiological impairments of the ovaries. The uterine flow velocity, the tubal function resulting in ectopic pregnancies and the folliculogenesis (development of the ovarian follicles) itself are impaired. A reason for impaired folliculogenesis is the retainment of smoke components in the ovaries and the toxic follicle environment. This toxic environment leads to follicles loss, impairment of morphology and oocyte maturation. Which means that egg cells cannot develop in a proper way. Because also female hormone levels play an important role in getting pregnant, the hormonal disruption also leads to an impaired fertility, with a follicle depletion and an oocyte dysfunction triggered by the oxidative stress (Dechanet et al. 2011; Barron 2013b; Sharma et al. 2013, Sobinoff et al. 2013). All negative impacts of smoking can lead to impaired fertility at the time a woman decides having a baby. Combined with other factors, people might have been able to alter these negative effects if they have had the information about those modifiable risk factors earlier.

As mentioned before, men cannot be released from any responsibility because also their decisions have an impact on their fertility and therefore on their reproductive life plan. Their decisions may also effect to the birth outcomes for their children and so the next subchapter focuses on smoking and its impact on fertility, preconception health and birth outcomes from the male perspective.

What does smoking do to preconception health, fertility and what does it mean for the birth outcome of the children – male perspective

For a long time, men were not involved with pregnancy. Fatherhood began when the baby has been born. Nowadays, the situation changed for men during pregnancy. They accompany their female partners to prenatal classes and birth. Still they often feel that they cannot do anything for the baby in pregnancy. At least they think that their choices cannot affect the outcome of pregnancy at all. This manner of thinking is wrong. In addition, men can do a lot in preconception period to stay healthy and so ensure their chance for having a baby, a healthy pregnancy and a healthy child outcome.

Similar to women, also men seem to have little information about modifiable risk factors. Studies show that fertility knowledge beyond men even seems lower than in women. Therefore, it is especially important to take into account also the male perspective of modifiable risk factors. Another reason why it is important to include also men in preconception health is that men tend to have a general overconfidence in fertility issues (Bodin et al. 2013). Men often keep talking about their ability for parenting even in their old age they entertain the idea that their biological clock ticking merciless. They are not aware that dealing with modifiable risk factors has an impact on their fertility or their ability for having

a healthy baby. Those myths have to be clarified too, so men can make wiser decisions concerning their preconception life planning.

Smoking is one modifiable risk factor that weakens the semen quality and contributes to infertility. In addition, the health of a baby can be affected by paternal smoking. First, smoking impairs the semen parameters including semen volume, sperm density, total sperm count and the motility and morphology of sperms. Even if the evidence concerning these aspects is moderate, men should consider the possibility that semen parameters can suffer from tobacco exposure. Further negative aspects are harm to the sperm DNA, dysfunction of spermatogenesis, impaired spermatozoa function, impaired sperm maturation process and mutations in sperms. Mutations and DNA damages in sperms usually result in infertility, subfertility or spontaneous abortions, which is frustrating for whom is concerned. A blind eye on this topic is that with some degree of DNA damage pregnancy is still possible and so these negative impacts of smoking on the semen quality may have serious effects on pregnancy outcomes like birth defects or childhood cancer. Research exists that there is a higher risk for a child to develop acute lymphoblastic leukaemia later when her/his father was smoking. Additionally, second hand smoke negatively affects the mother and indirectly her chance to quit smoking becomes smaller if the partner also smokes (Barron 2013a; van der Zee et al. 2013; Barrat et al. 2017).

What recommendations can health professionals give men and women about smoking and its effect on preconceptional health? The recommendations, which can be given after checking the research in this field, are listed in the next subchapter of this article.

Recommendations health professionals can give

Despite the negative impact on fertility, smoking can cause severe serious diseases no matter if you are female or male, so people should generally avoid it. Public Health shows that blaming people is often not the right way to stop them from harming themselves by modifiable risk factors. So only giving the right information can help people to make informed decisions. Women should stop smoking quite some time before they plan to have a baby. When it is not possible, they at least should reduce the number of cigarettes smoked, cause research indicates that the less smoking the better for the fertility. Women should also choose a smoke free environment because of the hazardous effects of second-hand smoke. Also, men should stop smoking a while before planning to have a baby. Information must be given to the male population that semen has the ability to reproduce itself and so men can lower the risk of low sperm quality when they quit smoking.

Conclusion

Preconception health care is an important issue for generations to come (or next generations), especially when it is considered that smoking does not only influence pregnancies but also the fertility of more generations. Smoking is one modifiable risk that can be changed to improve maternal, child and paternal health. Hence, it is important to focus on interventions on both genders to achieve an optimal outcome. The focus of tobacco consumption and its outcome on our health exists already for a long time. What is missing in most countries is to connect the information of smoking with preconception health. That is the aspect we have to gander now. The knowledge about what we do to our fertility and what we can possibly do to our offspring has to be brought within the public. Health providers are the first contact point

who are able to spread this information. Teaching your pupils, giving the information to the patients/clients in your workplace and spreading the information in your faculties/schools can help bridging the gap in and through education.

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Sleep and fertility

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Abstract

It has been noted that the quality of sperm has deteriorated at the same time as sleep disturbances have increased in societies around the world. Sleep has a holistic impact on human health, including sexual and reproductive health. This article describes what sleep is, why it is so important to health, how it affects hormones and therefore fertility, and how, as a professional, one can advise youth and young adults to protect and improve their fertility by prioritizing sufficient and high-quality sleep. This information can be used in health guidance of youth and young adults, and training future health professionals in better preconception health awareness.

Key words: sleep, fertility, preconception health, hormones

Tiivistelmä

On huomattu, että siemennesteen laatu on heikentynyt samaan aikaan, kun unihäiriöt ovat lisääntyneet. Uni vaikuttaa kokonaisvaltaisesti ihmisen terveyteen, myös seksuaali- ja lisääntymisterveyteen. Tässä artikkelissa kuvataan mitä uni on, miksi se on terveydelle niin tärkeää, miten se vaikuttaa hormoneihin ja sitä kautta hedelmällisyyteen ja miten voit ammattilaisena neuvoa nuoria ja nuoria aikuisia suojelemaan ja parantamaan hedelmällisyyttään priorisoimalla riittävän pitkät ja laadukkaat yöunet. Saat tämän artikkelin avulla tietoa unen vaikutuksesta hedelmällisyyteen, voit hyödyntää tietoa ohjatessasi nuoria ja nuoria aikuisia hedelmällisyyden suojelemaan.

Introduction

Does quality and quantity both matter? Yes, it does, when it comes to sleeping. Calculating hours of sleep is important, but so is assessing the quality of sleep. In the pursuit of better sleep, it is most often started by counting the number of hours spent in bed. The amount of sleep is a good starting point, but in addition to that, the focus must also be on the restfulness and quality of sleep. It would be optimal to maximize both, the amount and quality of sleep, to promote health and fertility. (Walker 2017.) The recommended amount of sleep in adults is seven to nine hours every night. This does not mean time spent in bed. When sleeping, eyes are closed, the smart phone put away, and the TV is in a different room entirely. (Walker 2017.)

The quality of sleep means how well one sleeps. An adult's good quality sleep means falling asleep in less than 30 minutes, sleeping through the night, waking up once at the most, and then falling asleep again within 20 minutes. Poor sleep involves difficulty falling asleep, staying asleep, and restlessness when sleeping. The quality of sleep is more difficult to measure than the amount of sleep. (Walker 2017.)

To sum it up, both the amount and quality of sleep are relevant. Sleep loss and poor sleep quality both cause physical and mental exhaustion. Neither quantity or quality should be compromised, since both good quality and consistent sleep allows for an optimal amount of restoring sleep. (Walker 2017.)

The importance of sleep

A person sleeps about a third of his or her whole life. Sleeping is perceived as passive and somewhat useless, but in fact many bodily functions and the brain are very active. The brain works almost as efficiently as when the person is awake. (Cirelli et al. 2006.)

During the day, waste material accumulates in human organs, which must be removed. Waste material also accumulates in the brain because of metabolism, and that must also be removed. In other parts of the body, this waste management is carried out by a lymphatic system. The lymphatic system does not reach the brain; therefore, the brain must have its own purification system. (Hablitz et al. 2019.)

This system, glymphatic system, works mainly during sleep. The glymphatic system is a functional waste clearance system for the vertebrate central nervous system (CNS). While sleeping, cerebrospinal fluid flows through the brain tissue and flushes the waste out of the brain. Efficient brain waste management requires deep sleep. A short or decreased amount of deep sleep impairs the glymphatic system and can cause neurological diseases in the long run. (Hablitz et al. 2019.)

For a long time, it was thought that sleep is important primarily in restoring brain function. It is currently known that sleep has a strong impact not only on normal brain function, but also on metabolism, immunity, and cardiovascular function. In addition, sleep has a major effect on normal endocrine function. (Andersen & Tufik 2008.)

Regular circadian rhythm ensures hormonal balance

Sleep affects health and well-being in many ways. Sleep and circadian rhythm -dependent human biology is strongly linked to fertility biology, which explains why sleep is so essential for good fertility (Palnitkar et al. 2018).

Normal hormonal activity of women is based on cyclicity and a circadian rhythm. It can even be stated that women's sexual and reproductive health depends on a regular circadian rhythm down to a molecular level, each fertility-related activity benefits from

wakefulness, sleep, and their regular cycles. (Sen & Sellix 2016.) Men's endocrine function is also dependent on a regular circadian rhythm. Testosterone secretion follows the circadian rhythm and is highest during sleep (Rose et al. 1972). The prolactin hormone is also important for male fertility, the secretion of which also occurs during sleep (Spiegel et al. 1994). Studies have shown that men with sleep apnea have lower testosterone levels, even when overweight is excluded as underlying reason (Hammoud et al. 2011). In summary, there is some understanding of the links between male fertility and sleep disorders, but all sleep disorders and their specific effects are difficult to research. Many connections are indirect through hormonal balance and primary health. When poor sleep impairs health, it usually also impairs hormonal balance and therefore, sexual and reproductive health (Palnitkar et al. 2018).

As noted, normal testosterone levels require good and high-quality sleep. Low testosterone levels cause symptoms typical of menopause in men, or andropause, without it being connected with age. These symptoms include impaired sexual desire and erection, decreased intellectual performance, reduced muscle mass, reduced bone mineral density and increased visceral fat. Andropause also causes the testicle tissue to decrease. (Andersen & Tufik 2008.)

Sleep and fertility

The effect of sleep on fertility has only been researched more in recent years. It is still uncertain whether the effects are due to the amount of sleep or the quality of sleep. Kloss et al. (2015) presented a model in which the effect of sleep on fertility was approached by three different factors. In this model, stress, sleep regulation disorders and normal circadian rhythm disorders were thought to explain the effect of sleep on hormones and,

by extension, fertility. By repairing sleep, hormones function normally in balance, restoring the conditions for fertility.

Kloss et al. (2015) reported that sleep disorders are associated with infertility through at least three different mechanisms of action. The first is the activation of the hypothalamus-pituitary-adrenal gland (HPA) axis, which increases sleep disturbances, while also interfering with reproduction. Secondly, they explain that the changed sleep duration and ability to stay asleep can in themselves hinder conception, since the HPA axis is overly activated. Thirdly, disorders in the normal circadian rhythm in itself, can cause infertility.

In terms of protecting fertility, maintaining a normal and regular circadian rhythm supports the body to function as it should, in balance. As a consequence, the menstrual cycle is regular, ovulation occurs in its time, and the quality of the sperm remains good with the help of good testosterone levels.

Sleep disorders and fertility

Sleep disorders bring with them a wide range of health challenges. In a woman, sleep challenges can arise for a variety of reasons, but hormonal causes are related to menstrual cycles, pregnancy, or menopause. It seems that the quality of sperm has deteriorated around the world at the same time as sleep disorders have increased in our societies. It is suspected that behind sleep disorders and unexplained infertility there is sleep-time oxygen deprivation, oxidative stress, low-level inflammation, insulin resistance and elevated blood fat levels (Palnitkar et al. 2018). In women, for example, polycystic ovarian syndrome (PCOS), which causes infertility, is linked to sleep disorders (Fogel et al. 2001).

Shift work can cause menstrual and fertility disorders, increase the risk of miscarriage, and cause low birth weight in the infant

(Goldstein & Smith 2016; Sen & Sellix 2016). For shift workers, it takes longer to conceive (Zhu et al. 2003) and their ovarian reserve has decreased (Mínguez-Alarcón et al. 2017).

Sleep disorders have been studied to increase appetite and hunger. A sleep deprived person needs to eat more, and normal control can easier be lost. Too little sleep can increase insulin resistance and therefore, increase the risk for diabetes. Low levels of sleep also hinder normal metabolism, which can increase blood glucose levels. Focusing on adequate sleep length and quality effectively prevents the overweight and diabetes risk. (Goldstein & Smith 2016; Reutrakul & Van Cauter 2018.) Overweight and metabolism disorders are a significant risk to fertility. Sleep disorders may also cause biological changes in the same way as stress and may affect fertility (Goldstein & Smith 2016). Insomnia can greatly reduce the outcome of infertility treatments and, on the other hand, good sleep can be a good and cheap way to improve the chances of success in IVF-treatments (Goldstein & Smith 2016).

Promoting good sleep

Increasing the amount of sleep is easier than improving its quality. One can easily increase the sleep volume by going to bed earlier or waking up later. Extending sleep time by 30 minutes at each end can improve sleep quality and improve its' restorability. (Walker 2017.) In fact, time spent in bed is not always the same as the time spent sleeping. Sleep time can be reduced by electronic devices in the bedroom and poor sleep hygiene. Poor sleep hygiene is clearly accompanied by practices that harm sleep, e.g. drinking coffee, tea, cola, or energy drinks in the late afternoon or in the evening before going to bed. Consuming alcohol in the evening also affects the quality of sleep. Alcohol may feel relaxing at first, but it adversely affects the quality of sleep.

Physical activity in the evening can lead to restless sleep and extra awakenings at night. In smokers, nicotine acts as a stimulant in the evenings and again the lack of nicotine can cause waking up too early. (Walker 2017.)

Electronic devices (smart phones, TV's, tablets) glow artificial blue light. Blue light interferes with the secretion of the sleeping hormone, melatonin. It confuses the body's internal clock, which notifies when it's time to sleep and wake up. The longer one spends in shining blue light in the evenings, the greater the delay in melatonin secretion. Delays in melatonin secretion cause problems both in falling asleep and staying asleep. (Gooley et al. 2011.)

One can improve the quality of sleep by creating routines for the evening. Regular bedtimes, minimizing use of stimulants, avoiding heavy meals or exercise at bedtime, are good ways to improve the quality of sleep. The bedroom of a good sleep is dark and cool and there is a comfortable bed. (Walker 2017.) With small, but smart steps it is possible to improve health and fertility, by balancing the hormones with enough good quality sleep.

Here are ten steps that can help to improve healthy sleep habits (Walker 2017; THL 2021):

1. Make time to sleep.
2. Keep a regular sleep rhythm; Go to bed and wake up at the same time every day. Keep it also during weekends.
3. Calm the last 2 hours before bedtime for quiet and relaxing activities, such as reading. Too much blue or artificial light signals the brain to wake up.
4. Avoid heavy meals, exercise, or alcohol too close to bedtime.

5. Avoid nicotine and caffeine in late afternoon or evening. Caffeine has an 5–7-hour half-life, which means that after 7 hours, the body still contains 50 % of the caffeine that was consumed 7 hours ago.
6. Take a hot shower, bath, or sauna in the evening. The drop in temperature after getting out from the heat may help one feel sleepy.
7. Keep the bedroom dark, cool and gadget-free.
8. Enjoy daylight during the day, it will help to regulate daily sleep patterns.
9. If you cannot fall asleep in 15 minutes, get up and do something relaxing, until the sleepiness returns.
10. Instead of a long nap during the day, take a walk outside in the fresh air.

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The role of maternal stress in the fetal programming

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Abstract

The maternal physical health has received special attention in the past decades. Many preconception health and care programs consider the overall assessment of physical health before conception. However, mental health does not take the attention of these programs as it deserves. Mental illnesses are included in some programs only if the woman is already diagnosed with a mental problem, but mental health is not the absence of mental diseases.

Recent evidence indicates that prenatal maternal stress has negative effects on the fetal growth and development by programming mental disorders in human population. Although the cause of mental disorders is not completely understood, stress is known as a crucial factor in susceptibility to mental disorders. The aim of this review is to investigate the role of stress in fetal programming and pregnancy outcomes.

Keywords: preconception health and care, mental health, stress, fetal programming, epigenetics

Zusammenfassung

Die körperliche Gesundheit der Mütter hat in den letzten Jahrzehnten besondere Aufmerksamkeit erhalten. Viele präkonzeptionelle Gesundheit und Prävention Programme berücksichtigen die Gesamtbeurteilung der körperlichen Gesundheit vor der

Schwangerschaft. Allerdings ist die psychische Gesundheit nicht die Aufmerksamkeit dieser Programme, wie es verdient. Psychische Erkrankungen sind in einigen Programmen nur dann enthalten, wenn bei der Frau bereits ein psychisches Problem diagnostiziert wird, aber psychische Gesundheit ist nicht das Fehlen von psychischen Erkrankungen.

Die Studien aus den letzten Jahren deuten darauf hin, dass psychische Belastungen der Mutter sich negativ auf das Wachstum und die Entwicklung des Fötus auswirken können, indem sie psychische Störungen in der menschlichen Bevölkerung programmieren. Obwohl die Ursache psychischer Störungen noch nicht vollständig verstanden ist, gilt Stress als wertvoller Faktor für die Anfälligkeit für psychische Störungen. Das Ziel dieses Reviews ist es, die Rolle von Stress auf die fetale Programmierung und Schwangerschaft Outcome zu untersuchen.

Stichwörter: präkonzeptionelle Gesundheit und Prävention, psychische Gesundheit, Stress, fetale Programmierung, Epigenetics

Introduction

The internal and external environments influence the growth and development of living organisms. Evolution illustrates the adaptation responses of living organisms to the environmental changes during a long period of time. However, the environmental effects are not always evolutionary. Epigenetic studies show how a certain genotype can express different phenotypes after adaptive responses to environmental conditions. The queen bee is an example of the environmental effects. The studies show that the genotype of the queen bee is not different from the workers, although the considerable differences are evident including the size.

The studies on the effects of early environmental conditions on the fetal development led to the concept of 'Developmental Origins of Health and Disease'. The notion has changed to the

“fetal programming” later. Fetal programming indicates how the alteration of the internal or external environment can trigger the functional and structural changes in the fetal body organs. The fetal development is a plastic process within several phenotypes can be characterized from a given genotype. (Entringer et al. 2015) Stress is an important factor for fetal programming. Stress is a neural, emotional, physical or chemical factor that creates different levels of tension on the physical or mental unite. The excessive tension can make a living organism be susceptible to certain diseases. Stressors can be internal factors (e.g. decrease in blood glucose) or external (e.g. COVID 19 pandemic).

The aim of this review is to investigate the role of stress in fetal programming and pregnancy outcomes.

Fetal Programming

David Barker and his colleagues (1989) have developed the concept of ‘Developmental Origins of Health and Disease (DOHaD)’ based on the observed associations between low-birth weight and its effect on the increasing risks of cardiovascular diseases and type II diabetes in later life. They have suggested that the function and structure of fetal organs can be altered during the sensitive period of the fetal development in responses to the early environmental events. Programming means that a particular environmental factor in the specific moment of the developmental period creates a permanent effect resulting in a bias to produce an exact response to certain environmental inputs. (Lewis et al 2014) Adaptation to the environment in utero can create permanent changes in the body organs in adulthood. Some adaptive changes have positive affect on the preparation for the life after birth. However, some environmental factors including high levels of stress can make the child be susceptible to certain diseases. (Babenko et al. 2015; King et al. 2015)

The concept of 'Developmental Origins of Health and Disease' is developed to the concept of "fetal programming" later.

Epigenetics

Babenko and colleagues (2014) defines the epigenetics as the study of heritable changes in the gene expression. Epigenetics is the promising field to disclose the secret of fetal programming. Epigenetics defines how a certain genotype can develop to multiple phenotypes without any changes in DNA sequence if being situated in diverse circumstances. (Crews 2008) Epigenetic information transfers across the generations. In other words, DNA sequence is not the only heritable components, the gene expression is also heritable. (Babenko et al. 2015) According to Crew (2008), the environment determines the properties of a cell and its fate. Briefly, epigenetics indicates how the changes in the internal and external environment affect the expression of genes. Epigenetic changes in gene expressions act through DNA methylation, histone modification and chromatin remodeling. (Babenko et al. 2015)

Stress

Stress is common during pregnancy and increases the risk of several diseases in adulthood for the unborn baby. In physics, stress is known as the resistance against force. According to American Institute for stress (AIS), the term "stress" (definition by Hans Selye, 1936) is "the non-specific response of the body to any demand for change". Traylor et al (2020) adopt the definition of stress from Cohen and co-workers as excessive environmental demands on an organism that exceed its adaptive capacity, causing psychological and biological changes that can be the predisposing factors for certain diseases. Stress is characterized by intensity and duration or types of stressors. Stress can be

acute, occurring in a short period of time with higher intensity, or chronic when it lasts a longer period of time. The stressful stimuli can be emotional (e.g. depression or anxiety) or physical (e.g. heat). (Glover 2014) They can be internal (e.g. decrease in blood glucose) or external (e.g. environmental events). It is possible that a stressor to be individual (e.g. financial problem) or global (e.g. COVID 19 pandemic). (Traylor et al. 2020)

Prenatal maternal stress and the environment in utero

Prenatal maternal stress (PNMS) creates an adverse environmental condition for the unborn baby and contributes to the birth phenotype and physiological alteration of organs. (Entringer et al. 2015) The fetal programming, with resetting of the HPA axis, is thought to be responsible for these effects. (Miranda und Sousa 2018) PNMS activates the maternal Hypothalamic-Pituitary- Adrenal (HPA) axis to produce high levels of cortisol. Cortisol is known to be one of the main factors affecting the fetal growth and development. The placenta regulates the maternal cortisol concentrations and prevents the fetal direct exposure to maternal cortisol. The placental enzyme, that is responsible for the regulation of excess maternal cortisol, is 11 beta-hydroxysteroid dehydrogenase type 2 (11beta-HSD2). This enzyme converts maternal cortisol to its inactive form cortisone. Unfortunately, 11beta-HSD2 is only a partial barrier. Increased cortisol levels decrease and inactivate 11 beta-hydroxysteroid dehydrogenase type 2 (11beta-HSD2). Downregulation of this enzyme exposes the fetus to excess cortisol. Cortisol alters the structure and shape of the fetal developing brain and sensitizes it to stress. In addition, excess maternal cortisol may increase the production of placental corticotrophin-releasing hormone (CRH) and subsequently the activation of fetal HPA axis for producing adrenal steroids. (Entringer et al., 2015)

It is not evident when the most sensitive time for the influence of prenatal stress is. However, it is considered that the developmental sensitivity must be seen in the light of the outcome studies on the fetal developmental stage. Because the effects of fetal exposure to prenatal maternal stress depend on the stage of pregnancy, the type of stress and the sex of offspring. According to two studies on schizophrenia, the sensitive period was known to be the first trimester. In contrast, stress in late pregnancy was associated with conduct disorder, or antisocial behavior. (Glover 2014)

The effect of prenatal maternal stress on pregnancy

Prenatal maternal stress (PNMS) is of utmost importance because it can alter the fetal healthy growth and development. The early period of life is the time of the neuronal plasticity. (Crews 2008) Therefore, many changes in the fetal neuronal system can be epigenetic changes, remain constant during life. (Babenko et al. 2015)

The current studies show that the fetal exposure to maternal stress may have the long-term consequences and increases the risk for physical, behavioral and mental disorders later in life. (van den Bergh et al., 2020) PNMS leads to dysregulated HPA axis activity and consequently, different types of mental and behavioral disorders, including depression, anxiety, schizophrenia, emotional problems, sleep disorders, symptoms of attention deficit hyperactivity disorder, increased fearfulness, and impaired cognitive development. (Glover 2014; King et al., 2015) In addition, PNMS is associated with low birth weight, small body size, early delivery, pregnancy induced hypertension and other problems such as increased risk of asthma, and autism. (Glover 2014; Entringer et al. 2015). Furthermore, stress can lead to intellectual impairment through the reduction of the grey-matter density of the fetal brain. (Glover 2014)

Sum up

Physical health is naturally considered as the important aspect of preconception care and health programs. However, mental health is not taken appropriate attention as it deserves. To manage the chronic diseases and improve the child outcomes, it is expected that preconception health and care programs provide a holistic approach towards the health.

It is evident that the intrauterine environment plays a crucial role in the health status across generations through fetal programming. Several factors can cause an adverse environment intra utero for the fetal growth and development including stress. Prenatal maternal stress with fetal programming effect can create an adverse environment for fetal healthy development, resulting in susceptibility to certain diseases in offspring. Unfortunately, stress can frequently remain undetected by health professionals, and untreated. (Glover 2014) It is advisable to offer psychological consultation to every couple planning to have a child in the future. In addition, it is necessary to develop the effective strategies for stress management.

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Part IV;

Pre-existing
medical conditions

Chronic medical conditions and preconception care

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Abstract

The prevalence of chronic medical conditions is increasing in the general population and among women who are at reproductive age. Several pre-existing, chronic medical conditions can cause adverse maternal and fetal pregnancy outcomes. Preconception care aims to detect and control these conditions in order to improve pregnancy-related outcomes.

To guide reproductive life planning, women with chronic medical conditions need information regarding the risk of pregnancy complications and maternal morbidity and mortality, disease prognosis, conflicts between the treatment of the medical condition and fetal wellbeing, optimal timing of pregnancy, and the ability to become pregnant at present time or in the future.

An optimal pregnancy timing is important during the preconception care of women with chronic medical conditions. Therefore, the use of contraception for women with chronic medical conditions is often brought forward.

Keywords: pre-existing medical conditions, chronic medical conditions, preconception, pregnancy

Abstract

Chronische medische aandoeningen komen steeds vaker voor. De prevalentie van deze aandoeningen stijgt ook bij jonge vrouwen, tijdens hun reproductieve levensfase. Verschillende reeds aanwezige chronische medische aandoeningen kunnen een nefaste zwangerschapsoutcome voor moeder en foetus veroorzaken. Preconceptiezorg wil deze medische aandoeningen opsporen en opvolgen om eventuele problemen voor de vrouw en haar kind(eren) te voorkomen.

Een optimaal geplande zwangerschap is belangrijk. Daarom hebben vrouwen met een gekende chronische aandoening correcte informatie nodig met betrekking tot het risico op zwangerschapscomplicaties en maternale morbiditeit en mortaliteit, ziekteprognose, mogelijke interacties tussen hun therapie en het welzijn van de foetus. Hierbij hoort ook het bespreken van contraceptie.

Sleutelwoorden: chronische medische aandoeningen, preconceptie, zwangerschap

Introduction

The prevalence of chronic medical conditions is increasing in the general population and among women who are at reproductive age (Neff, Hunt & Shawe 2020). Several pre-existing chronic medical conditions can cause adverse maternal and fetal pregnancy outcomes. Preconception care aims to detect and control chronic medical conditions in order to optimize pregnancy-related outcomes for the woman and her child(ren) (Dunlop et al. 2008).

To guide reproductive life planning, women with chronic medical conditions need information regarding the risk of pregnancy complications and maternal morbidity and mortality, disease prognosis, conflicts between the treatment of the medical condition and fetal wellbeing, optimal timing of pregnancy, and the ability to become pregnant at present or in the future.

The chapter presents an overview of pre-existing chronic medical conditions of the respiratory, cardiovascular, neurological and endocrine system. Followed by the genetic condition 'cystic fibrosis', the gastro-intestinal condition 'inflammatory bowel disease', the immunological condition 'rheumatological disease' and cancer. Rare conditions are not included here. Each section summarizes the points of care that health care professionals should consider concerning preconception and the pre-existing chronic medical conditions.

Because an optimal pregnancy timing can be important during the preconception care of women with pre-existing chronic medical conditions, the use of contraception is brought forward.

Pre-existing chronic medical conditions of the respiratory system: Asthma

Asthma is a common medical condition that can be well-controlled, but asthma may complicate a pregnancy. However, becoming pregnant is not contra-indicated for women with asthma. The main goal is to maintain optimal control of the asthma for maternal health as well as fetal health. Asthma control should start in the preconception period with patient education on the use of medication, avoidance of asthma triggers and in time treatment of asthma exacerbations. Also, active and passive smoking must be prevented. Acute asthma exacerbation during the first trimester increases the risk of congenital malformations and must therefore be avoided where possible. Uncontrolled asthma can cause low birth, pre-eclampsia, and preterm birth (Neff, Hunt & Shawe 2020).

Most asthma medications can safely be used during pregnancy with few exceptions. Inhaled corticosteroids are the preferred therapy and asthma medications should be continued during

pregnancy and lactation. Healthcare professionals need to motivate medication adherence because half of women stop their medications in pregnancy. Women should be aware that poorly controlled asthma can put the fetus at greater risk than asthma medication (Vatti & Teuber 2012).

Physiologic pregnancy changes interact with the pathophysiology of asthma. There are positive effects e.g., bronchodilatation due to pregnancy hormones, but also negative effects. Pregnancy increases the oxygen consumption with 20%. To compensate this need minute volume will increase by 40–50%. As the uterus enlarges, it pushes the diaphragm up which results in a reduction of lung capacity. In consequence, around 75% of the pregnant women with asthma suffer from dyspnea (Vatti & Teuber 2012).

Cardiovascular system

Pathology in the cardiovascular system is uncommon in women of reproductive age. However, heart disease remains a cause of death in young women. Cardiovascular problems should be considered in women who attend a preconception consultation. If present, referral to a specialist is needed and an individualized and interdisciplinary guidance should be started.

Hypertension

Risk factors for cardiovascular problems such as hypertension are common. Up to 1 in 10 pregnancies are complicated by hypertension that was present before the pregnancy. Pregnancies complicated by pre-existing hypertension can worsen the already present hypertension and can cause (pre-) eclampsia, central nervous system hemorrhage, cardiac decompensation, and renal deterioration. Other risks are preterm birth, low birth weight, intra-uterine growth restriction, placental abruption, and fetal death. There is also an increased risk for a caesarean section.

Pregnancy outcome is related to the degree of hypertension and whether preeclampsia is present or not (Neff, Hunt & Shawe 2020; Dunlop et al. 2008).

Medical treatment of hypertension is very effective in reducing long-term adverse outcomes. However, the evidence proving or disproving the benefits of pharmacologic treatment of all types of high blood pressure during pregnancy is small and there exists an increased risk of complications. For women suffering from severe (180mmHg–110mmHg) chronic hypertension, antihypertensive therapy can positively affect the pregnancy outcomes. All antihypertensive medications will cross the placental barrier and some agents can increase the risk of congenital malformations (Neff, Hunt & Shawe 2020; Dunlop et al. 2008).

Thrombosis and embolism

Thrombophilia is a condition that causes increased blood clotting and is associated with an increased risk for deep vein thrombosis (DVT), lung and brain embolisms and arterial thromboembolic processes. Thrombophilia can be roughly divided into hereditary (or congenital) and non-hereditary (or acquired) variants (NHS website, 2020).

Thrombophilia in pregnancy is associated with an increased risk of miscarriage, severe pre-eclampsia, placental infarction, solution placentae, fetal growth retardation, fetal cerebral infarction and fetal death (Neff, Hunt & Shawe 2020).

Pulmonary embolism is the leading cause of maternal death in pregnancy. Women with a history of DVT are at a higher risk. Superficial thrombophlebitis in the medical history is also a risk factor for venous thromboembolism in pregnancy (Neff, Hunt & Shawe 2020).

Screening for DVT is a necessary step during the first consultation. Women with a history of DVT should be referred preconceptionally to specialists. They guide the therapy. Oral anticoagulants with warfarin are teratogenic and should therefore be avoided. They can be substituted by low weight heparins which are less teratogenic for the fetus (Neff, Hunt & Shawe 2020).

Neurological system

Epilepsy

Seizure disorders, like epilepsy, are common in preconception care. Around 6 per 1000 women have a form of epilepsy and 1% of pregnancies are complicated with epilepsy. This prevalence seems low however epilepsy is associated with significant morbidity and mortality in pregnancy including maternal death and is therefore very important (Fiest et al. 2016).

Luckily most of these pregnancies (90%) are uncomplicated. Possible complications are miscarriage, low birth weight and congenital fetal malformations including reduced head size, cardiac malformations, genitourinary defects, orofacial dysmorphisms, but also neurodevelopmental problems, neonatal bleeding problems and perinatal death are described (Fiest et al. 2016; Neff, Hunt & Shawe 2020; Tomson et al. 2019).

During pregnancy convulsions are more frequent and caused by increased sleep deprivation, changes in medication, lapses in therapy compliance due to the fear of congenital malformations. Medical treatment of seizure disorders and epilepsy is associated with congenital malformations. All four major groups of epilepsy treatment, phenytoin, carbamazepine, valproate and phenobarbital can increase the risk for malformations. It is unclear which therapy is the safest, but valproate is considered to have the highest associated risks (Harden et al. 2009; Tomson et al. 2019).

Women with epilepsy or a seizure disorder should be well informed preconceptionally about the increased risk of seizures during pregnancy, the potential risks of serious complications due to the seizures and the effect of anti-epileptic therapy on the pregnancy and neonatal outcome (Harden et al. 2009; Neff, Hunt & Shawe 2020; Tomson et al. 2019).

A planned pregnancy is recommended under supervision of a multidisciplinary preconceptional team, including a neurologist. The target of possible treatments during preconception is to avoid maternal seizures. If the woman has been without seizures for at least two years one may consider lowering the drug dose to a stable blood level to prevent the seizures. The neurologist should aim for monotherapy in combination with a lower dose. When using the medication women must take folic acid supplementation, minimum 400mcg, up to 4mg per day starting at least one month before conception until the end of the first trimester (Harden et al. 2009).

Note: ant-epileptic, antiseizure therapy (e.g., carbamazepine and phenytoin) affects the effectivity of hormonal contraception. The contraceptives can fail due to the rapid metabolism, which may result in unplanned pregnancies.

Migraine and tension headache

Headache is a frequent reason for referral to a neurologist. Mostly women are affected, and the peak incidence is situated around their 20-ties and 30-ties, during their reproductive period. The association headache and pregnancy are easily made and quite frequent. Few studies write about the impact of the headache on pregnancy outcome. However, migraine improves during pregnancy there seems an association between migraine and developing hypertension and pre-eclampsia. The mechanism behind this complication is not well understood. Evidence also

shows a higher incidence of preterm delivery. The effect of a pregnancy on tension headache is not known yet (Marozio et al. 2012).

It is important to note that migraine patients manage the headaches themselves, by over-the-counter medication. Healthcare providers have to advise women known with migraine and who have a pregnancy wish to contact their general practitioner or neurologist (what to do) in case of a migraine attack. The usually used medication, triptans and ergotamine, should be avoided because of the teratogenic effects they cause (Marozio et al. 2012; Neff, Hunt & Shawe 2020).

Endocrine system

Thyroid conditions

The manifestation of thyroid diseases varies and is related to the availability of iodine in the diet of men and women. Iodine is essential to produce thyroid hormones. In 1000 women, 6.2 suffer from thyroid disease (Samyn et al. 2011). In regions where iodine is widely available, most thyroid disorders have an autoimmune cause. Whereas in regions where iodine is depleted congenital hypothyroidism is found in 1 per 3500–4000 newborns (Alexander et. 2017).

Because euthyroidism is necessary for the development of a healthy embryo, health professionals should screen for 3 types of thyroid disease (Van Lieshout et al. 2013):

- Hypothyroidism
- Subclinical hypothyroidism
- (Subclinical) Hyperthyroidism or thyrotoxicosis

Hypothyroidism

As a result of increased estrogen levels, the need for thyroid hormones in pregnant women increases starting at 5 weeks of gestation and stabilizes from the 16th to the 20th week of pregnancy. Healthy pregnant women can meet the extra need by producing more thyroid hormone. This will not work in case of maternal hypothyroidism and extra supportive medication (levothyroxine) will be needed from the 5th week up until the 20th week (Van Lieshout et al. 2013; Neff, Hunt & Shawe 2020).

In un(der)treated hypothyroidism, sub- or infertility is possible. There is also a higher risk for pregnancy complications, miscarriage, gestational hypertension (with pre-eclampsia), solutio placentae, anemia, postpartum hemorrhage, prematurity, low birth weight and fetal mortality. Long term consequences are impaired cognitive and psychomotor development (Alexander et al. 2017; Van Lieshout et al. 2013)

Subclinical hypothyroidism

Subclinical hypothyroidism manifests as a thyroid gland that is functioning well and is producing normal quantities of hormone but requires additional stimulation to maintain normal output. The disorder affects up to 3% of women at reproductive age (Alexander et al. 2017). Subclinical hypothyroidism in pregnancy is associated with an increased risk of pregnancy complications.

However, this condition does not always require treatment. Hormonal supplementation is safe during pregnancy and therefore is recommended as there may be a benefit in terms of a reduction in miscarriage risk (Van Lieshout et al. 2013; Alexander et al. 2017).

The main aim of preconception counselling in (subclinical) hypothyroidism is optimizing TSH concentrations prior to pregnancy in order to prevent antenatal complications.

(Subclinical) Hyperthyroidism

Hyperthyroidism affects around 1% of the population at some stage in their lives and it puts a woman at an increased risk of thyrotoxicosis, especially around the birth. In addition, there is an increased risk of miscarriage, intra uterine growth retardation and premature birth (Van Lieshout et al. 2013; Neff, Shunt & Shawe 2020). The expecting mothers are at risk for pre-eclampsia, solutio placentae, heart failure and stroke (Alexander et al. 2017). Due to these severe risks, individual preconception care is needed in women with hyperthyroidism for optimizing the disease and its therapy.

Diabetes Mellitus

Diabetes mellitus is characterized by high blood glucose and defects in insulin production or action. Diabetes is common and increasing in prevalence. Worldwide 9.3% of the adult population is diagnosed with diabetes and the number is increasing (Saeedi et al. 2019). The three most common types are type 1 diabetes, type 2 diabetes and gestational diabetes mellitus.

Type 1 diabetes is a state of absolute insulin deficiency caused by an autoimmune destruction of the insulin-producing beta cells in the pancreas and can only be treated with insulin replacement.

With Type 2 diabetes, the patients' body is increasingly resistant to the effect of insulin. More insulin is needed to maintain normal blood glucose concentrations, but the pancreas inadequately produces insulin. Type 2 Diabetes is more common in older adults but is increasingly seen in children, adolescents, and younger adults (World Health Organization 2021). This type counts for +/- 90% of all diabetes patients (International Diabetes Federation 2020). In patients with Type 2 diabetes medication is not always needed. If necessary, patients may use non-insulin pharmacotherapy, insulin therapy only, or a combination of therapies. (Damm et al. 2016).

In obstetric care, pregnancies can be complicated by gestational diabetes. This type of diabetes knows its onset during pregnancy and is diagnosed by a raised blood glucose during pregnancy. This raised blood glucose usually normalizes on delivery. However, about half of women with gestational diabetes will develop diabetes within 5 to 10 years after delivery (Damm et al. 2016).

Up to 6% of pregnancies are now complicated by pre-gestational diabetes. Pre-gestational diabetes is associated with an increased risk of adverse pregnancy outcomes for both the mother and baby: congenital malformations (e.g., neural tube defects), miscarriage, pre-eclampsia, preterm delivery, large for gestational age, birth injury (to the mother and baby), induction of labour, caesarean section, neonatal morbidity (including hypoglycaemia, hyperbilirubinaemia, and respiratory distress), and neonatal death (National Institute for Health and Care Excellence 2015; Neff, Hunt & Shawe 2020).

Moreover, maternal diabetes status may also be important as babies exposed to maternal hyperglycaemia during pregnancy are at increased risk of developing obesity and Type 2 diabetes growing up (Shafaeizadeh et al. 2020). Adverse outcomes can be reduced with good care, with the focus on preventing hyperglycaemia. Therefore, the importance of preconception care, and avoiding unplanned pregnancy, should be part of standard clinical care for women with diabetes during their reproductive stage of life (National Institute for Health and Care Excellence, 2015; Neff, Hunt & Shawe 2020). Only 1 in 12 women with pre-gestational diabetes mellitus receive the correct preconceptional counselling, e.g. 1st trimester HbA1c < 6.5%, folic acid 5 mg and stopping teratogenic medication (Neff, Hunt & Shawe 2020).

Additionally, women with diabetes are more likely to have associated medical problems such as hypertension, dyslipidaemia, and obesity. Given these comorbidities, the preconception care of women with diabetes can be complex. Pregnancies need to be planned carefully and should be followed by specialists. Effective preconception care focuses on excellent blood glucose control, folic acid supplementation, adjusting medication, and optimizing the preconception management of associated conditions (National Institute for Health and Care Excellence 2015).

Genetic conditions: Cystic fibrosis

Cystic fibrosis (CF) is an autosomal recessive condition that affects the lungs, gastrointestinal tract, liver, pancreas and testes by producing tough mucus. There is a shorter life expectancy due to the occurrence of chronic respiratory infections. However, with improved care focused on optimizing nutrition and respiratory function, most people with CF now live into adulthood, and rates of pregnancy, though low, have increased over time (Edenborough et al. 2008; Heltshe et al. 2017).

CF causes impaired fertility in men (inhibition of sperm transport), and women (menstrual disturbance, changes in cervical secretion). Because of this, reproductive assistance is needed for couples in which the man or woman suffers from CF. Preconception care can help couples to conceive physiologically, and the majority of pregnancies have a healthy outcome (Heltshe et al. 2017; Neff, Hunt & Shawe 2020).

Once pregnant, women risk respiratory failure due to the physiological deterioration in respiratory function. Mostly the deterioration passes and doesn't cause change in lung function postpartum, but women still should be counselled (Edenborough et al. 2008). Complications such as miscarriage and preterm

labour are more common. The risk depends on genotype and on preconception lung function. Therefore, preconception counselling needs to be individualized. Good preconception and antenatal care can help women experience a good pregnancy and a vaginal delivery (Heltshé et al. 2017; Neff, Hunt & Shawe 2020).

Gastro-intestinal: inflammatory bowel disease

Inflammatory bowel disease affects up to 1% of young women and men. In inflammatory bowel disease, both the disease itself and the treatment can complicate preconception care. Fertility can be impaired in both men and women by both disease activity and previous surgical interventions. Active inflammatory bowel disease at the time of conception or during pregnancy is associated with an increased risk of complications during pregnancy. The primary aim of the individualized preconception care is to ensure that the maternal disease is stable (Neff, Hunt & Shawe 2020).

Immunological: Rheumatological disease

The term 'rheumatological disease' refers to a wide range of conditions, including rheumatoid arthritis and lupus. Rheumatological disease is on the rise in women of reproductive age. The morbidity and mortality rates are associated with the specific therapy that women follow. The specific preconception care plan for a woman with rheumatological disease will depend on the type of disease and the therapy used. An individualized assessment in collaboration with the woman, the preconception care team, and the rheumatology team is recommended (Neff, Hunt & Shawe 2020).

Cancer

The incidence of cancer slowly stabilizes with an estimated 1.7 million new cases in 2018. Advances in cancer treatments have improved the outcome for pediatric cancers, with 80% of children now surviving 5 years or more. Unfortunately, 5-year survival rates for adolescents and young adults remain lower (70%) (Appiah & Green 2019; Kinahan et al. 2019). Compromised fertility occurs in 12% and 66% of at-risk female and male survivors of childhood cancer. Standard options for fertility preservation include sperm, oocyte, and embryo banking. Diagnosed cancer patients with a (future) pregnancy wish must be informed as soon as possible and fully about the influence of cancer and their treatment on fertility and future pregnancy, and about the possible options for fertility preservation. They must be referred to specialists in oncofertility (Appiah & Green 2019; Kinahan et al. 2019).

Contraception for women with pre-existing medical conditions

Women of reproductive age with chronic medical conditions are at risk for unplanned pregnancy. This risk is caused by a reduced efficacy of the contraceptive due to their chronic therapy (Neff, Hunt & Shawe 2020).

Because those women are at a higher risk of complications in pregnancy timing for pregnancy is important and so effective contraception is needed (Lathrop & Jatlaoui 2014; Hoek et al. 2020). The choice of contraceptive will depend on the woman and her medical history and many options are available. Planning a pregnancy opens the possibility to start optimal and customized preconception care which aims to stabilize the pre-existing medical condition before pregnancy.

Concluding remarks

The medical history of couples with a pregnancy wish needs to be examined. A checklist can be used to screen for specific pathologies or medical conditions that may affect a future pregnancy or the fertility of the man or woman.

The prevalence of couples with a pre-existing chronic medical condition that want to become pregnant is increasing. As those medical conditions can be associated with maternal and fetal complications during pregnancy, starting a good preconception care consultation with an interdisciplinary team is indicated. However, most women with a chronic medical condition do not think about reproductive life planning. This calls for an increased awareness among women, men, and the involved health care providers about the importance of pre-pregnancy, preconception counseling in couples with chronic medical conditions. Patients in their reproductive years should be routinely asked for their intentions to become pregnant.

Management of chronic medical conditions needs customized care. This approach also applies to preconception care. Broad preconceptional recommendations can be suitable for many women with a pre-existing medical condition but can be unsuitable for others. Person-centered care is vital.

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Important infections to avoid before and during pregnancy

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Abstract

Some infections are dangerous for pregnant women. As such, it is important that women avoid risks as much as possible when they want to become pregnant. Certain food products should be avoided because they can cause toxoplasmosis or listeria infection, other food products should be prepared with more care during pregnancy because of an existing risk to infect the pregnant mother and the subsequent danger of congenital infections in the baby.

Keywords: infection, toxoplasmosis, listeria, food, contagious

Abstract

Sommige infecties zijn gevaarlijk voor zwangere vrouwen. Deze ziektemakers zijn dus zo veel mogelijk te vermijden bij kinderwens en tijdens de zwangerschap. Bepaalde voedingsmiddelen kunnen toxoplasmose of listeriose uitlokken, andere voedingsmiddelen moeten heel hygiënisch verwerkt worden omwille van het risico op een voedselvergiftiging of omwille van een potentieel gevaarlijk effect op de baby.

Sleutelwoorden: infectie, toxoplasmose, listeria, voedsel, besmettelijk

Food infections

Raw food is contaminated with micro-organisms of which some are pathogenic for humans. Common food pathogens are campylobacter jejuni, listeria monocytogens and salmonella. There are different ways by which food can be contaminated. Farm animals, poultry in particular, is often contaminated with pathogenic gut bacteria, which are released at the time of slaughter. These pathogens can be kept under control if the meat is stored at low temperature. Pathogens are killed if the meat is cooked or baked at sufficient high temperature. If food is not stored or prepared properly, pathogens enter our body when contaminated food is consumed. Food infection may occur without complications or the contaminated person may get mildly or seriously sick. Unfortunately, some people may even die from the infection. The sincerity of the infection depends of the number of pathogens 'consumed', the virulence of the micro-organism and the condition of the acceptor. Persons at risk will get sick at a lower dose of pathogens than healthy people (Ridderbos 2014).

Mode of transmission

Contact contamination takes place whenever there is direct contact between food and a source of contamination. As such, an infection may be transmitted at several objects or nutrients. For example, when meatballs are prepared, our hands or the plate upon which the raw meat was kept, may be contaminated. If this plate is used afterwards for other food, without cleaning it first, there is cross contamination of this food. A kitchen is a room where a large number of contact contaminations may occur; consequently, proper hygienic measures are of importance.

Next to that, post-contamination may occur if food is prepared correctly, but is mixed afterwards with raw ingredients.

While preparing food, it is of interest to take hygienic measures into account: work with clean utensils, wash hands, clean the kitchen worktop before you start and in-between. Raw food should be considered as contaminated (and it is in most of the cases). As such, raw and prepared food should be handled separately. Hands, kitchen utensils and worktops should be cleaned in-between with hot water and detergent in order to avoid contact – and cross contamination. Dishcloths and towels should be washed daily at 90°C/190°F. Scrubbing sponges should be replaced regularly.

Micro-organisms multiply best at temperatures between 15–45°C/60–113°F. The period of time that food is kept at this temperature should be as short as possible. This means that cooked or baked food should be cooled (forced) as fast as possible and prepared food cannot be kept at room temperature. If food has to be kept warm, this should happen at 65°C/150°F or preferably at 80°C/180°C and only for one hour.

Prepared food should be kept covered in order to avoid post-contamination from the air (Ridderbos 2014).

Of course, contact contamination is only of importance if the contaminated food is consumed afterwards. People may become sick by eating contaminated food. Some food pathogens are teratogenic (which means that infection of the mother may cause birth defects).

Dangerous food infections in pregnancy

Toxoplasma gondii

Toxoplasma gondii is an immobile gut parasite which can multiply sexually and asexually. Sexual reproduction occurs in cats; asexual reproduction occurs in cats, pigs, sheep, cattle, mice, birds, invertebrates and humans.

Within sexual reproduction, oocysts develop in epithelial tissue of the small intestine of young cats. Those oocysts are secreted together with feces and can survive up to 18 months in nature.

Humans are generally contaminated by eating raw, contaminated food (vegetables, meat, ...). Probably half of the population gets contaminated before their thirties. If contamination occurs during pregnancy, the embryo or fetus gets infected as well.

Most of the time, infected people experience mild symptoms: flu like symptoms, feverish, mild swelling of lymph nodes. If a pregnant woman gets infected, infection may cause severe eye or neurologic conditions (such as encephalitis or hydrocephalitis) in the fetus. Sometimes, consequences of a congenital infection are only noticeable after a couple of years.

In order to prevent toxoplasmosis, it is of importance that pregnant women avoid contact with raw food. They should cook or bake meat thoroughly; vegetables are cooked preferably before consumption, if not possible, they should be peeled or washed very well. Cross contamination should be avoided by applying strict hygienic measures in the kitchen. Worktops and utensils which were used for preparing raw food, should be considered as contaminated and should be washed thoroughly before using them for other food. hands should also be washed every time after raw food is handled.

As feces from cats may contain oocysts, the partner of a pregnant woman preferably cleans the litter box. If not possible, the use of gloves is advised, also for working in the garden (Ridderbos 2014; De Jong-Potjer et al. 2011).

Listeria monocytogenes

Listeria monocytogenes is a Gram – positive bacteria. It can multiply at low temperatures (1–4 °C / 30–40°F). It is often found in soft surface-ripened cheese (such as Brie or Camembert) and in cheese au lait cru. In some countries, listeria is found in 45% of raw milk.

In people with suppressed immunity (babies, elderly, pregnant women and sick people), listeria acts as an intracellular parasite and can infect multiple organs. As such, it can cause a serious infection. Within pregnant women, the placenta and fetus will be infected as well.

In healthy infected people, flu like symptoms may occur, or people may experience symptoms of a mild gastro-enteritis. These people may be immune for listeria after infection. In people with suppressed immunity, a serious meningitis or encephalitis may occur.

In healthy pregnant women, listeria may also manifest flu like, but because of transmission to the fetus, miscarriage or stillbirth may occur. If infection takes place shortly before birth, the fetus may develop neonatal meningitis until a couple of weeks after birth. This condition may be lethal in a large number of cases or may cause serious neurological abnormalities.

In order to avoid infection with *Listeria monocytogenes*, pregnant women are advised not to consume soft cheese and cheese au lait cru.

Nonetheless, *Listeria monocytogenes* may also be present in meat and fish. As such, above described hygienic measures should always be taken into account while preparing fish and meat.

Listeria monocytogenes also has been found on cucumber, radishes, celery, lettuce and tomatoes. As a consequence, cooking

vegetables is the safest option in pregnancy (De Jong-Potjer et al. 2011; Ridderbos 2014).

Salmonella

Next to the above, it is advised to avoid raw and softly cooked boiled eggs during pregnancy, because of the risk on salmonella contamination. Some types of salmonella may cause a serious intestinal infection and cause a lot of annoyances (for example dehydration because of diarrhea). However, infection with salmonella is not threatening for the fetus (Ridderbos 2014).

Other infections

Cytomegalovirus infection

This infection is one of the most common causes of deafness and mental problems in the newborn. If a woman is infected during pregnancy, there is a 20–40% chance of transmission to the fetus. One in 10 to 20 of these babies will show more or less serious symptoms at birth. Ten to fifteen percent of infected mothers who seem healthy at birth, will develop symptoms (motoric or mental retardation or deafness) within the next year(s). As it is not clear which babies will be affected during pregnancy if the mother is infected and as there is no medication available, there is no sufficient evidence to screen systematically for antibodies before or during pregnancy.

As there is no cure or vaccination (yet), the only way to avoid infection for pregnant women is taking preventive hygienic measures. As transmission happens through body fluids, hands should be washed thoroughly after contact with body fluids of other people (e.g. also after changing diapers of other children, avoid drinking of the same glass of other people, ...). Contact with people who have symptoms of a flu or a cold should also be avoided. However, a great amount of people infected with cytomegalovirus (CMV) will show no symptoms at all.

Women who work with children are at risk for CMV. In some countries these women can change jobs temporarily during pregnancy (Gyselaers et al. 2015; Ridderbos 2014; Samyn, Bastiaens, De Sutter & Van Royen 2008).

Washing hands

During pregnancy, it is advised to wash hands more frequently in order to protect the baby for infections. Infections can enter by eating contaminated foods (see higher in this chapter), but also by touching the mouth or rubbing eyes with contaminated hands. Hands are not always visible dirty when contaminated.

It is advised to wash hands: before preparation of food, after handling raw meat, raw vegetables, fruit or herbs, after handling raw eggs, after contact with pets or pet food, after contact with people who are possibly ill, after changing diapers of children or after cleaning their nose and after gardening. While gardening or changing the litter box of pets it is advised to wear gloves.

Hands should be washed long enough (40 to 60 seconds or the duration of singing “happy birthday” twice).

3.2 Rubella

The rubellavirus is transmitted by airborne droplets. An infected person is contagious for two weeks and will show in 50 to 80% of cases the following symptoms: fever, problems with breathing and mild cold, swollen lymph nodes in the neck and typical red, irritating rash for one to three days. The rash spreads from the face and neck downwards.

Women who are infected in the first months of their pregnancy are at high risk of miscarriage or to have a baby with congenital malformations. However, most women are vaccinated as a child; nonetheless, it is useful to check the immunization status of

women who want to become pregnant, as some women who had vaccination are no longer immune.

Women who are not vaccinated or who are not immune for rubella, are recommended to get vaccination before pregnancy and wait four weeks to get pregnant. Vaccination is not advised during pregnancy (De Jong-Potjer et al. 2011; Gyselaers et al. 2015; Samyn et al. 2008).

Varicella

Most people are infected with the varicella zoster virus during childhood and thus immune for the rest of their life. If the immunization status is unknown before pregnancy, an analysis should be performed and vaccination provided when necessary. Vaccination is not recommended during pregnancy and pregnancy should be delayed for four weeks after vaccination.

In the rare case of an infection during pregnancy, 8 to 12% of fetuses will be infected and a proportion of them will develop congenital varicella syndrome (CVS) which includes skin problems, eye deviations and hypoplastic limbs, sometimes in combination with deviations of the central nervous system.

When the infection occurs between week 13 to 20 week of pregnancy, 2% of the children develops CVS. The chance of CVS is smaller before week 13 of pregnancy and non-existent after week 20 of pregnancy (De Jong-Potjer et al. 2011).

Parvovirus B19

Most people get infected with parvovirus B19 (also known as fifth disease) in their childhood and are thus immune as an adult.

Currently, there is no vaccination or cure available and there is no evidence for screening before pregnancy. The only thing that can be done to prevent for infections, is to avoid contact with

people who are sick. However, some (20%) of people will be asymptomatic. Symptoms of infection are: the classic 'slapped cheek' rash on both cheeks, headache, light fever and sore throat.

Parvovirus B19 infection during the first 20 weeks of pregnancy causes a 9% extra risk of intra uterine death or hydrops fetalis within three to five weeks after maternal infection. When infection in this period is suspected, frequent follow-up by ultrasound and doppler are recommended.

Pertussis

Pertussis is a serious and very contagious respiratory tract infection with the *Bordetella pertussis* bacteria. Symptoms appear one to two weeks after infection and the infection can be transmitted three to four weeks. Symptoms start with a common cold and evolve to intense and long coughing with mucus which is difficult to cough up. There is often a screeching noise while inhaling and the coughing can cause vomiting and stuffiness.

Due to the serious symptoms, pertussis is life-threatening for babies. They often turn cyanotic and breathing can be interrupted. Because of the persistent coughing, cerebral hemorrhage and lack of oxygen can occur, which can lead to cerebral damage.

Because of these serious complications, vaccination during pregnancy is recommended. Between week 24 and 32 is the best period for vaccination, because antibodies will be transferred to the fetus and will protect the fetus until he/she will be vaccinated at three months of age. Vaccination is recommended in every pregnancy and also vaccination of the father and grandparents are justified (cocoonvaccination).

Tuberculosis

Tuberculosis (TBC), or an infection with *Mycobacterium tuberculosis*, is currently uncommon in the general population. People at risk are people living in extreme poverty, drug users, HIV positive patients and immigrants from countries with a high prevalence.

Active tuberculosis may increase the chance of premature birth and low birth weight.

When there is a positive Mantoux-test during pregnancy, tuberculostatic medication is advised. Vaccination with live tuberculosis bacilli is contra indicated during pregnancy.

Conclusion

The importance of washing hands and a good hygiene to prevent for infections is important for everyone, but particularly for pregnant women. Food and other infections may not only make the future mother sick, some infections are teratogenic, which means they can (permanently) harm the unborn child and cause lifelong handicaps. Because of that, pregnant women should avoid some food and /or take particular preventive hygienic measures when preparing food or in encounters with other (potentially infected) people.

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Sexually transmitted infections and preconception health: scoping review

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Abstract

Sexual health may influence the potential for conception. The main aim of the scoping review was to establish a link between fertility and sexually transmitted infections. The main medical databases were searched (Cochrane, Medline, CINAHL and PubMed) and other sources were used to find information. The inclusion criteria were: texts in English, publications from the last 10 years. There is strong evidence that some sexually transmitted infections are closely associated with infertility in women and men. Previous chlamydial and gonorrhoea infections are associated with tubal damage and poor sperm quality. For some sexually transmitted infections, data on their impact on fertility are still inconclusive and more research is needed. We need to counsel youth to make informed decisions about sexuality.

Keywords: fertility, preconception, sexually transmitted infections, men and women.

Povzetek

Spolno zdravje posameznika vpliva na njegovo sposobnost koncepcije. Glavni namen pregleda literature je bil povezati plodnost s spolno prenosljivimi infekcijami. Pregledane so bile medicinske baze podatkov (Cochrane, Medline, CINAHL and PubMed) ter drugi relevantni viri. Vključitveni kriteriji za uporabljeno literaturo so bili starost publikacije manj kot 10 let, angleški jezik ter vsebinska primernost. Trdni dokazi kažejo močno povezavo med nekaterimi spolno prenosljivimi okužbami in poznejšo neplodnostjo pri moških in ženskah. Gonoreja in klamidijska infekcija lahko puščajo okvare jajcevodov in vplivajo na kakovost semenčic. Glede ostalih spolno prenosljivih bolezni, so dokazi nasprotujoči si in zahtevajo nadaljnje raziskovanje. Potrebno je zagotoviti mladostnikom in mladim odraslim svetovanje, ki jim bo omogočilo informirane varne odločitve o spolnosti.

Ključne besede: plodnost, prednosečno obdobje, spolno prenosljive infekcije, vpliv na moške in ženske

Introduction

Sexuality is closely connected to conception. This chapter is dealing with potential effects of Sexually Transmitted Infections (STI) on the ability of the couple to conceive a baby.

Background

Basic information on Sexually transmitted infections are presented before the search of their potential impact on fertility.

Chlamydia is one of the most common sexually transmitted diseases and it is very contagious. It is a bacterial infection caused by *Chlamydia trachomatis*. Risk factors are: not using a condom during sexual contact and having multiple sexual partners or a large number of consecutive partners.

Most women experience no symptoms, but if left untreated, chlamydia can have serious consequences, including later

ectopic pregnancy. Infection during pregnancy can lead to premature rupture of membranes, premature birth, and low birth weight. During delivery, chlamydia can be transmitted to the baby. Chlamydia can also be asymptomatic in men, sometimes manifesting as an infection of the urethra. Chlamydia screening is done in some countries, but only in high-risk groups or when a couple has been trying to get pregnant for a year or more. Treatment for chlamydia is simple and effective with antibiotics. Because chlamydia is very contagious, the partner of the infected person should also be treated.

Gonorrhoea is caused by a bacterium (*Neisseria gonorrhoeae*) that lodges in the male urethra after infection. Symptoms include severe pain when urinating and copious yellow-greenish secretions from the penis (droplets). Symptoms in men are obvious but not severe; the opposite is true in women. Infection in women can cause uterine inflammation or tubal adhesion. Pregnant women who are infected may miscarry, have a premature birth, or deliver a low birth weight baby. Treatment with antibiotics is effective, but sexual partners should also be treated. Screening is done only in high-risk groups.

HIV stands for Human Immunodeficiency Virus, this virus causes AIDS. HIV infection is caused by unprotected sexual intercourse or transfusion with infected blood. Without treatment and appropriate measures, HIV can be transmitted also from mother to the baby. Without treatment, HIV infection causes long-term illness and is fatal. In some countries women are tested for HIV in pregnancy, while in others are not. If antibodies are present, preventive measures can be taken to protect the mother and baby. With HAART (Highly Active Antiretroviral Therapy), a combination of drugs to suppress the HIV virus, life expectancy and quality of life have improved significantly in HIV-positive patients.

Syphilis or lues is a bacterial infection caused by *Treponema Pallidum*. It is uncommon in most developed countries. Untreated syphilis during pregnancy can be very dangerous to the unborn child, leading to congenital malformations or stillbirth. Women who have syphilis can pass the disease to their fetus years after infection because the bacteria are in latent phase. A blood test (treponemal test) can detect syphilis and is recommended before pregnancy. In case of infection, administration of antibiotics is favorable for the outcome in both mother and child.

Hepatitis B virus causes liver infection with jaundice. Other symptoms include flu-like symptoms such as fatigue, fever and loss of appetite, nausea or aching joints. Symptoms appear 2 to 3 months after infection and may last a few weeks to 6 months. Hepatitis B can be transmitted through infected blood, semen and vaginal fluid. An infected mother can infect her baby; if not treated, the baby will develop chronic hepatitis B. Vaccination against hepatitis B is available and recommended for all people with a history of sexually transmitted disease or people with multiple sexual partners. Vaccination during pregnancy is possible. Preconceptional screening for hepatitis B surface antigen is recommended.

The hepatitis C virus is transmitted mainly through material contaminated with traces of contaminated blood (needles, razor blades, and syringes), but it can also be transmitted through (usually anal) sex. It is less contagious than hepatitis B. Transmission from mother to child is low and usually occurs during birth; baby needs treatment.

Human papilloma Virus (HPV) can be transmitted through sexual or intimate contact. A condom is not always effective in preventing HPV; a vaccine is available and is the most effective prevention. The infection can manifest itself in four different

ways; the infected person may heal but can continue to infect others for some time after symptoms have subsided. Genital warts are the most common sign; they are very contagious. The warts occur around the genitals and anus and have different appearances: cauliflower-like growths, small pink or red dots, or invisible in the vagina, anus, or urethra. They can itch, burn, or be painful and usually appear within weeks or months of contact with the virus. High-risk types of HPV can cause cancer.

Genital herpes is a common sexually transmitted infection caused by the herpes simplex virus. Sexual contact is the primary way the virus spreads. After the initial infection, the virus lies dormant in body and can be reactivated several times a year. Genital herpes can cause pain, itching, and sores in genital area. However, may not have any signs or symptoms of genital herpes. If you are infected, you may be contagious even if you have no visible sores. There is no cure for genital herpes, but medications can relieve symptoms and reduce the risk of infecting others. Condoms can also help prevent the spread of genital herpes infection. If pregnant and the disease is active, the woman is advised to have a cesarean section to prevent transmission to the baby.

Trichomoniasis is caused by infection with a protozoan parasite called *Trichomonas vaginalis*. Symptoms appear within 5 to 28 days after infection. In some people, symptoms do not appear until much later. The infection shows up as: itching or irritation, burning sensation after urination, sometimes discharge. Premature birth and low baby's birth weight are common in pregnant women who are infected. Trichomoniasis can be treated with medication (either metronidazole or tinidazole).

The aim of the literature search was to find out whether the above mentioned infections have impact on fertility of both partners.

Methods

A scoping review of literature has been undertaken, searching the medical databases Cochrane, Medline, CINAHL, Science Direct and PubMed and other reliable sources in order to retrieve information on the topic. The keywords used were – “sex”, “fertility / reproduction” AND “STD/STI – syphilis, gonorrhoea, chlamydia, human papilloma virus, herpes, HIV / AIDS, trichomoniasis, hepatitis”. The inclusion criteria were: texts in English, literature from the past 10 years. The texts that reported problems of past infections on pregnancy and birth (not conception) were excluded as were also the studies that evaluated infertility treatments or reported results of experiments with mice. After elimination of the duplicates and content screening, 9 texts were selected for the final analysis. The findings are presented below.

Results

Results of a study show that sexual health of the couple prior to conception is very important. More sexual partners in an individual’s sexual history and irregular use of condoms indicate risky behaviour that can be closely connected to STIs or unplanned and unwanted pregnancies (Fairfortune et al. 2019).

There is strong evidence that STIs such as *Chlamydia trachomatis* and *Neisseria gonorrhoeae* are linked to infertility or subfertility in women, causing tubal inflammation and consequent permanent damage. Tubal factor infertility is quoted as the most common cause for female infertility (Tsevat et al. 2017) and it is also the most common result of *Chlamydia trachomatis* infection with or without coinfection with *Gonorrhoea* (Paavonen 2004; Tang et al. 2019).

Chlamydia can also have adverse effects on male reproduction. It usually occurs as asymptomatic and is estimated to cause 15% of male infertility with changes of the parameters of semen quality (Goulart et al. 2020), sperm DNA damage, and as a consequence of epididymitis (Brookings, Goldmeier & Sadeghi-Nejad 2013; MoazENCHI et al. 2018).

Latest researches are reporting additional (nowadays more common) STIs to impact the fertile ability of individuals. Studies report negative effect of HIV on fertility of women and men; however, no detrimental effect on fertility was found in cases of perinatally acquired HIV (PaHIV) (The et al. 2019; Goulart et al. 2020).

Studies also report cases of infertility in men and in women caused by the Human Papillomavirus infection (Xiong et al. 2018). Data on female infertility after infection with *Mycoplasma genitalium* or *Trichomonas vaginalis* are limited and inconclusive (Tsevat et al. 2017).

Studies dealing with men's infertility after STIs are rare; due to commonly asymptomatic course of illnesses it is sometimes hard to link the diagnosis of infertility to the past STI.

STIs can impact also future pregnancies. More complications such as ectopic pregnancies, preterm births or placenta praevia, were detected in pregnancies of these women (Thorp, Hartmann & Shadigan 2005). In order to prevent STIs, women are usually advised to use contraception. Despite the well-known fact that only condoms can prevent STIs, a lot of lay people do not know that they are not always effective in HPV prevention.

Discussion

It is of crucial importance to counsel already pupils regarding the protection against STIs before they become sexually active. Counselling for healthy sexuality should be introduced already in the early years of primary school and it should become a compulsory topic at regular health check-ups. It is not enough to discuss just the physical aspects of safe sex (e.g. how to use different contraceptive methods); promotion of safe sexuality is much more about the relationship and self-acceptance. The studies do reveal that youth is aware of the consequences of unprotected sexual intercourse; however, researchers claim that their knowledge does not necessarily underpin their actions. Many do not use condoms regularly (Castro 2016; Cabral et al. 2018), especially when they are in a longer-lasting relationship (Fairfortune et al. 2019). It is also important to share new knowledge with them – for example, that condoms are considered the safest contraceptive against STIs, but that they do not prevent HPV infection since the transmission of HPV goes through the genital skin.

The literature reviewed reaffirms the detrimental effect of some STIs on female fertility, but little data was found regarding the effect on men's fertilizing capacity. The conducted search shows that infertility studies still largely focus on women and neglect male infertility. A hindrance in studying STIs and subsequent infertility is also their asymptomatic course. It is crucial that screening and treatment is provided to both partners, which is often neglected. However, it is proved that partner's referral contributes to prevalence reduction. Cost-effectiveness analyses support regular routine screening for Chlamydia, quotes Paavonen (2004). Centres for Disease control and prevention (CDC 2013) even suggest annual screening for all women under 25 years of age.

Conclusion

At this point, with information available, we can claim that the consequences of STIs are quite clear and therefore counselling for safe sexuality and contraception methods that are barriers for STIs should be promoted. Advice should be given early; counselling young people as early as in primary school must become a priority. Moreover, counselling must exceed the level of physical protection of contraceptives; much more should be done in terms of counselling for a holistic approach to safe sexuality. The focus of the research should shift on the effect of STI's on male fertility. Women are still at the centre of infertility studies and it should not remain so, since evidence show that sexual infections might have detrimental effect also on men.

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Medication and fertility

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Abstract

Medication in general has a vital role in health and wellbeing. There are several good and lifesaving reasons to use adequate medication during adolescence and fertile years.

In this article medication is divided into three different categories; prescribed medication, non-prescribed medication (also called over-the-counter medication) and herbal medication.

It is important to ensure wise and safe medication use for both mother and child. This can be done by efficient and evidence-based pre-pregnancy and pregnancy counselling.

Key words: medication, herbal medication, fertility

Tiivistelmä

Lääkitys ja lääkkeet ovat tärkeitä terveyden ja hyvinvoinnin kannalta. Lääkkeiden käyttöön on useita hyviä ja henkeä pelastavia syitä myös murrosiässä ja hedelmällisessä iässä.

Tässä artikkelissa lääkitys on käsitelty kolmessa eri kategoriassa; reseptilääkkeet, käsikauppalääkkeet ja luontaistuotteet.

Raskautta edeltävä ja raskauden aikainen lääkkeiden käytön neuvonta on tärkeää, jotta voidaan varmistaa turvallinen lääkityksen käyttö sekä äidin että lapsen näkökulmasta.

Avainsanat: lääkitys, luontaistuotteet, hedelmällisyys

Introduction

Medication in general has a vital role in health and wellbeing. There are several good and lifesaving reasons to use adequate medication during adolescence and fertile years.

In this article medication is divided in three different categories; prescribed medication, non-prescribed medication (also called over-the-counter medication) and herbal medication.

According to the European health interview survey between 2013 and 2015, women are more likely to use some medication (Eurostat 2014). In United States the prevalence of using medication during pregnancy, has increased by 68% during the last 30 years (Thorpe et al. 2013). That is why professionals in healthcare must be aware of the advantages and disadvantages of all kind of medication; prescribed, non-prescribed and herbal medication.

The long-term effects of using medication in the pre-pregnancy period and during pregnancy are not yet fully known. Therefore, the information given does not always help to make informed decisions (Thorpe et al. 2013).

Prescribed medication

Without doubt, prescribed medicines have a purpose and place to life in general. Prescribed medicine is vital, and it may even be lifesaving. Prescribed medicine makes living possible and easier, healthier and reduces many illnesses and reduces risks. It is important that women, especially fertile women, have a good plan on how to protect their fertility even if they have a medical condition that requires regular medication.

It's not just the patients' own fertility that should be considered. Professionals must consider the fertility of the child the patient

is planning to have in the future or the one she is carrying, the unborn child. (Leverrier-Penna et al. 2018.) Epigenetics has a vast influence on fertility and pregnancy outcomes of our future generations (Pisarska et al. 2019).

In EU member countries, approximately half of the population have used some prescribed medication during a survey period in 2013-2015. In all age groups, in all member states women were more likely than men to use prescribed medicines. That difference was partly explained with the use of birth control pills and hormonal medication for menopause. (Eurostat 2014.)

In nearly all EU countries the use of prescribed medicines among women was lowest in the age group of 15–24, and then it increased with age, peaked in the oldest age group 75 years and over (Eurostat 2014).

According to research by Trønnes et al. (2017) most European women used medication that was safe to them or their fetus during pregnancy. However, if the pregnant women had some chronic illness or condition, she was more likely to use medication that was risky for the pregnancy. Other factors that increased the risk of using risky medication during pregnancy were socio-demographic reasons, such as being a student, having a lower education level, having previous children, not using folic acid, alcohol consumption and smoking. (Trønnes et al. 2017.)

A study made in the Netherlands (1999–2007) revealed that 77% of pregnant women received prescribed medication 12 months before they were pregnant and 67% during pregnancy. Potentially risky medication for the developing embryo or fetus were taken by 16% of the pregnant women in the 12 months before conception and 5% of all women took these medications during pregnancy. (Zomerdijsk et al. 2015.)

For the sake of the health of the mother or the unborn child it is not always possible to avoid potentially risky medication. Even

so, healthcare professionals must have the knowledge and time for thorough counselling and guidance before the patient is even pregnant to adjust the medication or the dosage, if possible. (Trønnes et al. 2017.)

Non-prescribed medication

In this article, non-prescribed medication or over-the-counter medication refers to painkillers such as paracetamol, ibuprofen, and salicylic acid.

According to studies paracetamol, ibuprofen and salicylic acid may have endocrine disruptive properties capable of altering human reproductive function from fetal life to adulthood in both genders (Holm et al. 2016; Trønnes et al. 2017; Banihani 2019).

Paracetamol may disturb fetal hormone signaling. Disturbed fetal hormone signaling can cause the female fetus to have a diminished follicle reserve. The reservoir of primordial follicles is decreased due to intrauterine exposure to paracetamol. Maternal exposure to paracetamol may cause male fetus an undescended testicle and therefor reduced fertility for both sexes. (Holm et al. 2016.)

Ibuprofen is one of the most widely used non-prescribed pain killer worldwide. It is very well known that using ibuprofen in the third trimester of pregnancy closes the fetus' ductus arteriosus prematurely. (Leverrier-Penna et al. 2018.)

But according to recent studies anti-inflammatory drugs (indomethacin, diclofenac, naproxen, ibuprofen and ketoprofen, coxibs) which act as inhibitors of prostaglandins may cause ovulation disorders and even inhibit ovulation. Prostaglandins are needed in normal ovulation. Ultrasound has shown that in ovulation the follicle does not rupture, and the egg isn't released

among women who have received a prostaglandin inhibitor. (Leverrier-Penna et al. 2018.)

Hormonal signaling of prostaglandin is also needed in normal fetal ovarian development. Organogenesis is happening in early pregnancy, so the use of ibuprofen or other anti-inflammatory medication in early pregnancy may harm the fertility of the unborn girl. (Leverrier-Penna et al. 2018.)

A study made among healthy young men who used ibuprofen regularly (up to six weeks) showed that ibuprofen disrupted the production of male sex hormones. The use of ibuprofen led to anti-androgenic effects and to compensated hypogonadism, a condition normally seen in older men and smokers. (Kristensen et al. 2018.)

High doses of ibuprofen affect the hormonal balance, affects the endocrine action of Leydig cells (Leydig cells produce testosterone) and inhibits steroidogenesis. Using ibuprofen for months alters the endocrine system and causes infertility and other health problems such as muscle wastage, erectile dysfunction, and fatigue. (Kristensen et al. 2018.)

Several scientific researchers have discovered that salicylic acid or aspirin affects the production of testosterone and therefore, has a negative effect on semen. The testosterone induces the spermatogenesis in the testes. Minor exposure to aspirin decreased the production of testosterone and bigger exposure had anti-androgenic effects. (Banihani 2019.)

As Banihani (2019) concluded, aspirin seems to affect semen many ways. Aspirin may decrease the amount of testosterone and formation of testicular prostaglandins. Aspirin may prevent

or reduce nitric oxide synthases and for the sperm to be able to fertilize an egg, the nitric oxide synthase is necessary. Aspirin may also cause increased oxidative injury to sperm. Aspirin seems to harm many semen quality parameters; motility, viability, volume and count and the DNA. (Banihani 2019.)

Herbal medication

Herbal medication is often referred as natural medication and thought to be safer alternative, lacking the side-effects of conventional medication. Herbal medication may work, heal, and influence in many valuable and beneficial ways, but the safety and true efficacy must be taken into consideration. (Colalto 2020.)

In the past decade, the use of herbal medication has been increasing in western countries to replace or complement conventional medication. In Britain it is reported that nearly 60 % of women used at least one herbal medication during pregnancy. Commonly used were ginger, cranberry, raspberry leaf, chamomile, peppermint and echinacea. Ginger was used to avoid nausea and to promote healing of a wound, but recent studies have shown that ginger might be harmful to organogenesis and development of the fetus. Cranberry may prevent urinary tract infection, but it also may cause gastrointestinal upsets. (Izzo et al. 2016.)

Many substances in herbal medication, natural products and medicinal plants cross the placental barrier and are transmitted to the developing fetus. According to several studies there is only a couple of individual case reports in which an herbal plant or substance was teratogenic in humans. Causal link is in most cases not shown. More high-quality research in herbal medication is needed to firmly establish the efficacy and safety. Also, the development and access to the market should be regulated

worldwide in the same way as in Europe where European Medicines Association (EMA) is regulating medicine. (Malm et al. 2008.)

Most commonly the disadvantages of herbal medication occur when the product is intentionally added or during the manufacture the product has accidentally been exposed to synthetic medicinal substances, toxic medicinal plants, or heavy metals (Malm et al. 2008). Sometimes it can be that the wrong part of the plant is used, it should have been for example the root of the plant, but leaves were used to manufacture the product. Toxic amounts of metals and metalloids, such as lead, arsenic and mercury, have been found in herbal medication. (Gyamfi 2019.) Purchasing herbal medication online may not be safe or even healthy. It might be cheaper, but consequences to health may be dangerous (Malm et al. 2008).

To the conclude

All kind of medication must be taken seriously, specially from the point of view of fertility. Pre-pregnancy and pregnancy counselling, how to wisely use medication is important. With proper measures it is possible to ensure safe and purposeful medication use for both mother and child. Healthcare professionals are responsible of giving timely and adequate guidance and counselling to clients and patients. To be able to offer adequate guidance and counselling, healthcare professionals must update their knowledge widely and regularly from trustworthy sources.

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Oral health and fertility

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Abstract

Many things affect human fertility. The effects of oral health on male and female fertility and on pregnancy and the future health of the child are significant but often ignored. Good oral hygiene can prevent small and innocent problems. Ignoring oral hygiene may lead into chronic inflammation in the mouth and systemic infectious status throughout the body. Smoking and snorting are known to weaken oral hygiene. Fertility is protected by good oral health.

Keywords: oral health, fertility, pregnancy

Tiivistelmä

Hedelmällisyyteen vaikuttavia asioita on useita. Suunterveyden vaikutus miehen ja naisen hedelmällisyyteen sekä raskauteen ja syntyneen lapsen tulevaan terveyteen on merkityksellinen, silti usein asia, joka sivuutetaan. Hyvällä suuhygienialla voidaan ehkäistä pieneltä ja viattomalta tuntuvat ongelmat, jotka hoitamattomana aiheuttavat kroonisen tulehduksen suussa ja systeemisen infektiotilan koko kehossa. Tupakointi ja nuuskaaminen ovat tunnetusti suun hygieniaa heikentäviä tekijöitä. Hedelmällisyyttä suojellaan myös hyvällä suunterveydellä.

Avainsanat: suunterveys, hedelmällisyys, raskaus

Introduction

This article will briefly review the effects of oral health on fertility and pregnancy. Dental care is important throughout life, but it is

especially important when planning for pregnancy and during pregnancy. Studies are proving that oral health has an effect on fertility and pregnancy in both men and women (Vamos et al. 2015). Good oral hygiene and regular brushing of teeth have also been associated with the experienced self-confidence by the young person, the survival in everyday life and the risk of exclusion (Scheerman et al. 2016). The use of tobacco products has a significant impact on oral health and oral hygiene.

Oral health

Oral self-care refers to regular cleaning of teeth and mouth, the use of fluoride toothpaste and smart eating habits that supports oral health. It is also important to avoid snacking and sugary drinks in maintaining oral health. The conditions for maintaining good oral health are oral care and regular use of oral health care services. (Koponen et al. 2018.)

According to the Finnish institute for health and welfare study report (2018), in 2017 53% of Finnish men and 83% of Finnish women brushed their teeth at least twice a day. Young men were reported to brush their teeth twice a day, which is more often than older men. In women the differences between age groups were small. (Koponen et al. 2018).

A healthy mouth is a mouth with no inflammation of the gums (gingivitis), cavities in the teeth or inflammation of the tissues that surround and support teeth (periodontitis). Gingivitis, tooth plaque and caries or periodontitis cause excess bacterial infection in the mouth. It strains mouth and body. Any excess burden and strain should be taken care of when planning to become pregnant.

Effect of tobacco products on oral health

Smoking causes several diseases and premature deaths. Tobacco products are harmful to health in general, but they are also very harmful to oral health. Tobacco products cause tooth discoloration, inflammation of the gums, reduced tooth fixation and oral cancer. Smoking and snorting weakens the oral immune system, causes oxygen deficiency in the tissues of the oral area, and reduce blood circulation and healing of mouth wounds. (Heikkinen 2011.)

Tobacco products contain several different chemicals, some of them are carcinogens. Thousands of different chemical compounds have been identified in tobacco, of which more than 100 compounds are harmful to humans and more than 60 of them cause cancer. Carcinogens and harmful chemical compounds of tobacco products originate from the tobacco plant itself, some of the pesticides and some come from substances used for preservation and manufacturing. All tobacco products (cigarettes, cigars and cigarillos, fine-cut tobacco for handrolled cigarettes, pipe tobacco and moist snuff / snus) contain cancer-causing agents. (Leon et al. 2015.)

Smokers are at greater risk of developing dental and gum disease compared to non-smokers. The adverse reactions are seen both clinically, but also when measuring inflammatory inhibitors of blood in people using tobacco products. Inflammatory levels in smokers have increased levels. Oral bacteria moves forward through the blood circulation, and is a risk and burden for the whole body. Smoking multiplies the risk of oral inflammation and makes it often more difficult to treat. The more and longer a person has smoked, the more serious the periodontitis usually is. (Heikkinen 2011.)

Effect of oral health on fertility

Inflammation of the mouth affects the body in three different ways

- bacteria in the mouth passes through the blood stream throughout the body and causes new inflammation in another target organ
- toxins produced by bacteria in the mouth cause new inflammation or tissue damage
- immunity decreases and it facilitates access of another inflammation in the body. (Heikkinen 2011.)

Smoking and smoking related infections of the oral area cause oxidative stress in the body. In a normal, healthy state, the body's cellular metabolism produces free radicals; reactive oxygen compounds. They are produced only to the extent that the cell's own natural antioxidant systems are able to eliminate the resulting disadvantages. In inflammation, the balance swings to the wrong direction. Reactive oxygen compounds are produced more, and it leads to oxidative stress. High oxidative stress is straining the body increasingly. Oxidative stress leads often to structural and functional disorders of cells, which in turn can cause cell death through different mechanisms. (Tremellen 2008.)

Oxidative stress disrupts male fertility in two different ways. It damages the sperm membrane and reduces sperm motility and the ability to fertilize the egg. Secondly, it damages the DNA of sperm. Damaged sperm DNA effects sperms genomes on the embryo and may harm normal development of the embryo. (Tremellen 2008.)

Oral health also affects sperm. The amount of healthy sperm is at risk if mouth is untreated; the amount of poor sperm elevates. Poor oral health is associated with reduced sperm

quality. (Nwhator 2014; Rashidi Mayfodi & Iranaq 2017.)

Treating the problems of the oral area (teeth and gums), it is possible to improve the amount, mobility and structure of sperm in men with periodontitis. (Rashidi Mayfodi & Iranaq 2017.)

Inflammation, acute or chronic, adversely affects spermatogenesis and decreases sperm quality (Pergialiotis 2018). Poor oral health affects the number of bacteria found in a man's body and his semen. Abnormal sperm count is one of the main reasons for decreased male fertility. (Nwhator et al. 2014; Pergialiotis 2018.)

Like male germ cells and fertility, oxidative stress also affects female germ cells and fertility. Oxidative stress affects many physiological events in a woman's reproductive health. It affects the maturation of the ovum and ovulation, as well as the attachment, growth and differentiation of the blastocyst. Oxidative stress interferes with the normal endocrine system, causing hormonal imbalance. Under oxidative stress, the DNA of the ovum may be damaged. (Agarwalet et al. 2012.)

Periodontitis is an inflammation of the oral area, but it causes an inflammatory condition throughout the body (Rashidi Mayfodi & Iranaq 2017). It increases the risk of endometritis, endometrial inflammation (Agarwalet et al. 2012; Rashidi Mayfodi & Iranaq 2017). Inflammation of the mouth appears to complicate and prolong pregnancy (Rashidi Mayfodi & Iranaq 2017). Oxidative stress is suspected to cause these problems as well (Agarwalet et al. 2012).

Inflammation in the mouth and body's mechanisms to prevent and heal inflammation affects the hormonal balance strongly. Normal hormonal balance is a prerequisite for ovarian function, cyclic changes of the endometrium, as well as the development of the embryo and its' implantation. (Rashidi Mayfodi & Iranaq 2017.)

Effect of oral health on pregnancy

Problems with oral health during pregnancy can affect pregnancy, the developing fetus and the child after birth. High concentrations of bacteria that cause caries in the mother's mouth increases the risk of caries in the child's mouth. Gingivitis and periodontitis increase the risk of premature births, low birth weight and pre-eclampsia. (Bogges & Edelstein 2006; Agarwalet et al. 2012.) Oxidative stress caused by oral inflammation increases the risk of miscarriages, premature births and pre-eclampsia (Agarwalet et al. 2012).

A change in the endocrine system in pregnant women also causes acidification of the mouth and the pH of saliva is lower than usual. One of the purposes of saliva is to restore the pH of the mouth to normal after eating. Since the pH of saliva has changed during pregnancy, its corrective effect is impaired. Demineralization of the enamel may happen when the saliva's pH is low. As demineralization progresses, so does the carious lesion. This causes the risk of tooth decay to increase. (Heikka et al. 2015.)

Nausea and hyperemesis gravidarum increases oral acidity and vomiting may corrode tooth enamel (Bogges & Edelstein 2006; Heikka et al. 2015). Nausea is often prevented by eating small snacks. Pregnant women may also have cravings and snack many times per day. However, snacks and snacking cause acid attacks on the teeth. Since the pH of saliva has already changed due to the endocrine function and the ability to restore the pH of the mouth to normal is weakened, an acid attack strikes the teeth harder than usual. (Heikka et al. 2015.) So snacking means repeated hard acid attacks to the teeth, challenging the normal pH of the mouth and leading to impaired oral health.

Overview

Dental care before pregnancy is essential for good fertility and healthy pregnancy. It is important to ensure that the teeth, gums; the whole mouth is well taken care of. Good oral health plays an important role in the health and well-being of women, men, and children. Smoking and the use of tobacco products (snuff and snorting) significantly reduces oral health. Pregnancy is a time when the family is motivated to make lifestyle changes to improve their future health. This time should be utilized. By increasing the knowledge of healthcare professionals, the counselling and guidance in family planning and during pregnancy is motivating and effective.

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Preconception care tends to address mental health: anxiety disorders and pregnancy

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Abstract

Preconception health and care programs tend to optimize the outcome of pregnancy through the identification of health problems before pregnancy. Health problems must be considered both physically and mentally. Anxiety disorders are common during pregnancy and have negative effect on maternal, fetal and neonatal outcomes. In addition, anxiety disorders may lead to risky behaviors such as smoking, drug abuse and excess alcohol consumption. Furthermore, comorbidity of anxiety disorders with other mental disorders are high. To improve the outcome of pregnancy and promote health across generations, it is necessary to pay specific attention to mental health in preconception period. The aim of this review is to investigate the effect of anxiety disorders on reproduction health.

Keywords: anxiety disorders, fertility, maternal anxiety, preconception period, pregnancy

Zusammenfassung

Präkonzeptionelle Beratung und Prävention neigen dazu, das Outcome der Schwangerschaft zu optimieren, indem sie gesundheitliche Probleme vor der Schwangerschaft identifizieren. Gesundheitliche Probleme müssen sowohl körperlich als auch psychologisch/seelisch berücksichtigt werden. Angststörungen treten sehr oft während der Schwangerschaft auf und können negativen Einfluss auf das mütterliche, fetale und neonatale Outcome haben. Darüber hinaus können die Angststörungen zu riskanten Verhaltensweisen wie Nikotinkonsum, Alkoholismus, Drogenkonsum etc. führen. Komorbidität der Angststörung mit anderen psychischen Störungen ist auch hoch. Um das Outcome der Schwangerschaft zu verbessern, ist sowohl die psychische Gesundheit als auch körperliche Gesundheit wichtig. Ziel dieses Review ist es, die Auswirkungen von Angststörungen auf Fortpflanzungs-Gesundheit zu untersuchen.

Schlagwörter: Angststörung, Fortpflanzung, präkonzeptionelle Beratung und Prävention, Schwangerschaft

Introduction

Pregnancy can be the source of overwhelming anxiety and trigger depression for the first time. Getting pregnant is the onset of a prolonged responsibility in association with the fundamental changes. The oncoming responsibilities can be scary. Worry about the baby's health can be triggered time to time. It is also possible to be needed to reduce working hours, take a long break from the job or sacrifice the career in favor of the motherhood. The social relationships can be not as the same as it was before pregnancy. The physical shape will change during pregnancy. These changes can be unexpected and affect the satisfaction with the body image.

15% of pregnant women meet the criteria for having at least one of the anxiety disorders. The risk increases when the pregnancy is complicated due to an unplanned pregnancy or other conditions e.g. poverty or domestic abuse. Anxiety disorders may affect the

physical health, the growth and development of the baby and the care that the baby will receive after birth. (WHO) Anxiety is associated with risky behaviors such as smoking, drug abuse or eating disorders. Pregnant women with one of the anxiety disorders had a 32% greater risk of gestational hypertension, a 52% greater risk of preeclampsia, and an 81% greater risk of eclampsia compared with pregnant women without anxiety. (D`Arrigo 2021.)

Unfortunately, mental disorders can be wrongly seen under the light of innocent hormonal changes during pregnancy. Moreover, the absence of a trustworthy mental assessment tool is frequently felt by health professionals during pregnancy. It seems that preconception period must be seen as an opportunity to optimize the parental health status both physically and mentally. The aim of this review is to investigate the effect of anxiety disorders on reproduction health.

Method

The online search was conducted through Google Scholar and Medline. The aim was to investigate the effect of the anxiety disorders on pregnancy outcomes. From initial 125 studies concerning anxiety disorders in pregnancy, that have been published in the last five years, only 12 studies were considered as relevant to the subject.

Anxiety

Fear and anxiety activate the same physiological responses in the body. Fear is a defensive behavior to support the organism against a life-threatening situation. Fear is considered as a reaction to an observable danger at the present, while anxiety is an unpleasant mental state aroused without any observable threat. Anxiety can

be triggered by a physical threat such as death or a mental threat such as losing things that we value. Traditionally, we talk about anxiety when there is not an observable object or a threatening situation to be afraid of at the moment.

Anxiety disorders

A moderate level of anxiety is necessary to force us to do what must be done. For example, exam anxiety is essential for appropriately preparation for an exam. Anxiety is considered as a disorder if a situation to be seen as a threat, although it is safe or excessive worry interferes with an individual`s abilities to function effectively.

The anxiety disorders are considered as chronic illnesses. They can start in any age and affect both genders. The average age for beginning of an anxiety disorder is 11. Although anxiety disorders are common, unfortunately, half of the cases remain undetected and only one third receive drug treatment. (Bandelow & Michaelis 2015.)

Social anxiety disorder (SAD)

Social anxiety is a common problem. It is known as a disorder when it is extensive and causes situational avoidance and impaired social functions. Fears against public speak or speaking up in public meetings are common features of social anxiety. (Blair Simpson et al. 2010.)

Generalized anxiety disorder (GAD)

It is characterized with extensive worry in combination with somatic symptoms. GAD has the profound effect on quality of life, mental well-being, social life and carrier. (Blair Simpson et al. 2010.)

Panic disorder (PD)

Panic disorder is a period of intensive fear accompanied with somatic symptoms such as palpitation and sweating. (Blair Simpson et al. 2010.)

Obsessive compulsive disorder (OCD)

Obsessive compulsive disorder is characterized with overwhelming, repetitive thoughts (obsession) or urge to do certain rituals, routines or behaviors constantly (compulsion) or both (obsession and compulsion).

Post-traumatic stress disorder (PTSD)

PTSD is an anxiety disorder that can develop after being exposed to a traumatic experience or event.

Separation anxiety disorder (SepAD)

It refers to an inappropriate anxiety regarding separation from major attachment figure(s) or home. (Blair Simpson et al. 2010.)

Phobia

It refers to a great fear against a specific object, situation etc. (Blair Simpson et al. 2010.)

Pregnancy-specific anxiety

Anxiety during pregnancy is common. 10–15% of all pregnant women experience some level of anxiety during pregnancy. Pregnancy-specific anxiety refers to the condition in which a pregnant woman worries about the pregnancy itself, for example: fetal health or birth. (Khalesi & Bokaie 2018) To optimize the outcome of pregnancy, it is necessary to decrease every possible risk to maternal health including maternal anxiety.

Anxiety disorders and reproductive functions

Anxiety disorders can affect reproductive functions by producing stress responses. It is already known that several forms of stress can suppress Hypothalamic-Pituitary-Gonadal (HPG) axis in human. This problem can eventually lead to fertility disorders such as amenorrhea and infertility. It is evident that Kisspeptin and GnIH/RFRP-3 play crucial roles in producing stress-induced disruption of HPG axis. (Iwasa et al. 2018.)

In addition, the link between anxiety and reproduction can be seen in term of physical health. It is evident that constant anxiety impairs the physical health. For example, the studies have shown that post-traumatic stress disorder weakens the individual's health functioning both physically and mentally. (Zayfert et al. 2002.) Patients, who had persistent anxiety disorders, have been exposed to several medical illnesses. The link between anxiety disorders and sudden cardiac death, hypertension, gastrointestinal disorders, genitourinary problems, thyroid disease, cancer, diabetes, autoimmune diseases, asthma and migraine is determined. (Härter, Conway & Merikangas 2003; Sareen et al. 2006.) In addition, anxiety disorders are the risk factors for suicidal attempts. (Sareen et al. 2006.)

The effect of anxiety disorders on pregnancy

Anxiety makes pregnancy complicated. Anxiety disorders are known as an independent risk factor for adverse obstetric and developmental outcomes. (Schubert et al. 2017.) The studies have shown that there was a 32% greater chance for developing gestational hypertension among the anxious mothers, a 52% greater chance of preeclampsia, and an 81% greater chance of eclampsia in comparison with non-anxious pregnant women. (D'Arrigo 2021.) Third trimester anxiety increases the preterm labour. (Khalesi & Bokaie 2018.) Furthermore, prenatal anxiety

has also been a risk factor for the development of postpartum depression.

Excessive anxiety has negative effect on fetal and neonatal growth and development. The level of anxiety is correlated to the level of cortisol in bloodstream. (Schubert et al. 2017.) Cortisol cannot normally cross through the placenta due to the function of placental 11 β hydroxysteroid dehydrogenase type II. However, excessive circulating cortisol can cross through the placenta and affect fetal growth and development. (Fan et al. 2018.) The high levels of maternal anxiety during pregnancy can increase the chance of negative outcomes in the children including impaired fetal growth patterns, behavioral and emotional problems later in life. (Schubert et al. 2017.) Moreover, the neuronal and cognitive development in the fetus can be impaired by increased levels of cortisol and other stress hormones. (Fan et al. 2018.)

Sum up

Maternal mental disorders are considered as major problems in the public health. Anxiety disorders negatively affect maternal, fetal and neonatal health. The association of anxiety with preterm labour increases the risks of neonatal mortality, morbidity and the cost for health system. (Khalesi & Bokaie 2018.) Anxiety is an independent cause of depression during the postnatal period. It is evident that anxiety transmits from parents to offspring. (Sydsjö et al. 2018.) What`s more, it is shown that anxiety during pregnancy links to parenting stress. (Huizink et al. 2017.)

13% of pregnant women experience some levels of anxiety at some point during pregnancy. Anxiety can be present before pregnancy or appears for the first-time during pregnancy. Although anxiety is a common problem during pregnancy, unfortunately it has been received less attention. Optimizing the

outcomes of pregnancy requires considering maternal mental health as important as her physical health. Preconception period provides an opportunity to evaluate maternal mental status and investigate probable risk factors. To optimize the outcomes of pregnancy, it is advisable to screen women for anxiety disorders during preconception period.

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Preconception care tends to address mental health: Depression and pregnancy

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Abstract

World Health Organization (2021) has announced that about 10% of pregnant women and 13% of women who have just given birth experience a mental disorder worldwide. In severe cases, the mother can be at higher risk of committing suicide. The mothers with mental disorders cannot function properly. As a result, unfortunately, the children's growth and development may be negatively affected as well. The preconception period (before or between pregnancies) provides an excellent opportunity to address any risk to mental health as well as physical health and adjust risky behaviors. The aim of this review is to show what depression is and investigate in what level it can affect the outcomes of pregnancy.

Keywords: preconception period, mood disorder, depression, pregnancy, fetal programming,

Zusammenfassung

World Health Organisation (2021) hat bekannt gegeben, dass weltweit etwa 10% der Schwangeren und 13% der Wöchnerinnen psychische Störungen erfahren. In schweren Fällen kann das Suizidrisiko

für die Mutter höher sein. Die Mütter mit psychischen Störungen können nicht richtig funktionieren. Infolgedessen können leider auch das Wachstum und die Entwicklung der Kinder beeinträchtigt werden. Die Präkonzeptionelle Zeit (vor oder zwischen den Schwangerschaften) bietet eine hervorragende Gelegenheit, um Risiken für die psychische und die physische Gesundheit anzugehen und riskantes Verhalten zu korrigieren. Das Ziel dieses Review ist es, aufzuzeigen, was Depression ist und in welchem Ausmaß sie das Outcome der Schwangerschaft beeinflussen kann.

Stichwörter: präkonzeptionelle Zeit, Stimmungsstörungen, Depression, Schwangerschaft, fetale Programmierung,

Introduction

When addressing preconception care, the intention is to optimize the outcome of the pregnancy. Optimizing the outcome of pregnancy requires identifying any adjustable risks to an individual's health. It is evident that the human body consists of both physical and mental units that they work as a whole together in harmony. It is known that dysfunction of the mental unit affects the physical body and vice versa. As known, there is an increasing risk for whom suffering from chronic diseases to develop mental problems.

Although pregnancy is traditionally considered as a happy event for a mother, it can be the source of overwhelming anxiety and trigger depression for the first time. Both disorders are common during pregnancy but unfortunately, they can be wrongly seen under the light of innocent hormonal changes and mood swings. Therefore, they mostly remain undetected and underestimated.

Depression and anxiety are among the most common diseases worldwide and are considered as the risk to maternal and fetal health. Both disorders are seen with unhealthy behaviors and dysfunctional conditions including drug abuse, smoking, alcohol

use, poverty and domestic violence. Preconception period opens an opportunity to address who is at risk of depression if there is an intention to promote the capacity of the mental health and adjust unhealthy behaviors. The aim of this review is to show what depression is and investigate in what level it can affect the outcomes of pregnancy.

Depression (Moragne 2011)

Depression is a mood disorder characterized by sadness and distressing symptoms over a long period of time. Depression is a combination of signs and symptoms that affects personal ability to function appropriately in every-day life. A person, who suffers from depression, has the signs and symptoms of depression most of the time in every day, for at least two weeks while interfering with the routine activities including thinking, eating and sleeping.

Depression is categorized as major depression, persistent depressive disorder (dysthymia), seasonal affective disorder (SAD), psychotic depression, situational depression, atypical depression, bipolar, perinatal depression etc.

Major depression

Major depression refers to the presence of the symptoms of depression for most of the day, every day for at least two weeks. It can be only a single episode and never happens again. However, many people frequently experience depression episodes.

Persistent depressive disorder (dysthymia)

A person, who suffers from dysthymia, had the symptom of depression for a period of two years. It can be a combination of major depression and less severe episodes. It can be less serious in comparison with major depression but affects relationships and daily activities. People with dysthymia have lower self-esteem and feel inadequacy.

2.3 Seasonal affective disorder (SAD)

This form of depression has seasonal patterns. It occurs mostly in the late of autumn and early winter and disappears in spring and summer. It can be a cause for oversleeping, weight gain, as well as sadness and unworthiness.

Psychotic depression

This form of depression is a combination of psychotic disorders plus major depression. People with psychotic depression lose touch with the reality. It involves delusion and hallucination. Hallucination refers to see, hear, taste, smell things that do not exist there. Delusion refers to have ideas or beliefs that are not true or do not make any sense. This type of depression can have physical symptoms too.

Situational depression

It is the adaptation problem and seen in specific situations or events including facing death of loved one, divorce etc. Although situational depression seems to be natural, the problem is about how long it takes and how much it interferes with a person's daily activities. The signs are sleeplessness, aches or pains, loss of concentration, anxiety etc.

Atypical depression

Atypical depression refers to the condition within the signs of depression can disappear in response to happy life events. The problem with this form of depression is that the person or other people reject depression because its signs become occasionally better.

Bipolar (Manic-depression)

People with bipolar disorder suffer from mood swings. Their moods change from low to high separated by phases of normal mood. When experiencing low mood, the symptoms of major depression are dominant. On the contrary, in the manic phase, these people experience the elevated mood characterized by being full of energy, talking very fast and pressure of speech, decreased need for sleep, inflated self-esteem etc.

The signs of depression

Depression encompasses a cluster of signs and symptoms. Depressed people may feel anxiety, emptiness, hopelessness, pessimism, helplessness, guilt, sleep disorders, lack of energy, difficulty to do daily activities, loss of interest in hobbies or activities, inability to concentrate, eating disorders, irritability, digesting problems, cramps, headache etc. In severe cases, a person may have suicidal thoughts or commit suicide.

Depression is diagnosed not only by the presence but also by the length and intensity of the symptoms. Depression affects both gender but women are twice more at risk to develop depression than men.

The causes of depression

Genetic, biological, environmental, socioeconomic factors can individually or in combination with other factors cause depression. Depression is highly heritable disease and runs in the family. It is also known that depression has a connection with stress-inducing situations and the health of physical body. It is also possible that the certain chemicals including some medications cause the symptoms of depression. Depression can also show up without any good reason for it.

Maternal depression

Maternal depression refers to both prenatal and postnatal depression. Depression is common during pregnancy with a frequency of 10 to 20%. (Nylen et al. 2013.) Prenatal untreated depression is associated with a wide range of obstetric complications including lower weight gain, preeclampsia, gestational diabetes, hypertension, abortion, preterm labor, increased need for pain relief and operative deliveries, smaller fetal head circumference, Intra Uterine Growth Retardation (IUGR), Small for Gestational Age (SGA) (Hasanjanzadeh & Faramarzi 2017), elevated fetal heart rate baseline etc. (Szegda et al. 2014.)

Depression during pregnancy can cause fetal and maternal complications in postpartum period. Postpartum depression can develop as the consequence of untreated prenatal depression. Problems with initiation of breastfeeding and bonding have been observed in depressive mothers.

Depression can indirectly have negative effect on the outcome of pregnancy through maternal risky behaviors such as lower participation in prenatal care, malnutrition, smoking, drug abuse or increased alcohol use. Furthermore, major depression is associated with risk of disability to follow medical advice, self-injuries, committing suicide, and deteriorating social function.

Fetal development can be negatively affected by maternal depression. Developmental programming indicates that fetal rapid growing organs are vulnerable to influences of in utero environment. One of the most important organs that can be affected by maternal depression is the fetal brain. The development of the brain depends on the constant interactions with its environment. It is evident that depression can alter the placental metabolism and exposes the fetus to excess stress

hormones. Stress Hormones including cortisol pass through the placenta and affect the development of the fetal brain causing hyperactivity of Hypothalamus-Pituitary-Adrenal (HPA) axis. The normal function of HPA axis is necessary for maintaining homeostasis in the fetus and child. The studies have shown that hyperactivity of HPA axis can cause several health problems later in these children.

Identification of depression during pregnancy

Unfortunately, the signs and symptoms of depression are not exclusive during pregnancy. Many of these symptoms can be seen in a normal pregnancy including mood swings, sleep disorders, nausea, eating disorders, concentration disorders etc. In addition, a valid and reliable assessment tool has not been known for identification of depression in pregnancy so far. (Langan & Goodbred 2016) As the result, it is advisable to have a psychological consultation before pregnancy if there is any concern about mental health or predisposing risk factors.

Conclusion: what is necessary to do?

The identification of depression before pregnancy is crucial for the maternal and fetal health and wellbeing. Depression during pregnancy can lead to malnutrition, drug abuse, excessive alcohol use, smoking, sleep disorders etc. A mother, who has depression, is not able to take appropriate care of herself and her child. It must be seriously taken into consideration that depression is a leading cause for maternal death due to suicidal attempts.

The main goal for every preconception care program is to promote planned pregnancies. A planned pregnancy provides adequate preconception time to evaluate parental health. During this time, couples can receive appropriate care and consultation about physical health. In addition, they should be encouraged

to consider a psychological evaluation if they have any concern about mental health of their own and their family or at the presence of any predisposing risk factors including domestic abuse, poverty, lack of social support etc.

Furthermore, emotional self-regulation strategies should be available and offered to who tends to improve their personal skills. Moreover, information must be given to couples about where and how they can receive social support or any other helps. It should not be forgotten that preconception period is valuable for health professionals to promote healthy life style and discourage risky behaviors. (Geffen 2007)

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Pregnancy following Bariatric Surgery

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Abstract

In 2016, more than 1.9 billion adults were overweight, of these 650 million were obese (WHO, 2020). The prevalence of obesity increases the last decades. This increase boosted bariatric surgery (BS), a.k.a. obesity surgery. About 85% of the bariatric patients are women of reproductive age. Whilst fertility rates following BS improve, pregnancy after BS poses some challenges. Midwives and other health care workers need to work interprofessional when they follow women who want to become pregnant after BS. But even before the surgery, a preconception consultation could be beneficial so couples can make an informed decision. However, studies of the impact of preconception care in bariatric patients is scarce.

Keywords: pregnant after bariatric surgery, bariatrics, preconception

Abstract

In 2016 hadden meer dan 1,9 miljard volwassenen overgewicht, van deze 650 miljoen waren zwaarlijvig (WHO, 2020). De prevalentie van zwaarlijvigheid neemt de laatste decennia toe. Deze evolutie bracht een toename in bariatrische chirurgie (BS) met zich mee. Ongeveer 85% van de bariatrische patiënten zijn vrouwen in de reproductieve leeftijd. Hoewel de vruchtbaarheidscijfers na BS verbeteren, vormt zwangerschap na BS uitdaging. Verloskundigen en andere gezondheidswerkers dienen interprofessioneel samen te werken wanneer ze vrouwen volgen die na BS zwanger willen worden. Maar zelfs vóór de operatie kan een preconceptie-consult nuttig zijn, zodat koppels een weloverwogen beslissing kunnen nemen. Onderzoek

naar de impact van preconceptionezorg bij bariatrische patiënten is echter schaars.

Sleutelwoorden: zwanger na bariatric, bariatric, preconception

Introduction

Worldwide obesity has nearly tripled since 1975 (World Health Organization, 2020).

Overweight affects 40% of women and 39% of men, 15% of women and 11% of men suffer from obesity (Shawe et al. 2019). Estimates suggest that by 2025 more than 1 in 5 women (21%) will be obese. This trend is also manifesting in obstetrics. The prevalence of obesity in women of reproductive age is increasing all over the world (Poston et al. 2016; Ma et al. 2016).

Maternal obesity (pre-gravid and in pregnancy) represents a complex problem

Preconceptional obesity

Preconceptional obesity can worsen pregnancy complications (Poston et al. 2016). Pre-existing obesity-related disorders, e.g. type 2 diabetes and chronic hypertension have serious impact on the pregnancy outcome. Pre-existing diabetes type 2 increases in pregnant women. Also, chronic hypertension is an increasing problem with its known consequences of pre-eclampsia. Early antenatal screening for co-morbidities in women with known preconceptionally obesity is needed.

Poston (2016) states that preconceptionally, the obesity-related infertility is the most important adverse effect. Obese women who want to become pregnant take longer time to succeed, and time to pregnancy increases with the degree of obesity. Women with class III obesity (BMI ≥ 40 kg/m²) are almost 7 times more likely to take more than 12 months to conceive than those with a normal BMI.

Assisted reproductive technology in women with obesity-related infertility isn't a solution because a high BMI reduces the chance of success with assisted reproductive technology (Poston et al. 2016). Poston et al. (2016) states that the ovulatory dysfunction, the most common diagnosis among obese women, is not related with the age of parity. It is the result of from suboptimal glycaemic control and insulin resistance, both due to the obesity. Assisted fertility techniques do not provide a simple solution for the obesity-related infertility due the high BMI.

Obesity and pregnancy

Early pregnancy loss, foetal and infant death are more prevalent in women with obesity. The risk of miscarriage is 30% higher. The probability of stillbirth is raised, even doubled among women in the highest BMI category. Women with class I or II obesity gestational weight gain as well as gestational weight loss and very low gestational weight gain are associated with infant death. In the management of obese women, the current focus is on the limitation of weight gain during pregnancy. Professionals should be aware of the aforementioned risks associated with the low gestational weight gain.

Accurate assessment of foetal size and detection of congenital anomalies with ultrasound scanning is difficult in women with obesity. So, the follow up of foetal growth and detecting congenital anomalies increase the risk of delayed diagnosis of stillbirth (Poston et al. 2016). The same problems can be associated with the inability of the mothers to feel the foetal movements.

Obesity during labour, delivery and post-partum

Labour and delivery are compromised by the obesity. Induction of labour and caesarean section will therefore be more likely used as the mode of the delivery (Poston et al. 2016). Premature birth

is not recognised as an adverse outcome associated with obesity. Health professionals, such as midwives, should encourage post-partum weight retention to achieve reduced risk of adverse outcomes in future pregnancies (Poston et al. 2016).

Long-term morbidity for the unborn child

Not only has obesity an adverse effect on maternal health and pregnancy outcome. It also causes a disturbed nutritional balance in utero, giving lifelong health consequences to the unborn child, e.g. poorer cognitive performance, cerebral palsy, allergic and atopic problems, through the process of developmental programming (Magdaleno et al. 2012; Godfrey et al. 2017).

Bariatric surgery for maternity obesity

Pre-pregnancy and pregnancy-related problems increase with the severity of obesity. Therefore, weight loss is strongly recommended before pregnancy as it is the best strategy to decrease the complications that maternal obesity can cause (Ma et al. 2016). Since lifestyle changes have limited success in long-term weight loss, bariatric surgery is an important alternative for obese women planning pregnancy. Bariatric surgery should be considered during the preconception counselling of morbidly obese women of childbearing age since it improves fertility.

Bariatric surgery is currently seen as the most effective management for sustained weight reduction. However careful selection of the appropriate candidates is important to ensure an optimal outcome (Ma et al.; 2016). Surgery is recommended when lifestyle changes have failed in patients with a BMI $>$ or $=40\text{kg}/\text{m}^2$ (Class III obesity) and for patients with a BMI $> 35\text{kg}/\text{m}^2$ suffering from co-morbidities (e.g. sleep apnea, diabetes) (Shawe et al. 2019).

Important to mention is the fact that BS is also considered as a treatment for adolescents suffering from morbidly obesity. Therefore, in the future, more women with BS in their medical history will become pregnant. OECD in Magdaleno et al. (2012) reports an increase in the prevalence of overweight adolescents in Europe, which can lead to obesity and its comorbidities in adulthood.

It is clear that patients of reproductive age with a history of BS need a careful follow-up regarding their reproductive health.

Bariatric surgery

Types of bariatric surgery

BS offers an effective answer on the morbid obesity question. BS results in a significant and sustainable (long term) weight loss and improves the comorbidities of the obesity (Guelinckx, Devlieger & Vansant 2012).

Bariatric surgical procedures are classified in three groups (Guelinckx, Devlieger & Vansant 2012):

- A restrictive procedure group (1)
- A malabsorptive procedure group (2)
- A combination of 1 and 2, resulting in energy restriction and decreased uptake

Restrictive procedures.

Known procedures are vertical banded gastroplasty, sleeve gastrectomy, (laparoscopic) adjustable gastric band [(L)AGB]. In general, these procedures reduce the gastric storage capacity. This results in a restricted energy uptake.

In sleeve gastrectomy, which is the most frequently performed procedure, the stomach volume is reduced with 75%. The

reduction facilitates limited food intake. Also, appetite reduction is reached. AGB procedures reduce the stomach capacity and appetite.

Malabsorptive procedures:

The purely malabsorptive procedures, such as the biliopancreatic diversion or Scopinaro procedure and jejunoileal bypass, bypass a large section of the small intestine reducing energy and nutrient uptake.

Combination procedures:

The combination procedures limit both energy intake and uptake. Examples of these procedures are the biliopancreatic diversion with duodenal switch and the Roux-en-Y gastric bypass (RYGB).

Pregnancy after bariatric surgery? – Reproductive implication of bariatric surgery

Effect of BS on fertility of men and women

The relationship between obesity and infertility is well established and is mainly attributed to changes in hormone secretion resulting in oligo-ovulation and anovulation (Poston et al. 2016). Polycystic ovarian syndrome (PCOS) and its associated complications are also inherently linked with weight gain (Narayanan & Syed 2016).

Weight loss is often recommended for obese women desiring pregnancy to correct ovulatory dysfunction and improve fertility. Fertility physicians recommend morbidly obese patients to lose a massive amount of weight before proceeding with the fertility treatment. The surgery induced weight loss generally reverses the adverse effects of obesity on fertility and ameliorate the health complications linked with PCOS. Before the BS procedure obese women have irregular menstrual cycles or are even anovulatory. After BS and the related weight loss their menstrual

cycles normalizes, and infertility questions are mostly solved (Guelinckx, Devlieger & Vansant 2012). Weight loss reduces also hyperandrogenism and the polycystic ovary syndrome. This leads to a post-BS fertility rebound with an improved fertility (Narayanan & Syed 2016).

The decrease of adipose tissue after bariatric surgery alters hormones: Estradiol levels decrease, the hypothalamic release of Gonadotropin Releasing Hormone (GnRH) and Luteinizing Hormone (LH) is stimulated. Also, the secretion of Follicular Stimulating Hormone (FSH) by the pituitary gland is boosted. Moreover, the weight loss induces lower insulin secretion which will increase sex hormone-binding globuline levels and decreases peripheral testosterone levels. Due to the weight loss after BS Müllerian Inhibiting Substance (MIS) levels decrease with a positive impact on fertility (Guelinckx, Devlieger & Vansant 2012).

The post-bariatric weight loss also results in an increased sexual function. Guelinckx, Devlieger & Vansant (2012) report a rise in spontaneous pregnancies due to this increased sexual interest and function. About 71% of anovulatory obese women regain regular periods after BS (Teitelman 2006). Unintended pregnancies are common after BS because women do not use contraception, due to the anovulatory cycles, before the surgery. Discussing contraception, because of the increased fertility postoperatively, before planning the surgery should be discussed over with the patient (Guelinckx, Devlieger & Vansant 2012).

What about male fertility after BS? Very little is studied and known about BS in men and fertility. Therefore, more research is required before drawing conclusions. After surgery, the levels of total and of free testosterone increases, as well as the sexual quality of life. However, the nutrient absorption after Roux-en-Y gastric bypass can be insufficient for spermatogenesis (Guelinckx, Devlieger & Vansant 2012).

Time-to-pregnancy

The extent of weight loss determines fertility potential. The first year after BS represents an active catabolic state due to rapid weight loss, with gradual stabilization of the body's nutritional state in the following months. Therefore, women are advised to avoid pregnancy for 12–24 months after BS (Landsberger & Gurewitsch 2007; Shawe et al. 2019; Slater et al. 2017). This time-to-pregnancy interval is recommended to attain full benefit of the surgery and to reduce the potential risk of intrauterine growth retardation in the foetus in case of a pregnancy during this period. However, very little evidence can be found on this subject (Shawe et al. 2019; Slater et al. 2017).

Contraception counselling

Contraception counselling 1 to 2 years after BS should include consideration of non-oral contraceptives as the efficacy of oral contraceptive pills may be compromised by unreliable absorption following BS (Magdaleno et al. 2012; Shawe et al. 2019).

Roux-and-Y procedure and the sleeve gastrectomy alter the anatomical structure of the gastrointestinal tract. The gut shortening negatively affects the absorption of oral contraceptives using oestrogen (Narayan & Syed 2016; Shawe et al. 2019). Oestrogen normally metabolises in the upper gut wall, which is no longer possible after BS. As such, the efficacy of the oestrogen can be decreased. Postoperative consequences, like vomiting or diarrhoea, may also compromise the reliability (Shawe et al. 2019). For AGB procedures there is no substantial decrease of reliability of oral contraceptives with an oestrogen component (Shawe et al. 2019).

In general, oral contraception may be less effective after BS. Also, many women remain overweighed after BS. Overweight

contraindicates the use of oral contraception (with oestrogen) because of the risk of venous thromboembolism. Parenteral contraception methods as copper intrauterine device (IUD), intrauterine systems (e.g., Mirena®), progestogen implants (Implanon®) (Shawe et al. 2019) and or vaginal rings (Nuvaring®) (Woodard 2007) are unaffected by BS. Also, barrier methods as the male and female condom are an option (Shawe et al. 2019).

Counselling on contraception should be a part of the pre-operative preparation. Pre-conception during the post-surgery period should include consideration of non-oral contraceptives as the efficacy of oral contraceptive pills may be compromised by unreliable absorption following bariatric surgery. Because of the recommended to the time to pregnancy period of minimal 12 months long-acting reversible contraception is preferred (Shawe et al. 2019).

Women undergoing a fertility treatment are at risk for the ovarian hyperstimulation syndrome (OHSS) which leads to ascites and increased intra-abdominal pressure. In pregnant women who had BS this can potentially increase the risk of late surgical complications, internal herniation. Infertility physicians should closely monitor for signs and symptoms of OHSS (Magdaleno et al. 2012).

Nutrient deficiencies and periconceptional supplementation

Bariatric surgery patients have an increased risk to develop nutritional deficiencies post-operatively (Devlieger & Vansant 2012; Narayanan & Syed 2016; Shawe et al. 2019). Women of childbearing age, who have undergone bariatric surgery, need dietary supplementation of multivitamins and micronutrients.

Specialists, e.g. dieticians, need to monitor regularly for deficiencies. Care must be taken to ensure that any prescribed

supplements and medications for women planning a family are safe in pregnancy. The prescribed supplement should at least contain (Guelinckx, Devlieger & Vansant 2012; Shawe et al. 2019):

- Copper (2 mg)
- Zinc (15 mg)
- Selenium (50 μ g)
- Folic acid (5 mg*)
- Iron (45 – 60mg)
- Thiamine (> 12 mg)
- Vitamin E (15 mg)
- Vitamin A (beta-carotene**, 5000 IU)

*0.4 mg/day is sufficient after BS but despite the BS many women still have a BMI > m2. Therefore, for these patients 5 mg stays recommended.

**Retinol-based vitamin A products have to be avoided during pregnancy due to their teratogenic potential. The beta-carotene form of vitamin A is preferred.

Supplementation should be adjusted to maintain healthy concentrations. In order to detect potential deficiencies the health professional should check the aforementioned indices in women with a pregnancy wish. If one of the indices is not reached extra supplementation needs to be considered by the specialist. It may be clear that pregnancy has to be planned, and the nutritional state of the woman should be optimized by supplements preferably 3 to 6 months before pregnancy. Multivitamin and mineral supplements have to be taken daily preconceptionally and during pregnancy (Shawe et al. 2019).

Conclusion

Given the many obese women worldwide who start pregnancy with obesity, an effective approach before and in pregnancy is urgent. The options for managing pre-pregnancy obesity are either to prevent the obesity-related complications once pregnancy has started or to reduce the Body Mass Index before pregnancy. The latter option is possible through diet and exercise or Bariatric Surgery. To increase the prevention of the long-term consequences BS might have, compliance to a life-long medical follow-up and the intake of dietary supplements is advised.

Although, the weight loss after BS is beneficial for the fertility of obese men and women, pregnancy after BS poses challenges and needs proper monitoring and counselling during preconception.

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Part V;

The importance
of different
environments

Chemicals and fertility

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Abstract

It has long been known that chemicals in the environment can act as endocrine disruptors and have a holistic effect on human health. Awareness of the effects of endocrine disruptors on sexual and reproductive health, and fertility in particular, has increased, as has the research available on it. Pollution, pesticides, phthalates, and bisphenol A impair the fertility of both males and females. In some occupational groups, there are additional risks in working conditions in terms of fertility. These groups include professionals working in the oil industry and beauty industries. This article will equip sexual and reproductive health professionals with reasoned information to help them develop their fertility protection skills when guiding youth and young adults. This guidance allows youth and young adults to choose more wisely to avoid any unnecessary chemical load to protect their health and fertility.

Keywords: environment, chemicals, endocrine disruptors, fertility

Tiivistelmä

On jo kauan tiedetty, että ympäristön kemikaalit voivat toimia hormonihäirikköinä ja vaikuttaa ihmisen terveyttä kokonaisvaltaisesti heikentäen. Tietoisuus hormonihäiriköiden vaikutuksista seksuaali- ja lisääntymisterveyteen, ja erityisesti hedelmällisyyteen, on lisääntynyt, samoin siitä saatavilla oleva tutkimustieto. Ilmansaasteet, kasvien tuholaismyrkyt, ftalaatit ja bisfenoli A heikentävät sekä miehen, että naisen hedelmällisyyttä. Joillakin ammattiryhmillä työolosuhteisiin liittyy hedelmällisyyden kannalta lisäriskejä. Näihin ryhmiin kuuluvat öljyteollisuudessa, sekä kauneusaloilla työskentelevät ammattilaiset. Tämän katsauksen avulla seksuaali- ja lisääntymisterveyden ammattilaisille saavat käyttöönsä perusteltua tietoa, jonka avulla he voivat ke-

hittää hedelmällisyyden suojeluun liittyvää osaamistaan ohjatesaan nuoria ja nuoria aikuisia. Tämän ohjauksen avulla nuoret ja nuoret aikuiset voivat valita viisaammin välttääkseen turhaa ja ylimääräistä kemikaalikuormaa suojellakseen terveyttään ja hedelmällisyyttään.

Avainsanat: Ympäristö, kemikaalit, hormonaaliset haitta-aineet, hedelmällisyys

Introduction

Our environment, and the chemicals in it, have a negative impact on health and fertility in many ways. An individual's chemical burden might be difficult to control in every situation, but it is good to be aware of all factors. It is also important for professionals and decision-makers to be aware of these factors in the environment that are affecting fertility. The first study, which found that chemicals in the environment act as endocrine disruptors and impair fertility, dates to 1970 by Ratcliffe. So, we cannot talk about a new phenomenon.

Endocrine glands secrete hormones that strongly affect the functioning of the human body. Endocrine disruptors are chemicals that behave like hormones in the body by interfering with this sensitive system (Bergman et al. 2012). An endocrine disruptor can work in two ways. It can block the hormone receptor, preventing the hormone from binding to the receptor, so that the desired reaction does not occur. The disruptor can also mimic the body's own hormone, which means that the reaction begins even when it should not. (Finnish Institute for Health and Welfare (THL) 2019a.)

A big amount of scientific data is currently being produced regarding different chemicals affecting the delicate endocrine system. The impact of chemicals on fertility, and especially on sperm, has been studied comprehensively over the past few years. This article is based on a systematic data retrieval of meta-analyses, and systematic literature reviews from the years 2013–

2018. Good scientific practice has been respected in the acquisition and analysis of the data. This article will focus on the findings.

Activity of endocrine disruptors

Endocrine disruptors have a negative effect on health and fertility in many ways. According to human and animal studies to date, they reduce semen quality, cause genital malformations (e.g. undescended testicles), pregnancy problems (prematurity and low birth weight), thyroid problems, cancers (breast, ovarian, testicle and prostate cancers) and obesity (Bergman et al. 2012).

Cells in the testicles are metabolically sensitive and hormone responsive, which makes male fertility very susceptible to hormones, especially endocrine disruptors (Alves et al. 2013). Male fertility relies heavily on a well-functioning hypothalamic–pituitary–testicular (HPT) axis which is, among other things, a system that regulates the production of male hormones (Comninou et al. 2014). Male reproduction, development and sexual characteristics are controlled by the HPT axis (Dhole & Kumar 2017). Androgens, i.e. male hormones, cause the development of gender characteristics typical of a man, in the same way that female hormones (estrogens) cause the development of female gender characteristics in women.

Women also need male hormones, but too high androgen levels can cause menstrual disorders, and for example hirsutism, which is excessive unwanted hair growth. Too high androgen levels in a woman can also cause infertility. (Tiitinen 2019.) In men, excessive production of estrogen can cause gynecomastia, i.e. breast growth (Mustajoki 2019). This is a transient and normal phenomenon in puberty, but later may indicate an excessive effect of endocrine disruptors, such as estrogens, in the environment. Endocrine disruptors can also affect women's delicate hypothalamus-

pituitary-ovarian (HPO) axis function. Endocrine disruptors can affect estrogen levels, follicle count, egg cell quality, embryo attachment and quality, and cause risks for normal healthy pregnancies (Karwacka et al. 2019).

Normal endocrine function can be disrupted in many ways, for example by harming normal metabolism. Environmental compounds and chemicals that promote human weight gain are called obesogens. Roughly described, obesogens contribute to the formation of adipocytes (also known as lipocytes or fat cells) by disrupting metabolism, thereby increasing the formation and growth of the fat tissue. The tissue of the reproductive system includes fat tissue, which makes them a particularly sensitive environment for chemicals (Reame et al. 2014). Subcutaneous fat tissue stores fat-soluble environmental chemicals and toxins. The more fat tissue in the body, the more toxins are stored there as a burden for the body (Hughes 2005). Obesogens also affect the physiology and metabolism of the testicles, which in turn can directly affect sperm formation (Cardos et al. 2017).

Effects of hundreds of chemicals on fertility

More than 800 chemicals have been identified or suspected in the world that can act as endocrine disruptors in the human body. Not only humans, but also animals suffer from these chemicals. According to a study in the United States, each pregnant woman was exposed to 43 different chemicals in her life (Woodruff et al. 2011). Scientific research into the health hazards of these chemicals is still ongoing, but there is a great need for more research.

Substances that are known environmental toxins and are suspected of acting as endocrine disruptors are Dioxins, PCB compounds, fire extinguishing agents, pesticides, fluorinated compounds (e.g. PFAS, PFOA, PFOS), Bisphenol A, Parabens,

Phthalates, organic tin compounds and Methylmercury (Finnish ... 2019b). Not all of these disrupt the hormones needed for reproduction, but also impair health in other ways and therefore indirectly also affect fertility. Exposure to harmful chemicals may occur before pregnancy, during pregnancy, in childhood, adolescence, adulthood and old age (American College of Obstetricians and Gynecologists (ACOG) 2013). Harmful effects may be programmed into genes and cause for instance breast cancer later in adulthood (Doherty et al. 2010).

Air and traffic pollution that burden cities and their inhabitants has been studied to reduce fertility (Checa Vizcaíno et al. 2016; Lafuente et al. 2016). It is suspected that these environmental toxins are particularly detrimental to men's ability to reproduce (Bonde et al. 2016). Plant pesticides such as DDT and HCH have a particular impact on sperm count and mobility (Martenies et al. 2013).

Cosmetics for personal hygiene often contain parabens and phthalates, which are also suspected of being endocrine disruptors (Dodson et al. 2012). Women of childbearing age are generally high-level consumers of cosmetics. This has been shown in studies as high levels of phthalates and parabens in their urine (Silva et al. 2004; Calafat et al. 2010). Braun et al. (2014) found in their study that pregnant women who use body lotion, perfume, makeup, hair gel and nail polish had significantly more phthalates and parabens in their urine than women who did not use such a large amount of cosmetics. This can be particularly harmful to the fetus in early pregnancy, as it is then particularly sensitive to the effects of endocrine disruptors (Rice et al. 2000). In addition to cosmetics, phthalates are found in adhesives, electronics, packaging materials, toys, paints, medicines, some foods, and textiles (Finnish ... 2019b). There is sufficient evidence that phthalates are toxic to reproductive health. However,

there are still gaps and contradictions in this information and research. Low phthalate exposure does not appear to pose a high risk to female fertility (Kay et al. 2013), but it appears to have a debilitating effect on sperm quality even at lower exposure (Kay et al. 2014). The effects of exposure to continuous and large amounts of phthalates and other chemicals on fertility remain partially unknown but still of concern (Kay et al. 2013). However, it is known that phthalates act as weak antiandrogens, i.e. counter effects of male hormones. Phthalates reduce sperm count, mobility and increase DNA destruction and deformities in sperm (Cai 2015; Bonde et al. 2016; Høyer et al. 2018).

Bisphenol A (BPA) has been used to make polycarbonate plastics and epoxy resins. BPA is used in plastic cutlery, cups, beverage bottles and canned coatings. BPA is also found in the thermal paper of cash receipts. BPA used in baby bottles, pacifiers, and food packaging for children under three years of age is prohibited in the EU. Most of the exposure to BPA is through food. BPA is released to food from plastic coatings, plastic products containing food and plastic bottles. BPA can also be obtained from room dust, plastic toys, or cosmetics. BPA is toxic to fertility because it interferes with female and male hormones in the body. (Finnish ... 2019c.) The effects may be estrogenic, anti-estrogenic, androgenic or antiandrogenic. Experimental animal studies by Ziv-Gal & Flaws (2016) found that BPA has a very detrimental effect on the structure of the ovaries, fallopian tubes, and uterus, as well as on the functioning of the hypothalamic-pituitary-ovarian axis. BPA was also seen to interfere with the menstrual cycle and prevent the embryo from attaching in the uterus. BPS and BPF have come to replace the notorious BPA, but their effects have proved to be as harmful as BPA's. These substitute chemicals are as hormonally active as BPA and impair fertility. (Rochester & Bolden 2015.)

Different occupational groups have different chemical exposures and, as a result, risks of fertility decline. Chemicals used in the oil industry clearly reduce the quality of sperm. They also have a disruptive effect on reproductive hormone receptors (Balise et al. 2016). In addition, chemical exposures of beauticians and hairdressers significantly impair their fertility if compared to their chemical exposure to the rest of the population (Kim et al. 2016).

Phthalates, BPA, plant pesticides and tobacco are the most harmful of all chemicals to the functioning of the ovaries. These chemicals are harmful to women of all ages, from the fetus to the grandmother and are highlighted if there has been repeated exposure in several stages of life. These chemicals destroy antral follicles in the ovaries, i.e. small resting follicles which contains an immature egg, and can cause premature menopause in women. (Vabre et al. 2017.)

Conclusion

Can the results of animal testing be fully, or even partially, applied to humans? Animals, such as mice or rats, may have different reactions to a chemical in the environment than humans. It is not possible to research all the chemical effects on humans, for ethical reasons alone, but also for safety reasons. In these studies, animals may be given a dose containing a strong chemical, which in the results indicates possible human effects. However, people are not exposed to the doses or amounts used in these experiments in their daily lives. Many chemicals play a small part in everyday life and therefore do not need to be concerned about (Finnish ... 2019b). However, it would be important to try to somehow control better how much and which chemicals are used by better lifestyle choices.

Laboratory conditions can vary from country to country, for this reason studies cannot always be fully compared. When reading the results, it should be remembered that there are always a lot of confounding factors when studying people. A person can never be completely isolated from their environment or, for example, from their diet, so that it can be said for certain that it is a particular substance or product that affect gametes. Fertility is the sum of many factors; it may be impossible to say that only one factor is decisive in decline in fertility. Fertility and the factors affecting it accumulate together in the couple and together affect the likelihood of having healthy children.

How can these endocrine disruptors be avoided? Here are good guidelines from Finnish Institute for Health and Welfare (THL) (2019a):

- When cooking, use only containers that are made for cooking, storage and heating food.
- Drinking bottles intended for single use should only be used once, not continuously.
- Products containing plastics purchased outside the EU can be a risk to health.
- It is advisable to follow the instructions for use and warnings that come with detergents.
- Cosmetics and excessive use of chemicals should be avoided or used as little as possible during pregnancy.
- In addition to these, organic food should be favoured, if possible. They often contain fewer chemicals than ordinary products.

With these measures, everyone can reduce their own exposure to chemicals and endocrine disruptors.

In its statement, ACOG (2013) proposes that sexual and reproductive health actors must be involved in developing interventions and measures to better understand the effects of chemicals in the environment and to protect fertility from these harms, by all possible means. These chemicals in the environment affect a person at all stages of the life course, however, visibly wounding fertility, regardless of the time of exposure.

Fortunately, the individual is not alone at the mercy of chemicals in our societies. The use of chemicals that have proved harmful is limited or prohibited by international agreements and laws (Finnish ... 2019b) in the EU. This eases anxiety about the huge chemical load but leaves room for the individual's own ability to choose more wisely and, where possible, protect their own fertility and health.

It should no longer be thought that the aim is solely to have a healthy child as a result of healthy parents and pregnancy. Considering current research, the goal is for the future children to be healthy throughout their lives, as a result of healthy parents and pregnancy. The goal is long-term, as healthy children are wanted to be able to have healthy children themselves. The goal of health is over-generational. (Boekelheide et al. 2012; Sutton et al. 2012.) Due to their fertility and reproductive intentions, youth and young adults represent the most important stage of human development and life that affects overall health. During adolescence, a window opens to the possibility of over-generational health. If a young person avoids endocrine disrupting chemicals as much as possible at this stage of life, they will be offered the best possible view of their own health and of their offspring (Gustafson 2018). Professionals promoting sexual and reproductive health play a key role in this, guiding youth and young adults to identify and know the environmental effects on fertility when they are at this very critical stage of their lives, to choose wisely – whenever possible.

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Occupation hazards - fertility and pregnancy

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Abstract

Occupational exposures threaten both male and female fertility, pregnancy, and the health of the unborn child, e.g. by causing menstrual irregularities, reducing the number and / or deteriorating quality of maturing eggs and sperm, etc. The health hazards from work are in a special position in relation to other health hazards and threats because they are different in nature from general environmental exposure agents. If there are exposure agents in the work environment, most often we emphasize the amount of exposure, duration of action, and systematic nature of the effect, but environmental exposures are usually sporadic and temporary. But it is wise to remember that environmental exposures and a questionable lifestyle can multiply by the effect of environmental hazards, or vice versa. Occupational exposure agents are divided into chemical, physical, and biological exposures. Exposure may occur at work by inhalation, through the skin or through the gastrointestinal tract. If a potential hazard or harm is identified against fertility or pregnancy, the primary goal is to eliminate it. If the hazard or harm is not eliminated, this person, male or female, needs to be transferred to a position better suited for the preconception period and pregnancy. Every workplace should be a health promoting workplace.

Keywords: occupation hazards, safety, fertility, pregnancy

Tiivistelmä

Työperäiset altisteet uhkaavat sekä miesten että naisten hedelmällisyyttä, raskautta, sikiön ja syntyvän lapsen terveyttä mm. aiheuttamalla kuukautishäiriöitä, vähentämällä kypsyyvien munasolujen ja

siittiösolujen määrää ja / tai heikentämällä niiden laatua ym. Työstä johtuvat terveydelliset vaarat ovat erityisessä asemassa suhteessa muihin terveyden vaara- ja uhkatekijöihin, koska nämä ovat luonteeltaan erilaisia kuin yleensä ympäristön altisteiden. Työssä, jos siinä on altisteita, korostuu useimmiten altisteen määrä, vaikutusaika ja vaikutuksen järjestelmällisyys, mutta ympäristön altisteet ovat tavallisesti satunnaisia ja väliaikaisia. Mutta kuten sanottu, ympäristön altisteiden ja kyseenalaisten elintapojen merkitys voi moninkertaistua yhdessä työssä olevien altisteiden vaikutusten kanssa, tai myös tosin päin. Työaltisteet jaetaan kemiallisiin, fyysisiin ja biologisiin altisteihin. Altiste voi joutua yksilöön työssä joko hengityksen, ihon tai ruuansulatuselimistön kautta. Jos tunnistetaan hedelmällisyyttä tai raskautta uhkaava vaara työssä, se pitää ensi sijassa poistaa. Jos sitä ei voida poistaa, työntekijä on siirrettävä työhän, joka ei uhkaa terveyttä, eikä raskautta. Jokaisen työpaikan pitäisi olla terveyttä edistävä työpaikka.

Avainsanat: työperäiset vaarat, turvallisuus, hedelmällisyys, raskaus

Introduction

The most common diagnosis among working-age people aged 25–45 is infertility. About 13–15% of this age group suffer from infertility. Infertility in this age group is significantly more common than, for example, infarcts (1% <), cancer (about 1%) and diabetes (about 2%) in total. (Siepe 2019.) It is estimated that in Finland, for example, up to 40% of 35–45-year-olds suffer from childlessness, which is caused by infertility (Ovumia 2019).

Occupational exposure agents threaten both male and female fertility, pregnancy, the health of the unborn child, e.g. causing menstrual irregularities, reducing the number and / or deteriorating quality of maturing eggs and sperm, etc. Although working-age people spend about 20% of their time at work each year, linking work and infertility or pregnancy problems is not straightforward. First, there can be many causes of infertility, and

a causal relationship is difficult to demonstrate. Suspicion of the effects of occupational exposure is mostly based on individual epidemiological studies that have found a statistical association between exposure and fertility disorders. Secondly, occupational exposures, together with malnutrition and other unhealthy lifestyle habits and / or diseases resulting from the unhealthy lifestyle, can threaten fertility in both men and women, pregnancy, and the health of the unborn child. Thirdly, the exposure agent does not in itself mean illness, but the risk of illness depends on e.g. the mechanism of action of the exposure, its entry or avoidance, the time and level of exposure, the working methods and the individual characteristics and lifestyle of the person.

The health hazards from work is in a special position in relation to other health hazards and threats. In industrialized countries it is regulated by law, but differently in different countries. The EU has defined e.g. the Directive Protecting Pregnant Workers and New Mothers (Council Directive 92/85 / EEC), which have been applied in various ways by EU countries. For example, according to Finnish legislation, the employer is obliged to ensure that the work does not pose a risk to reproductive health. Occupational physicians and occupational health nurses are specially trained to identify work-related hazards and to guide and advise both the employer and the employee in these situations.

Linking work to pregnancy and female and male fertility is a matter of occupational health, but also a matter of maternity care. Although there is a strong occupational health perspective in this article, the review is on a general educational level. At a level that does not require knowledge of the intricacies of occupational health. It is left to occupational physicians and occupational health nurses, and other experts as well as to the special literature on occupational health. This article emphasizes the understanding

that every nurse and midwife should have, when dealing with clients with infertility or pregnant families and when to refer them to an expert.

This article is based on a scoping review with different kind of deliberately selected sources. Due to the defining of the article, a careful analysis of individual exposures and threats to individual occupations will be considered only as examples.

Occupational, environmental and lifestyle hazards

It can be said that almost all the articles in this book are more or less related to this article, because the importance of the environment and lifestyle for occupational health cannot be ignored. It is not easy to separate environmental and occupational hazards as 'Health for all by the year 2000' strategy states:

“There are many problems that require changes connected with environmental protection as well as with occupational health services and occupational safety. Examples of these are the many deficiencies in working conditions, the scarcity of co-operation in environmental protection and occupational safety and the emission of traffic that threaten the quality of air”. (WHO 1981.)

For example, an article by Botha (2021, in this book) clearly shows how environmental toxins are part of occupational hazards. Occupational hazards are different in nature from general environmental exposure agents because work, if there are exposure agents, most often emphasizes the amount of exposure, duration of action, and systematic nature of the effect, but environmental exposures are usually sporadic and temporary. But the importance of environmental exposures and a questionable lifestyle can multiply by the effect of environmental hazards, or vice versa.

An individual's genes, lifestyle, and behaviours are part of his or her work and other living environment. This individual is also a member of society as well as an actor in the global community. However, it can be said that while everything affects everything, work and the work environment may be the cause of illness, infertility and / or pregnancy problems or illness of the unborn child.

Occupational exposures and fertility, pregnancy, and the unborn child

In recent decades, there has been a growing understanding of the importance of occupational exposures to fertility and pregnancy, but even more so, for example, the harmful effects of pesticides and herbicides on gametes often become apparent by chance. When we are talking about occupational exposures and fertility, it is good to remember, in simple terms, the sex segregation is also observed between the occupation and fertility (Begall & Mills 2012). In female dominated jobs females are more fertile (get earlier pregnant and have more children) than females in male dominated jobs.

Occupational exposure agents are divided into chemical, physical, and biological exposures. Exposure may occur at work by inhalation, through the skin or through the gastrointestinal tract.

The aim of the EU directive (92/85 / EEC) is to promote the safety and health of pregnant workers and workers, who have recently given birth or are breastfeeding. The directive prohibits pregnant women from working under pressure or diving, working in an environment involving exposure to *Toxoplasma gondii* and Rubella virus, lead and its derivatives, and underground mining.

Chemical exposure agents

Some chemical exposure agents can damage sperm formation in the testicles in exposed men, which can result in infertility. In women, on the other hand, a possible link between exposure agents to organic solvents and miscarriages has been observed. A toxic substance may cause the death of a developing embryo or unborn child, cause a structural abnormality, i.e. be teratogenic, interfere with fetal growth or cause functional changes in the offspring, including in breastfed children. Table 1 describes some chemical exposure agents from heavy metals lead and mercury, organic solvents, anaesthetic gases, cytostats, pesticides, and tobacco smoke from environment. Table 1 also describes as examples the possible effects of these substances as well as examples of occupations where one may be exposed to these substances.

Table 1. Chemical exposure agents

Exposure agent	possible effects, for example	exposed jobs, for example
Lead	menstrual disorders affects the development of healthy sperm, leads to lower sperm count	painters plastics and rubber industry graphic arts industry manufacture of art ceramics
Mercury	fertility decrease (F&M) fetal growth retardation, damage to the fetal nervous system	pesticide industry repair and maintenance work chlorine industry
Organic solvents	menstrual disorders increase fertility decrease lower sperm count number of abnormal sperm increase risk of miscarriages increases risk of deformities increases low birth weight	painting and varnishing work gluing work silk screen floor waxing work printing work
Anaesthetic gases	fertility decrease risk of abortions increases risk of deformities increases low birth weight	maternity ward work operating theatre work dental clinic work veterinary work
Chemotherapy (changes may be genotoxic)	menstrual disorders increase fertility decrease (F&M) risk of deformities increases	tasks to dilute chemotherapy cleaning rooms where chemotherapy are made injection of cytostats
Pesticides	fertility decrease oestrogen-like effects, linked to poor semen quality risk of abortions increases risk of deformities increases low birth weight	farming work gardening work
tobacco smoke from environment	risk of miscarriages increases risk for premature births increases low birth weight	

Physical exposures

According to EU Directive 92/85 / EEC, the physical factors to be assessed during pregnancy are radiation, shock, vibration or movement, heavy lifting (risk for the back), noise, ionizing and non-ionizing radiation, extreme cold or heat, movement; and postural issues, mental and physical fatigue, and other physical exertion. Table 2 describes occupational exposures and their possible effects as example.

Table 2. Physical exposure agents

Exposure agent		possible effects, for example
Ionizing radiation (male & female)	electromagnetic X-ray and gamma radiation	in living cells, ionization can damage the cell's genome, the DNA molecule. abnormal sperm and lower sperm count, central nervous system damage to the unborn child risk of intellectual disability, microcephaly risk of fetal short stature
	alpha and beta particle radiation	
Non-ionizing radiation (radiofrequency electromagnetic radiation, microwave radiation)		sperm quality deteriorates male fertility decreases
Physical exertion		hormonal imbalances decreased uterine blood flow may harm the unborn child risk of miscarriage increases risk of preterm birth increases low birth weight
Noise		causes stress -> vasoconstriction of placental circulation increased risk of preterm birth retardation of fetal growth (effect on child's hearing > 85dB)
Heat exposure (male)		elevation of scrotal temperature to normal core body temperature results in complete failure of spermatogenesis, quality of semen decreases morphologically abnormal sperm, decreased sperm motility and count
Night work		risk of miscarriage increases, risk of preterm birth increases
Stress		prolonged and intense stress levels impair fertility
Violence or treat of violence		prolonged and intense stress levels impair fertility, risk of miscarriage/abortion, injury of unborn child

Biological exposure agents

Any pathogen, bacteria, viruses, or parasites in the mother's body can pass through the placenta to the fetus. The severity of the infection depends on the pathogen, the mother's immunity, and the stage of pregnancy. Maternal antibodies protect the fetus and unborn child from many infections.

Biological agents or diseases, which may damage fertility, cause harm for pregnancy or unborn child, are for example *Toxoplasma gondii*, *Listeria monocytogenes*, Hepatitis-B, HIV, Chicken pox, Rubella, Measles and Erythrovirus (Table 3). Delbaere (2021, in this book) in 'Infectious diseases' describes many of these biological exposures and how to protect oneself. On the other hand, in Mivšek's (2021, in this book) article she describes sexually transmitted infections, which might also be transmitted in work environments e.g. through dirty needles. In Table 3 are presented some possible effects, which biological exposure agents might have.

Table 3. Biological exposure agents

Exposure agent	possible effects, for example
Toxoplasma gondii	increased risk of injury to the unborn child increased risk of miscarriage increased risk of intrauterine death
Listeria monocytogenes	increased risk of miscarriage increased risk of death of newborn
Hepatitis-B	the newborn becomes infected
HIV	the newborn becomes infected
Chicken pox	increased risk of miscarriage risk of deformities increases
Rubella	risk of deformities increases Rubella-syndrome: heart defects, central nervous system developmental disorders
Measles	increased risk of miscarriages increased risk of intrauterine death
Erythrovirus	increased risk of intrauterine death

These effects are focusing mostly on the time during pregnancy. It remains unclear, how much before the conception special hazards should be avoided, but in principle all occupational hazards are hazards for health as long they exist.

Secondary infertility or problems in fertility due to work

We can speak of work-related secondary infertility or disorders in infertility. For example, the treatment of work-related cancer may lead to infertility problems. Strong cancer treatments can deplete a woman's entire egg supply, leading to sex hormone deficiency and infertility. Treatments can also reduce testicular sperm production or stop it altogether. Male fertility may be partially or completely restored after treatments. Permanent or long-term disruption of sperm production occurs when cancer treatment affects testicular stem cells.

Reproductive toxicity of substances and CLP -regulations

The European Commission verifies CLP (the classification, labelling and packaging of substances and mixtures) -regulations yearly. All packages, which maintain hazardous or harmful substances to reproductive health must bear a label, and it is good for everybody to know the pictograms to avoid these hazardous products.

Toxicants and mixtures, which may cause genetic defects or damage fertility or the unborn child, are identified by their CLP classification as category 1 A or 1 B. If the substance or mixture is suspected of causing genetic defects or impairing fertility or harm to the unborn child, it is classified in Category 2 according to the CLP. In addition, they are labelled with the following hazard statement and signal word according to the category (Table 4), and the warning symbol (Picture 1).

Table 4. Mandatory statements in products, which may cause effects to fertility or unborn children

Hazard statement	Signal word	Hazard category
May cause genetic defects	DANGER	1A and 1B
Suspected of causing genetic defects	Warning	2
May damage fertility or the unborn child	DANGER	1A and 1B
Suspected of damaging fertility or the unborn child	Warning	2

Picture 1 is in Finnish, but in every country the pictogram is similar, and the statement and signal word is in the same place in each individual country and language.



Picture 1. An example of a hazard pictogram.

Health promotion in the workplace and occupational environment

If a potential hazard or harm is identified for fertility or pregnancy, the primary goal is to eliminate it. If the hazard or harm is not eliminated, this person, male or female, needs to be transferred to a position better suited for the preconception period and pregnancy. The hallmarks of a health promoting workplace are:

1. The work culture of the workplace supports safe work
2. The work environment enables and supports healthy choices
3. The culture and professional identity of the work community encourages and accepts healthy choices
4. Individual attitudes, knowledge, and skills promote healthy choices and habits

To conclude

Cynically, it can be stated that while man invented agriculture, its' by-products were the invention of work, and work-related injuries and diseases. It is only in the last 50–70 years that we have paid serious attention to the dangers of work to reproductive health, and pregnancy. Research is being done all over the world, and the understanding is evolving continuously. However, people in different parts of the world are in a very unequal position. On the other hand, one can from time to time read about how many countries, or the various factories in many countries, do not heed to health regulations, not to mention the protection of individuals' reproductive health or pregnancy. On the other hand, researchers in universities are currently more or less confused about microplastics and nanoparticles, and their importance to fertility and pregnancy.

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Social environment factors: How does interpersonal violence, domestic (intimate partner) violence and female genital mutilation influence the preconception period?

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Abstract

The social environment and social conditions have an influence on people's health. This also counts for health during the preconception period. Social conditions include a wide range such as housing, working conditions, socio-economic status, safety, poverty, or interpersonal and sexual violence. This chapter focuses on the last factor: violence. What is violence and how does violence influence the health of women, mothers to be, and their offspring?

Women experiencing violence often feel alone. Where can they find help? Is help and support available or accessible? The preconception period can create opportunities to discuss violence.

Keywords: social determinants, social environment, violence, genital mutilation, preconception

Abstract

De sociale omgeving en sociale omstandigheden beïnvloeden de gezondheid van een individu. Dit geldt ook voor de gezondheid tijdens de preconceptionele periode. Sociale omstandigheden omvatten een breed scala, zoals huisvesting, arbeidsomstandigheden, sociaaleconomische status, veiligheid, armoede of interpersoonlijk en seksueel geweld. In dit hoofdstuk staat de laatste factor centraal: geweld. Wat is geweld en hoe beïnvloedt geweld de gezondheid van vrouwen, aanstaande moeders en hun kroost? Vrouwen die geweld ervaren, voelen zich vaak alleen. Waar kunnen ze hulp vinden? Is hulp en ondersteuning beschikbaar of toegankelijk? De preconceptieperiode kan mogelijkheden bieden om geweld te bespreken.

Sleutelwoorden: sociale determinanten, sociale omgeving, geweld, genitale verminking, vooroordeel

Povzetek

Družba in socialni pogoji vplivajo na zdravje ljudi. Slednje velja tudi za predkonceptijsko obdobje. Socialni pogoji vključujejo širok nabor dejavnikov kot so stanovanjske možnosti, delovni pogoji, socio-ekonomski status, varnost, revščina, medosebno in spolno nasilje. Slednje izpostavlja pričujoče poglavje in poskuša odgovoriti na vprašanje Kaj je nasilje in kako le-to vpliva na zdravje žensk, bodočih mater ter njihovih potomcev? Ženske, ki so izpostavljene nasilju se pogosto čutijo same, brez kakršne koli podpore. Kje lahko poiščejo pomoč? Sta pomoč in podpora dostopni in dosegljivi? Predkonceptijsko obdobje je priložnost, da se spregovori tudi o nasilju.

Ključne besede: socialne determinante, socialno okolje, nasilje, pohabljanje genitalnih sporov

Introduction

Social determinants of health influence the preconception period and therefore may impact the health of future generations. One of these determinants is interpersonal and sexual violence. Millions of girls and women experience some kind of violence during their lifetime. Violence against women influences the health and wellbeing of women, mother to be and has long term effects. The experiences violence can hinder them in their studies, their ability to work and the care for themselves and their family (Waelput 2020).

Women who experience or have experienced violence don't know where they can go, where they can seek for help. Pregnancy and the preconception period open opportunities for detecting violence because during these periods they are in contact with health care providers.

It is important to create awareness on this topic, on the prevalence and the lifelong effects of the experienced violence.

Globally, one in three women and girls experience sexual or physical violence during their lifetime. The confrontation with domestic violence as a young child influences the health and wellbeing of children. Being a witness of domestic violence creates a risk of tolerating intimate partner violence in their adult life (World Health Organization 2019).

Forms of violence

The United Nations General Assembly (1994) defines violence against women as "... any act of gender-based violence that results in, or is likely to result in, physical, sexual or psychological harm or suffering to women, including threats of such acts, coercion or arbitrary deprivation of liberty, whether occurring in public or in private life".

Violence against women is a type of interpersonal violence. This kind of violence takes many forms (Waelput 2020):

Intimate partner violence or physical and/or sexual violence by an intimate partner

Any form of sexual assault committed by someone other than a partner, such as friends, other family members.

Acceptance of violence against women and girls is attitude, which is hard to change. Luckily, norms are changing, and acceptance of violence is decreasing (United Nations Department of Economic and Social Affairs & Affairs 2015).

Understanding the Cycle of violence

In order to tackle and appropriately address intimate partner violence we need to understand its nature. Pioneer research about abuse of women was conducted by Lenore Walker in 1979. She discovered a cyclic pattern (Figure 1) of progression of abuse in female-male relationships that is now identified as the cycle of violence.

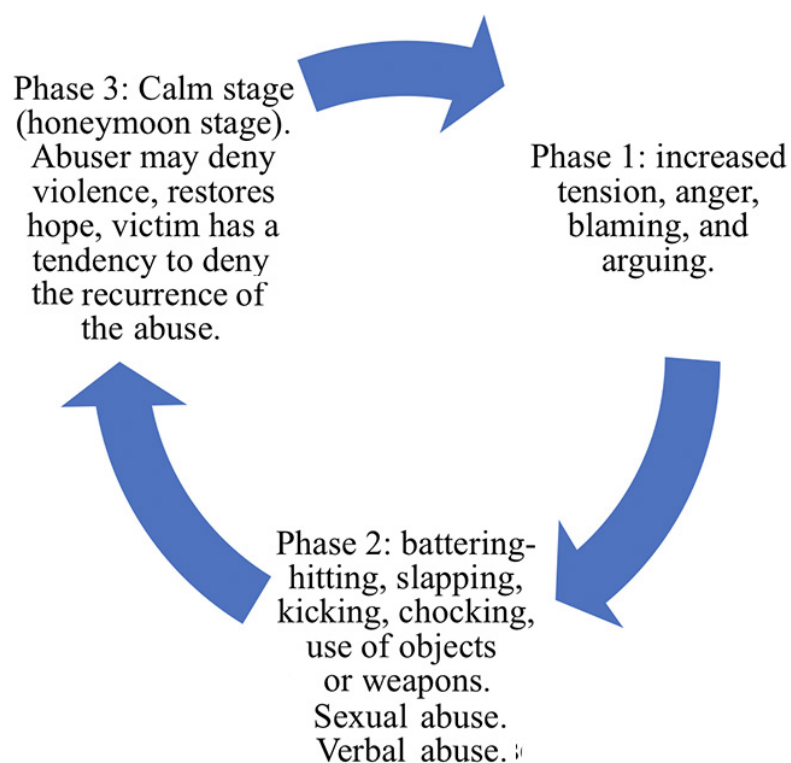


Figure 1. A three-phase cyclic pattern (Mattson & Smith 2015).

Phase 1 is characterized as a period of increasing tension towards woman (increased anger, blame and escalation of arguments). Phase 2 is the acute battering incident in which the abuser demonstrates an uncontrollable discharge of the built-up tension. This phase can last from a few minutes, sometimes even to several days. Phase 3 offers women hope and powerful, positive reinforcement. The abuser is usually remorseful and apologetic, promises that the abuse will never happen again, promises everything and profess his intense love and devotion for her (Mattson & Smith 2016).

Facts

Although violence against women is a worldwide problem with a high prevalence data are scarce because from the one in three women suffers from it less than 40% seeks for help (United Nations Department of Economic and Social Affairs & Affairs 2015).

Different stages of life show different forms of violence. During childhood and adolescence there is female infanticide, child abuse, genital mutilation of young girls. Later there is forced prostitution, trafficking, neglect of older women.

Violence is most common during the reproductive life stage. European countries show the highest prevalence of violence against women at the age from 18 to 29 years. With age numbers decline (United Nations Department of Economic and Social Affairs & Affairs 2015). Pregnancy (Desmarais 2014) seems to protect women against physical violence and intimate partner abuse. Alcohol and substance abuse, low educational level, or being witness of domestic violence during childhood are risk factors to be a victim or perpetrator of violence (Waelput 2020).

How does violence impact women's health?

Adverse effects are broad and have an impact on physical, e.g., sexually transmitted infections, intrauterine bleeding, and mental health, e.g., anxiety and post-traumatic stress. In addition, Waelput (2020) describes the impact of violence on women's sexual and reproductive health. The violent and controlling partner does not only sexually abuse the woman but also controls their fertility.

Examples of this behaviour are controlling contraception methods which leads to higher numbers of unintended pregnancies. Half of these unintended pregnancies are terminated often illegal and unsafe techniques, which can put the life of the women at risk, are used. Women who suffer from or fear intimate partner violence don't control their sexual intercourse, e.g., the use of condoms.

Violence during pregnancy is associated with low-birthweight and/or preterm birth. The World Health Organization (2011) made an overview (figure 2) of the negative health outcomes of intimate partner violence during pregnancy.

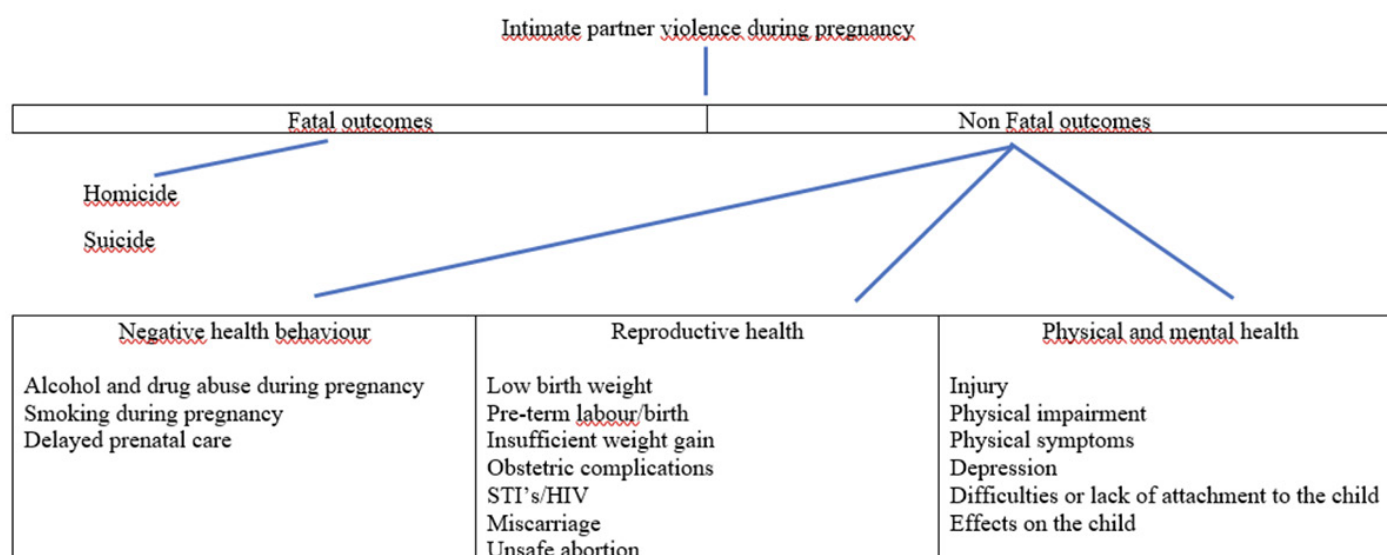


Figure 2. Overview of the health outcomes of intimate partner violence during pregnancy (World Health Organization, Dept. of Reproductive Health and Research, 2011)

Mothers who suffer from intimate partner violence during their pregnancy cannot care for their newborn as they wish. The violent partner remains violent during the postnatal period or is jealous. Mothers don't breastfeed or just shortly (Silverman et al. 2006).

Direct and indirect factors cause the adverse effects on maternal and neonatal outcomes. Stress is one indirect factor that can cause low-birthweight or preterm birth because of the release of prostaglandin (premature contractions) or cortisol (IUGR) due to the stress (Hill et al. 2016). Also, stress can influence existing chronic health conditions (e.g., diabetes, hypertension) and unhealthy lifestyles (e.g., smoking, the use of alcohol, illegal drugs) that also influence adverse pregnancy outcomes (Waelput 2020).

Women and mothers to be who suffer from intimate partner violence cannot decide on their own health, cannot decide to go to health care services. This results in inadequate prenatal care (Hill et al. 2016). Waelput (2020) cites that violence against women also has intergenerational effects. Being exposed to violence as a child is a traumatic experience with major consequences for health and well-being. Exposure negatively affects a child's brain development and thus increases the risk of social, emotional and behavioral problems and addiction tendencies.

Interventions

Addressing violence against women needs a comprehensive and woman centred approach. Awareness and education on the magnitude of the problem, on the long-term consequences on health and wellbeing is needed to create prevention, counselling and shelters for women suffering from violence (UNDEAS 2015).

Pregnancy and prenatal care are, because of the regular contacts with health care providers, open opportunities for detecting

violence (Vanparys et al. 2014). Consequently, violence against women should be part of preconception care (World Health Organization 2012; Lassi et al. 2014). Risk factors for the violence can be recognized and responded. Which elements should healthcare providers pay attention to during a consultation. An intrusive partner or husband present at all consultations should be noticed by the health professional. During the anamnesis professionals should pay attention to traumatic injuries, repeated sexually transmitted infections, genitourinary symptoms; adverse reproductive outcomes (e.g. unintended pregnancies, abortions). Also, women may mention psychological symptoms like depression, anxiety, or suicidality. The need for and use of alcohol, prescription drugs, tobacco, or other drugs can indicate violence. If one of these risk factors is present professionals have to enquire further. Treatment can only be initialized once the violence is identified (Waelput et al. 2020).

Female genital mutilation and preconception

Female genital mutilation (FGM) is a major human right issue that affects girls and women around the world recognized by the United Nations (2016) in SDG 5. FGM includes all procedures that involve partial or complete removal of the external female genitalia or other injuries to the female genital organs for non-medical reasons (World Health Organization 2020). It is a major health problem worldwide but is most common in many countries in Africa and a few countries in Asia and the Middle East. FGM reflects historical gender inequality and represents an extreme form of discrimination against women. FGM has no health benefits, only serious negative consequences, including those that directly affect their reproductive health.

The World Health Organization (2020) defines four major types:

- Type 1 is the partial or total removal of the clitoral glans, and/or the prepuce/ clitoral hood
- Type 2 is the partial or total removal of the clitoral glans and the labia minora, with or without removal of the labia majora.
- Type 3 or infibulation is the narrowing of the vaginal opening by a covering seal created by cutting and stitching the labia minora, and/or labia majora, with or without removal of the clitoris (Type I FGM).
- Type 4 includes all other harmful procedures to the female genitalia for non-medical purposes, e.g., pricking, piercing, incising, scraping the genital area.

Type 1 and 2 are most common, approximately 80%, while infibulation is found around 15% worldwide. All types of FGM have immediate and long-term health consequences. The severity of the consequences depends on the type, the expertise of the circumciser, the hygienic conditions, the health condition of the girl and if she resists a lot or not (Isman et al. 2013).

FGM is traumatic for girls and women with immediate and long lasting physical and mental problems (World Health Organization 2019). Physical problems include haemorrhage, pain, genital tissue swelling, urogenital pain and infections, wound healing problems, or even death. Mental problems include post-traumatic stress and anxiety. There are also specific obstetrical consequences: dyspareunia, increased risk of a caesarean section, lacerations, an instrumental delivery, stillbirth and neonatal death.

FGM remains deeply rooted within some cultures and traditions, and it can be challenging to rationalize the beliefs that provide a vehicle for the practice to continue. Attitudes towards FGM are

changing very slowly. While the exact number of girls and women who have undergone some form of FGM remains unknown, at least 200 million girls and women in 30 countries have been subjected to one of the four types of FGM. In general, FGM is concentrated in Africa, the Middle East and Asia. More than half of the girls and women live in Indonesia, Egypt and Ethiopia (United Nations 2016). In most of the countries, the majority of the girls were mutilated before the age of 5. Usually, FGM is performed by traditional practitioners, but in Indonesia half of the girls undergo the procedure by a trained health professional (Kimani et al. 2018).

As a result of migration women and girls with or are at risk for FGM are also present in Europe, Australia and North America. Correct data are currently not available (United Nations 2016; Waelput 2020). Overall, the African prevalence (1.4%–89%) in FGM declines from ½ in 1985 to 1/3 anno 2019 (UNFPA 2019). However, due to the population growth amongst young girls in countries where FGM knows a high prevalence FGM will rise from 3,9 million in 2015 to 4,6 million in 2030 (UNFPA 2018; UNFPA 2019).

There are a variety of sociocultural reasons, why communities practice FGM (World Health Organization 2018; Salute 2019):

- **Respect for tradition:** FGM is a part of the cultural tradition of the community. To show respect to the elder members of the community men and women support and continue FGM.
- **Rite of passage:** FGM leads girls to respectable adulthood.
- **Social convention:** FGM is seen as necessary to be accepted in the community. Those who do not adhere to FGM can be condemned or excluded from the community.

- **Enhance fertility:** Women and men may believe that a woman who is not mutilated, will not be able to become pregnant or may face difficulties during labour.
- **Marriageability:** The idea that men will marry only women who have undergone FGM is often believed in communities. As marriage is seen as an economic and social security, FGM perpetuates FGM.
- **Ensure virginity, and faithfulness:** FGM is believed to safeguard a girl's or woman's virginity prior to marriage and ensure fidelity after marriage.
- **Cleanliness and beauty:** Sometimes, communities perform FGM in order to make girls "clean" and beautiful.
- **Femininity:** The clitoris is considered masculine. Removal of genital parts is considered to make girls more feminine, respectable and beautiful.
- **Religion:** Some communities believe that FGM is a religious requirement. Some religious leaders promote the practice, even though FGM is not mentioned in any major religious texts.
- **Psychological and sexual:** In some communities there is a tendency to support the need for FGM to prevent uncontrolled sexual activity.

Although many girls or women who underwent FGM experience a healthy pregnancy. However, FGM is also associated with obstetric complications. The preconception period is an opportunity for health-care providers to assess women and to deliver care, support and correct information. What to do (World Health Organization 2012):

- Discuss the practice with the girl and her parents / partner.
- Screen women and girls for FGM to detect complications.
- Inform women and couples about the complications of FGM and about access to treatment.
- Plan defibulation before pregnancy or early in pregnancy
- Remove cysts and treat complications when present

Discussing and screening seem easy, but they are not. Healthcare facilities need to be prepared to address these issues. Healthcare professionals and social workers should be informed about the existence of these traditions and know how to offer women – victims of these practices the necessary assistance.

When should a professional address FGM? Risk assessment is difficult. If a health professional wants to perform a good risk assessment knowledge is essential! Starting an anamnesis with the question: “Where does the woman / girl come from originally?” opens the conversation. When the woman mentions a country, region where FGM is performed then the professional has to be warned. Further examination is possible when the surgical history is asked. Respect and understanding are letting the girl, family, community know that FGM is taken serious. Starting the conversation with women who have a pregnancy wish can prevent FGM in her children. At this point preconception shows his intergenerational benefits.

FGM is still a challenge to overcome due to the strong links to culture, tradition, and religion. Strengthening the healthcare professional’s competence in counselling and raising awareness among lay people would contribute greatly to eradicating such a violation of a basic human rights.

Conclusion

Violence against women and girls is a violation of their human rights and causes lifelong effects on the physical, mental, sexual, and reproductive health. The violence might also affect their children which can result in negative child health and development.

A comprehensive approach is needed: health, legal and social services, communities, and governments have to work together to fight violence. Creating awareness on the magnitude of the problem is the first step. Providing treatment, care and referral services for women who want help and support with trained professionals are the next steps.

To identify violence against girls and women a life course approach is needed because the violence occurs during any life stage. Sexual and reproductive health settings, general practitioners, public health nurses, school health professionals... should be aware. The preconception period is a period to address the violence. This period can be used for timely recognition so negative health consequences for mother and child can be prevented.

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Part VI;

Nurse and midwife
counselling in
preconception health
and health care

The Reproductive Life Plan. How one key question can help couples to reflect about parenthood

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Abstract

The concept 'reproductive life plan' (RLP) originates from the United States, where it was introduced as a method to prevent unintended pregnancies. In Sweden, the reproductive life plan was successfully introduced in contraceptive counseling to discuss future reproductive plans with couples and as such, to increase their knowledge about their fertility and preconception care. The question 'do you want to have children in the future' in primary health care may encourage individuals or couples to discuss parenthood with their health care provider and within the couple and enables people to reflect about having children.

Key words: reproductive life plan, unplanned pregnancy, prevention, pregnancy outcome

Abstract

Het concept 'reproductive life plan' (RLP) werd geïntroduceerd in de Verenigde Staten als manier om ongeplande zwangerschappen tegen te gaan. Men introduceerde het 'reproductive life plan' ook in Zweden tijdens anticonceptieconsultaties met de bedoeling om reproductieve levensplannen met koppels te bespreken en onrechtstreeks ook de kennis rond vruchtbaarheid en preconceptiezorg te doen toenemen. Als eerstelijnsverkeerswerkers de vraag 'wil je later ooit kinderen' stellen in een consultatie, kan dit patiënten en koppels aanmoedigen om hun

kinderwens te bespreken met hun zorgverlener en met hun partner en kan het aanzetten om na te denken over de kindwens.

Sleutelwoorden: reproductief levensplan, ongeplande zwangerschap, preventie, zwangerschapsgeschiedenis

What is the Reproductive Life Plan?

The Reproductive Life Plan (RLP) is a set of non-normative questions that can be used in primary care with people of reproductive age to ask about future plans for parenthood. It has been recommended by the Center of Disease Control (CDC, USA) as an instrument to improve reproductive health promotion, not only when couples express the wish to start a family, but during the complete life cycle of both men and women (Moos et al. 2008).

The goal of a RLP is to reflect on one's reproductive intentions and about effective strategies for family planning. This includes for example prevention for unplanned pregnancies, but also reflection on the number of children wanted and strategies to prevent for delayed parenthood and actions to protect health in general and reproductive health in particular. The CDC considers that primary health care providers can play a key role to address the RLP with people of reproductive age (Johnson et al. 2006). A number of booklets and worksheets are made available to support health care workers in their communication with patients (Quality Family Planning 2015).

The One Key Question™ to ask in a RLP is “would you like to become pregnant in the next year?”. This is considered as non-invasive to start communication about reproductive plans. The following conversation then depends on the response provided by the patient/couple (yes, no, not sure, it's equal) and indicates if the health care provider should focus on preconception health care or on effective contraception counselling (Reproductive Life Plan 2021).

According to the CDC (2006), a reproductive health plan reflects someone's intentions regarding the number of pregnancies and their timing in the background of their personal values and life goals. Addressing a reproductive life plan may increase the number of planned pregnancies and encourage people to address and handle risk behaviors before pregnancy. The encouragement for every man, woman and couple to have a reproductive life plan connects to the first recommendation of the CDC to improve women's health: individual responsibility across the lifespan (Johnson et al. 2006).

Preconception care is typically seen as a pre-pregnancy planning visit, but next to such an isolated visit, the CDC recommends preconception care to be part of primary and preventive care. This view also fits in the 'Life Course Approach': we should not only focus on pregnancy outcome within prenatal care, but before, within preconception care and even earlier, for example in adolescence, with the onset of unhealthy life style habits (Shawe et al. 2020). Also the ACOG, AAP and March of Dimes recommended to profit from every health encounter with a women at reproductive age to include counseling on optimizing pregnancy outcomes (Brundage 2002; Christianson et al. 2006; Johnson et al. 2006). As half of the pregnancies in the United States were unintended around the year 2000 and 48% of all women aged 15–44 years experienced at least one unintended pregnancy, it was extra important to address health risks and behaviors during any consultation (Moos 2003). Stated determinants of unplanned pregnancies are barriers to accessing contraception, errors using them, fear of using them (e.g. fear for infertility) and lack of skills to cope with an error (Moos 2003).

According to Moos, nurses (and midwives) are in an ideal position to provide health promotion activities, including patient education on unintended pregnancies (Moos 2003).

Moos et al. (1996) found that introducing a reproductive life plan may improve pregnancy planning and intention, which is of importance, because planned pregnancies are associated with improved birth outcomes. The PRAMS-study pointed out that 38% of women who planned a pregnancy and 30% of other women at reproductive age had one or more indications for preconception counseling (e.g. substance abuse, weight problems, ...) (Robbins et al. 2013).

Liu and colleagues presented a theoretical framework (Figure 1) of reproductive life planning, based on a concept analysis of the available literature (Liu et al. 2016), particularly based on the landmark article of Johnson et al. (Johnson et al. 2006). As a first attribute, RLP should be inclusive for both sexes, although women are placed at the center of the conceptual model of preconception care. Furthermore, responsibility is included in the model, because an RLP comes forth out of an individual's intent. As already stated before, the reproductive life plan should be included as a lifelong plan, from the beginning to the end of reproductive years. The RLP introduces discussion about reproductive health within routine consultation and as such, communication is another attribute. As you cannot predict life, the RLP should be flexible in order to adapt and fit in when life circumstances call for it. Finally, every RLP is unique and should be personalized to an individual. Liu et al. define antecedents as those events that precede the RLP. Having reproductive potential is a circumstance that may call for an RLP, next to that the perception of need (e.g. the perception of the lack of planning by a health care provider) may be an antecedent too. In this process, it is important that the health care provider assesses what an individual know about reproduction and adapts the education to the level of health literacy of the individual.

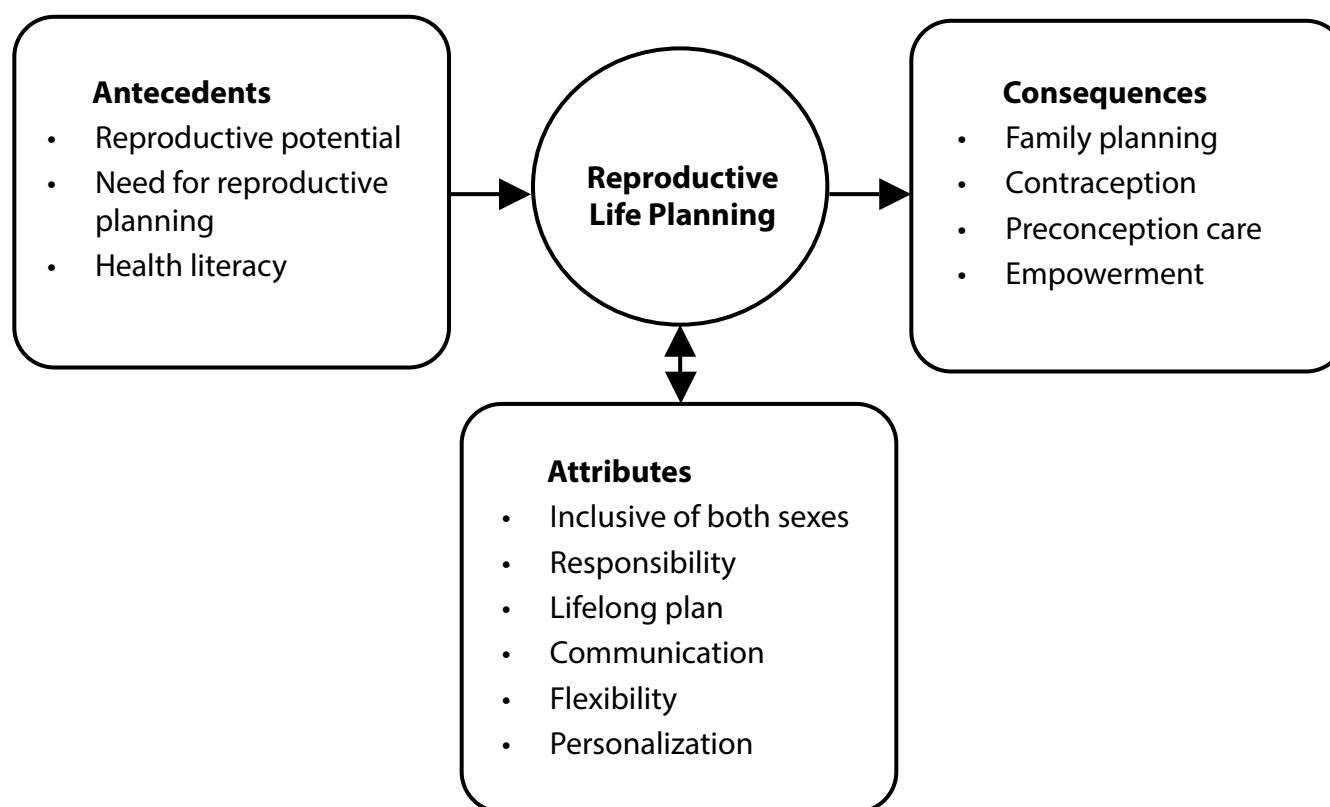


Figure 1. Theoretical framework of Reproductive Life Planning (Liu 2015). (Figure used with permission of Fuqin Liu)

According to the answer to the question ‘do you plan to have any (more) children at any time in the future’, there are several possible consequences after a RLP. In any case, the RLP has the aim to contribute to family planning and can lead to empowerment and a sense of control of the future for both men and women. If the couple does not plan a pregnancy in the near future, effective contraceptive methods should be proposed; if the couple wants to have children in the next year, the RLP is a precursor for preconception care.

Why is a RLP needed?

The focus of the CDC to recommend the RLP was to prevent for unintended pregnancies (half of all pregnancies were unintended in the US in those years). Unintended pregnancies are related to elective abortions, late entry into prenatal care, low birth weight, child abuse and child neglect and behavioral problems in the later life of the child. Furthermore, they are associated with lower socio – economic status in the mother (Moos 2003).

Some characteristics have been identified for women at risk for contraceptive failures: no future plans, no support for avoiding unintended pregnancies, previous unintended conceptions, short-term sexual relationships, previous unsuccessful behavior modifications and ambivalence feelings regarding a pregnancy (Oakley 1994).

Unintended pregnancies are still highest in women with low income and low education (Finer & Zolna 2016). Although a decrease was found in the incidence of unintended pregnancies between 2008 and 2011 in the United States (from 51 to 45%), Bommaraju et al. found no effect from RLP counseling in the use of effective contraception use among disadvantaged social groups (Bommaraju et al. 2015). Hultstrand et al. (2020) on the other hand, found positive experiences with pregnancy planning in a study in South – Africa and improved quality of contraceptive counseling (Niemeyer Hultstrand et al. 2020). In Sweden, knowledge about preconception care increased in women after a RLP – consult (Stern et al. 2013).

Moos (2003) suggests to invite women to talk about the amount of children they would like to have, as this is a nonthreatening manner to assess whether contraceptive counseling is necessary. Questions that can be asked in such an encounter can be:

- How many children would you like to have?
- How long would you like to wait until you become pregnant (again)?
- What will you do to delay your pregnancy until then?
- How can I help to achieve your plan?

Because these questions are neutral, barriers to talk about reproductive plans are minimal. These questions may encourage women and couples to take thoughtful decisions about future

conception. Depending on the answer of the woman/ couple, the information provided can be tailored. For example, if the couple plans a pregnancy in the near future, folic acid supplementation can be recommended and the health care provider can address other important factors for preconceptional health promotion. If the woman/couple indicates they do not want a pregnancy in the near future, risks for unplanned pregnancy can be explored and handled together with the couple.

The latter two questions (what will you do to delay your pregnancy and how can I help) are of major importance in order to help women with strategies to avoid unplanned pregnancies. For example, taking an oral contraceptive pill may seem easy, but perfect adherence to any therapy seems an unrealistic expectation. Women who chose for oral contraceptives, have to be able to purchase them, to take them correctly (in a correct order and with the correct interval) and to have a back-up plan when intake was not correct (Moos 2003). As such, when discussing the ideal contraception with a couple, strategies to maximize adherence should be taken into account and discussion of emergency contraception should be part of routine contraceptive counseling. To plan for a pregnancy may appear easy for a lot of couples, for others it may be a very complex thing to do. If you have the ability to plan, it means you have access to certain resources, knowledge, power over important decisions and a certain control over the future. As such, the RLP has been criticized not to take social determinants in account that may complicate making a plan. Another point of critique is that the RLP may rather discourage women who have ambivalent feelings towards a pregnancy, than to empower them (Delbaere & Stern 2020). Nonetheless, a number of good experiences with the reproductive life plan have been reported.

Experiences with the Reproductive Life Plan

The CDC sees regular health care visits of women at reproductive age as opportunities to deliver preconception care and all providers who routinely see women for health – related examinations as important to provide preconception health. For example also pediatricians, as they are visited regularly by women with young children (Johnson et al. 2006). This is particularly of importance for couples in a low-income situation and minority groups (Dunlop et al. 2010). Furthermore, preconception care should be delivered tailored and across the lifespan of women, instead of be limited to only one visit. Some preventive recommendations may be important at a certain life stage of women, others not. Risk screening may be different for a woman of 35 who wants a first child than for a woman of 25 who already has a child (Johnson et al. 2006). Women with chronic diseases can use more in-depth interventions than other women.

One of the first studies on the implementation of an RLP – like intervention was the study of Moos (Moos et al. 1996). In a prospective study, the effect of preconception health promotion on intendedness of pregnancy was assessed in a family planning clinic. Women who received the intervention during a regular visit reported more likely an intended pregnancy than women who did not receive the intervention.

In a cohort of 144 low-income, minority people, Dunlop et al. (2010) found that 81% of included women and 42% of included men (70% of men who wanted a child in the future) found discussing reproductive plans with a healthcare provider important. Nevertheless, more than 45% of people who did not want a child in the next year were at risk for an unintended pregnancy. Both adverse pregnancy outcomes and unintended pregnancy are more common in women who are poor are belong to a minority group.

According to the Institute of Medicine (1985), support for women who plan a pregnancy, entering pregnancy in good health and women who are informed about reproductive and general health are best protections available against adverse pregnancy outcomes.

Although the RLP has a broad scope in the protection of reproductive health, the focus of the CDC was to prevent unplanned pregnancies (at that time, 50% of pregnancies in the US were unintended). In Sweden, there are good outcomes for sexual and reproductive health. But even in such conditions, the introduction of an RLP may be relevant. Stern and colleagues (2013, 2015) introduced the RLP in contraceptive counselling in order to increase knowledge on reproduction and on aspects of preconception care (Stern et al. 2013, 2015). This was considered necessary because the use of condoms was declining and there was an increase of sexually transmitted infections in Sweden, the abortion rate was the highest in the Nordic countries (particularly in women aged 20–29) and also in Sweden couples tended to delay parenthood with resulting increase of the need for assisted reproduction. In addition, women were not sufficiently aware of recommended lifestyle changes to favor pregnancy outcome (e.g. folic acid intake). Stern and colleagues performed a randomized controlled trial at a Student Health Centre and compared 88 female students who received standard care with 89 students who received an RLP – intervention. The intervention lasted approximately 10 minutes and consisted of a semi-structured discussion to encourage reflection on the RLP of the student (Figure 2) and provision of tailored information based on the earlier mentioned reproductive intentions (Table 1).

The latter group first filled in a baseline questionnaire to assess knowledge about reproduction and preconception health issues and were interviewed two months after the intervention

according to a structured questionnaire, comparable with the one the women filled out earlier. In order to measure the effect of the baseline questionnaire, Stern included a third group of students (n = 85) who only filled in a baseline questionnaire but did not receive an intervention. According to this study, a 10 minutes intervention increased knowledge on reproduction in general and knowledge of folic acid intake. Women from the intervention group indicated to plan their last child earlier in life. Moreover, the women who received the intervention appreciated it and found that the RLP should be routinely implemented in the contraception consultation (Stern et al. 2013). Also in previous studies, women mentioned that questions, even personal ones, during a consultation may help to start a dialogue on their situation and helps to clarify it (Wendt et al. 2007). In 2019, Skogsdal et al. performed a similar study in 1946 Swedish-speaking women aged 20–40 years and found comparable results. Knowledge about fertility and awareness of preconception health increased in an intervention group, compared with a group that received no RLP (Skogsdal et al. 2019).

Have you thought about your Reproductive life plan?

Do you plan to have (more) children in your life?

If no: How do you plan to prevent becoming pregnant (again)?

If yes: How many (more) children do you wish to have?

When would you like to become pregnant (again)?

If within 0-6 months: How do you prepare for pregnancy?

If later: How do you plan to preserve your fertility?

How do you plan to prevent becoming pregnant (again) until then?

If maybe or don't know: What are your thoughts on having children?

From your point of view, what speaks in favour of or against having children?

How do you plan to prevent becoming pregnant (again) until you have decided?

What can I do to help you achieve your goals?

Figure 2. RLP-based interview guide used by the midwives during the RLP-intervention (Stern 2013). (Figure used with permission of Jenny Stern)

Table 1. Information for the intervention group, verbally provided by the midwives and given by means of a brochure (Stern 2013). (Table used with permission of Jenny Stern)

Topic	Information given	Assessed by knowledge question no.
Reproduction in general	At the age of 35 years there is a marked decline in women's ability to become pregnant and the risk for pregnancy complications increases.	5
	Since an ovum lives approximately 1 day and sperms up to 5 days, unprotected intercourse during 5 days in the menstrual cycle can lead to pregnancy.	3
	If the woman is younger than 25 years of age, the chance of becoming pregnant at the time of ovulation is approximately 30–35%.	4
	Factors that can impair female fertility are for example: 1. Old age 2. Sexually transmitted infections (STI) 3. Diseases (other than STI) 4. Hereditary factors 5. Stress 6. Unhealthy lifestyle	1
When wishing to become pregnant, one should...	Start taking folic acid daily, at least one month before conception <i>... to decrease the risk of foetal neural tube defects*</i>	2
	Avoid alcohol <i>...as alcohol consumption during early pregnancy can affect the development of the foetus and cause both earlier birth and lower birth weight*</i>	2
	Avoid tobacco – to smoke or to use snuff yourself, as well as passive smoking <i>...as tobacco consumption can decrease the possibility of becoming pregnant and increase the risk of miscarriage*</i>	2
	Avoid potentially toxic/harmful substances or exposures <i>...as some medications, chemicals and other substances can decrease the possibility of becoming pregnant and increase the risk of foetal malformations*</i>	2
	Avoid both under- and overweight <i>...as both can decrease the possibility of becoming pregnant and overweight can increase the risk for complications during pregnancy such as preeclampsia*</i>	2
Problems with reproduction	One out of four women who undergo assisted reproduction (for example IVF-treatment) will give birth.	6

*=Information in italic was additional material stated in the brochure but only provided by the midwife during the counselling if appropriate.

Stern recommends to include the RLP in contraceptive counselling and to approach women/couples in a tailored manner, to work non-normative and show appropriate respect for the patients autonomy. If there is not enough time to discuss the RLP with the patients, written information can be provided (Stern 2015).

In Denmark, a particular kind of fertility counselling has been established in 2011: the Fertility Assessment and Counselling (FAC) clinic. This free – of – charge counselling is an answer to the strong demand of a large number of women and men who want to learn more about their fertility status and pro-fertility behaviour (Hvidman et al. 2015). The target population are people with no known reproductive problems. They can book a 30-minute appointment with a fertility expert for an assessment of fertility and individual guidance. Women are offered a review of potential risk factors for female subfertility. For this review, four different colors are provided, all indicating a certain risk factor (green, yellow / orange, red). The review is based on 14 parameters (i.e. age, ovarian reserve and cycle length, gynecological history and general health, genetic disposition, lifestyle factors, ...). As a result of this counselling, 35% of women and 19% of men who attended the consultation indicated to advance their decision to become pregnant, more than 60% of clients had increased their knowledge about the impact of age and other risks factors on (female) fecundity.

In 2015, Stern and colleagues examined the experience midwives had with the adoption of RLP in contraceptive counselling (Sweden). The majority of midwives who were aware of RLP and could use it in practice, had a positive experience using it. They considered the RLP – guide (Figure 4) as a useful instrument to support their discussion, although it was seldom used literally. Some midwives asked the question ‘do you want children in

your life?', others wove the RLP – message in their discussion (Stern 2015). Although midwives were initially concerned about implementing the RLP into their consultation, but after some experience with it, midwives did not face great difficulties and appreciated the different angle the implementation of the RLP gave to the consultation. Considering time efficiency, some midwives had a hard time to fit in the RLP in a consultation if also antenatal care or cervical cancer screening had to be provided; others found the RLP less time consuming than expected. Moreover, most women receiving the RLP reacted positive and appreciated the questions. Some midwives considered adolescents as an excellent target group for RLP, others found it rather unsuitable to address the RLP in this group (Stern 2015).

In the United States, it was examined to what extent an RLP may increase reproductive knowledge and the understanding of risks of pregnancy associated with diabetes, hypertension and obesity in women with chronic diseases (Mittal et al. 2014). The implementation of this brief preconception and contraception counseling tool in primary care, increased the knowledge about reproduction and women were more keen to look for support and information to make reproductive health choices, particularly women with lowest knowledge before and women without children.

Table 2. Guide to assist midwives during RLP counselling (Stern 2015). (Table used with permission of Jenny Stern)

Do you want children in your life?	
<p><i>These questions should be regarded as a starting point for discussion. The goal is both to encourage the patient to reflect over reproductive goals and strategies and to mediate knowledge about fertility. Be sensitive to each individual regarding which questions and topics may be appropriate. The reproductive life plan may change over the years, just as life itself does.</i></p>	
<p>Don't know</p> <p>What are your thoughts about children?</p> <p>What would you do if you became pregnant unintentionally?</p> <p>How do you plan to prevent becoming pregnant until you are sure? Which contraception method suits you?</p> <p>Optimise your chances of becoming pregnant in the future by</p> <ol style="list-style-type: none"> 7. Protecting yourself from sexually transmitted infections 8. Trying to maintain a normal BMI 9. Not waiting too long 	<p>Yes, sometimes in the future, but not now</p> <p>How many children would you like?</p> <p>When would you like to have your first child?</p> <p>When would you like to have your last child?</p> <p>Which contraception method suits you?</p> <p>What other parts of life affect your reproductive life plan?</p> <p>Optimise your chances of becoming pregnant in the future by</p> <ol style="list-style-type: none"> 1. Protecting yourself from sexually transmitted infections 2. Trying to maintain a normal BMI 3. Not waiting too long <p>Remember this when it is time: Start taking folic acid supplement 1 month before</p> <p>Improve your lifestyle before trying to become pregnant.</p>
<p style="text-align: center;">No</p> <p>Which contraception method suits you?</p> <p>How can you protect yourself from sexually transmitted infections?</p> <p>Take care of yourself. Your reproductive and sexual health is important for your own wellbeing, even if you do not want children.</p>	<p style="text-align: center;">Yes, I want to become pregnant within a year</p> <p>How many children would you like?</p> <p>When would you like to have your last child?</p> <ol style="list-style-type: none"> 1. Try to maintain a normal BMI 2. Take supplement of folic acid every day, at least 1 month before trying to become pregnant 3. Avoid alcohol and tobacco, both cigarettes or exposure 4. Avoid potentially toxic/harmful substances or exposure 5. Get to know your menstrual cycle and the fertile window <p>Contact health care for consultation, if you have tried to become pregnant for one year without succeeding.</p>

Conclusion

The Reproductive Life Plan was introduced in the United States to improve reproductive outcomes. It is suggested that primary health care workers ask the question ‘do you have plans to have children in the future’ at regular health care encounters with people of reproductive age. The RLP is appreciated by patients and health care providers using it, it may increase knowledge about reproductive health in young people and prevent for unplanned pregnancies.

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Psychological aspects of infertility and the role of counselling and psychotherapy

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Abstract

Couples with fertility problems deal with numerous challenging emotions which can lead to anxiety, depression, or distress. They may develop behavioural problems, issues in their personal relations with their partner, friends and family as well as trouble in decision making and problem-solving skills. Some studies suggest that the psychological distress of couples coping with infertility can lead to treatment termination and can diminish the probability of a positive treatment outcome (pregnancy). Hence, it is worth considering including psychological counselling/ psychotherapeutic treatment of these couples while they cope with such stressful life events. One of the most scientifically proven approaches for individuals coping with infertility is cognitive behavioural therapy. In the third wave of cognitive behavioural therapy, mindfulness has been shown to be effective in the treatment of couples with fertility problems.

Keywords: couples, fertility problems, counselling, cognitive-behavioural therapy, mindfulness

Povzetek

Pari s težavami s plodnostjo se srečujejo s številnimi izzivnimi čustvi, ki lahko vodijo v tesnobo, depresijo ali stisko. Prav tako lahko razvijejo vedenjske težave, na primer v partnerskih odnosih, s prijatelji in družino ter težave pri sprejemanju odločitev in veščinah reševanja problemov. Nekatere raziskave kažejo, da lahko ravno psihološka stiska parov, ki se spopadajo z neplodnostjo, privede do prekinitve zdravljenja in zmanjša verjetnost pozitivnega izida zdravljenja (nosečnosti). To kaže, da bi bilo vredno razmisliti o vključitvi psihološke / psihoterapevtske pomoči pri zdravljenju teh parov, medtem ko se spopadajo s tako stresnimi življenjskimi dogodki. Eden najbolj znanstveno dokazanih pristopov je kognitivno vedenjska terapija. V tretjem valu kognitivno-vedenjske terapije uporaba čuječnosti je dala dobre učinke.

Ključne besede: pari, težave s plodnostjo, svetovanje, kognitivno-vedenjska terapija, čuječnost

There is no doubt that it can be extremely stressful for couples to cope with infertility and to go through the various stages of infertility treatments. The experience of infertility, which some even define as a developmental crisis, can be accompanied by physical, economic, and social stress that affects all aspects of an individual's life (Cousineau & Domar 2007).

Psychological aspects of dealing with fertility problems

In addition to dealing with different bodily challenges, couples with fertility problems also deal with numerous challenging emotions such as guilt, sadness, worry, helplessness, grief etc., which in the case of high intensity and duration can develop into psychological symptoms of anxiety, depression, or distress (e.g. Stanton & Dunkel-Schetter 1991; Hasanpoor-Azghdy, Simbar & Vedadhir 2014). The majority of couples are able to adjust and cope with infertility, but some respond with emotional problems, depression and anxiety (Stanton & Dunkel-Schetter 1991). To better understand the occurrence of these challenging emotions

or psychological symptoms it is crucial to assess what couples experience during treatment.

Stressful procedures

For example, going through the cycles of emotional ups and downs from month to month while dealing with failure, disappointment, loss, and grief and then again hope and desire can explain why it can be very stressful. Women take enormous physical risks during some procedures; couples experience a lack of spontaneity in their sexual lives, which is subordinated to sexual activity aimed at becoming pregnant, some couples will experience financial pressure caused by the limited trials covered by health insurance. These are only a few of the factors that can contribute to the emotional stress of infertility treatment.

Lack of support

Unpleasant challenging emotions can also diminish self-esteem and deteriorate the relationship. The hardest part for many couples is finding the right way to build support for each other (Lasker & Borg 1994). Family and friends often don't know how to be supportive or can't understand couples facing infertility (Hasanpoor-Azghdy, Simbar & Vedadhir 2014). Infertile couples often feel socially isolated from the fertile world, partly because of perceived or actual social acceptance and a lack of empathy from family and friends regarding their pain. Moreover, in some societies having children ensures the parent's economic survival as they will be expected to care for the elderly members of their families. Fertility and parenthood as important life values, are inherent the world over and infertile people can feel completely alone in their experiences (Cousineau & Domar 2007). Hence, partners are forced even more to turn to each other to seek support, which at times may be the only support they receive. If

there are communication problems in their relationship it can be a heavy burden for each partner as they face their vulnerabilities.

Gender differences in coping with crises

Problems in communication between partners can also arise due to pronounced differences between the way men and women react to the crisis which may be brought on by infertility. Research has generally shown that women are slightly more anxious and preoccupied with infertility than men (e.g. Hsu & Kuo 2002; Peterson et.al. 2006). Moreover, the manner in which men and women cope with those feelings differs substantially. For example, men are likely to cope by distancing themselves from the infertility, keeping their feelings to themselves through self-controlling strategies and emphasising plans to solve the problem of infertility (Peterson et al. 2006), while women prefer to talk about it and seek social support (Hsu & Kuo 2002; Peterson et al. 2006). Accordingly, in situation of extreme stress when facing anxiety, loss or failure, the woman may feel unsupported as her partner is providing instrumental but not emotional support via the use of problem solving techniques, which may cause resentment and blame. On the other hand, the male partner can feel hopeless in his effort to resolve her emotional upset and blame her for being demanding and too stressed. This can create a vicious cycle of negative communication resulting in interpersonal distance rather than emotional connection and support. The differences can also be found in the desire to keep their infertility problems a secret (Larkin & Borg 1994). Couples may hesitate to express their feelings, thoughts and needs to those closest to them, such as friends and family and sometimes avoid talking about it even with each other, which can result in increasing mental tension. In contrast, infertility patients may project their discontent and dissatisfaction with the level of health-care they are receiving and repeatedly contact their health

professionals to voice their discontent, resulting in significant stress for health-care providers (An et al. 2009).

In previous research, the prevalence of psychiatric problems among infertile couples was estimated to be 25–60% (De Berardis et al. 2014), across different countries all over the world. The prevalence of depression and anxiety in infertile couples were significantly higher than in fertile couples and in the general population, respectively. Researchers are investigating how infertility and psychological difficulties may be associated. Some aim to prove the effect of psychological state on neuroendocrine activity and pregnancy rate (e.g. Csemizcky et al. 2000; Cwikel, Gidron & Sheiner 2004), while others see psychological stress as undoubtedly implicated in fertility problems, but not directly effecting reproductive physiology or hormones but instead operating through patient behaviour (e.g. Boivin, Griffiths & Venetis 2011). The question of whether stress and anxiety levels affect the outcome of IVF and similar treatments is still controversial. Nevertheless, there is strong evidence to indicate that there is a significant association between patient distress and treatment discontinuation. For example, in Domar's study (2004), patient distress was the most commonly reported cause for treatment termination.

Psychological counselling and psychotherapy

Based on previous studies and the above summarised findings, it is clear that the psychological aspect of infertility plays an important role in the care of the infertile couple and mental health counselling or psychotherapy should be an integral part of their treatment. The first important step is to assess the psychological status of infertility patients correctly and sensitively, through structured interviews held by a mental health professional and the use of valid questionnaires. Those individuals found to be

most at risk of developing serious psychological symptoms should be provided with some form of psychological help, for example through group support meetings or individual or partner counselling led by a psychologist or psychotherapist. Most effects can be achieved through interventions focused on stress management, relaxation techniques, communication skills, and the expression of feelings and needs (Peterson et al. 2012) although interventions that emphasise education and skills training are more effective than those addressing emotional expression and support (Boivin 2003). All the above-mentioned interventions can mediate distress and facilitate a higher level of compliance with treatment protocols. Some research indicates that women may benefit more from psychological intervention in comparison to their male partners (Hammerli, Znoj & Barth 2009).

Some important interventions can also be done on the level of healthcare workers, not just mental health experts. For example, many women find difficulty coping with feelings during treatment, especially some specific feelings like jealousy and envy when learning of other women's pregnancies or when in the presence of other adults who have infants. Many hide their distress from health care providers because they are afraid of being criticised, judged or fear being evaluated as crazy. It is vital that all health care workers understand those are normal emotions and try to normalise those feeling to their fertility patients by showing understanding, without blame or judgement. In order to reduce the patient's stress level, it is also very important that healthcare professionals provide patients with clear, comprehensive information, particularly during essential treatment phases.

For those who show a higher amount of difficult emotions, those meeting the criteria for mental health disorders diagnosis or those who have already been diagnosed with a mental health disorder

before treatment, such as diagnoses of anxiety or depressive disorders, more profound help in the form of psychotherapy should be provided.

Furthermore, mental health professionals who provide help to the couples undergoing fertility treatment can offer psychological help in particular during crucial intervals such as: immediately after diagnosis, during the most sensitive part of the treatment (e.g. 14 days of waiting to know the outcome), and each time couples face treatment failure and /or the desire to interrupt reproductive services. All of these phases provide different opportunities for the expert to help couples cope with their infertility and the demanding emotions that can occur in each of these phases (Peterson et al. 2012).

Cognitive-behavioural therapy for couples with fertility problems

Cognitive-behavioural therapy (CBT) is a form of psychotherapy which focuses on modifying dysfunctional emotions, behaviours, and thoughts. It is very well structured and focused on the present and solutions, the aim of which is to encourage patients to challenge distorted cognitions and change destructive patterns of behaviour by using a variety of behavioural and cognitive techniques. The effectiveness of CBT is very well documented in various evidence-based research (e.g. Hoffmann et al. 2012). CBT has been used successfully to resolve or reduce depression and anxiety in infertile women. For example, Faramarzi et al. (2013) found a significant reduction in all dimensions of infertility-related stress (social, sexual, marital concerns, rejection of a childless lifestyle, and parental needs) in the group that underwent group CBT treatment, whereas the group that received no CBT, but did receive the antidepressant fluoxetine showed a significant reduction in sexual stress only. Therefore, CBT is not merely a reliable alternative to pharmacotherapy, but also

superior to fluoxetine in the resolving or reducing of depression and anxiety in infertile women. It is also found to be effective in the reduction of depression and anxiety in patients with or without in vitro fertilisation/intracytoplasmic sperm injection treatment (Abdollahi et al. 2019).

CBT goals for couples dealing with infertility are (Myers & Wark 1996):

1. changing unhelpful attribution and belief systems regarding infertility and marriage,
2. redirecting a couple's focus not just on having a child, but to other sources of satisfaction,
3. increasing expression of emotions, thoughts and needs through communication and problem-solving techniques,
4. improving a couple's sexual relationship.

Changing unhelpful attribution and belief systems regarding infertility and marriage

Identifying and evaluating thoughts and attributions related to infertility and marriage is a usual part of cognitive therapy and can be achieved by using Beck's traditional cognitive techniques of cognitive restructuring (Beck 1995). According to the tenets of cognitive therapy, it is vital for the therapist to explore what infertility means for a couple in terms of their value, sexuality, and integrity as human beings. For example, a woman may consider her infertility to be an indication that she is an inadequate wife. The therapist will work with her on her attribution by asking her to consider any evidence relating to her ability to be a wife (not just evidence arising from her infertility). Then they explore in general how well she is fulfilling her marital functions and what are the advantages and disadvantages of holding each of these two attitudes: that she is an inadequate

wife and that she generally fulfils her marital role appropriately. As a part of cognitive therapy, the therapist will educate the client about Beck's (1995) concept of cognitive distortions (e.g., catastrophising, mental filtering, mind reading, generalisation) which can also be very helpful for an infertile client. The client is asked to become aware of and recognise such erroneous thinking as it occurs. For example, she can be aware of the cognitive distortion of mind reading when thinking all her friends will pity her and her husband for not having children and consider them less valuable as human beings; or she can overgeneralise when thinking a new procedure will be as unsuccessful or painful as previous treatments. The therapist can teach the client to validate those cognitive distortions and exchange them for more rational ones and similarly investigate a male partner's beliefs and attributions, such as the belief that infertility makes a man less masculine. The therapist should generally investigate and recognise any negative automatic thoughts that occur as a couple's reaction to infertility, but especially those that involve guilt (Myers & Wark 1996).

Finding alternative ways of finding pleasure

To better understand why depression occurs in couples undergoing infertility treatment, we will consider two theories of depression. According to Lewinsohn's theory (1974, as cited in Myers & Wark 1996), people become depressed when they fail to generate positive events and prevent negative events through their behaviour and efforts. Accordingly, it is clear why couples can develop depressive symptoms, especially after repeatedly experiencing failure to achieve the joyous event of pregnancy. Seligman (1975, as cited in Myers & Wark 1996) proposes a similar theory in explaining depression, the theory of learned helplessness. According to this theory, people become depressed

when they repeatedly fail to control important outcomes in their lives and therefore believe and expect that they will not be able to control situations in the future. The theory of learned helplessness may also explain why depression poses a risk to infertile couples because they undoubtedly lack control over the important outcome of having a child. In the treatment of a depressive disorder, a CBT therapist usually encourages the client to plan daily activities to divert their attention from depressive thoughts and events to other pleasurable or neutral content. A therapist who helps an infertile couple should, in the same way as with a depressed client, encourage them to seek out activities that are rewarding but which do not revolve around children or child-rearing. Sources of enjoyment and fulfilment not related to raising children provides an opportunity for an infertile couple to learn that they can influence the generation of favourable events, for example, by growing their social support network. Consequently, such sources of pleasure can protect the infertile couple from depression and stress.

Communication and problem-solving techniques

Coping with infertility involves managing difficult emotions and making hard decisions, therefore beneficial for couples to learn constructive communication and problem-solving skills to better manoeuvre through the process. Some techniques to encourage good communication include: (a) using "I messages", that is, starting sentences with "I need," "I want," and "I think," instead of using "you messages," to avoid sounding as though they are blaming or attacking their partner and to avoid the subsequent withdrawal of their partner (b) paraphrasing the sentences of the partner in order to encourage the use of active listening and to avoid withdrawal and / or misunderstanding; (c) strengthening the attitude of experiencing infertility as "that something" that they fight together instead of directing their

negative emotions at one another; d) effective use of all stages of problem-solving skills in dealing with infertility: defining goals, generating possible solutions, evaluating each solution, making a decision with regards to potential solutions, planning steps and evaluation of each step and final outcome (Myers & Wark 1996). These techniques can increase awareness and facilitate a couple's expression of their own feelings and needs and those of their partner. In addition, these techniques can help in constructive communication and problem solving in a situation where a couple is faced with difficult decisions related to infertility. Constructive communication can also be applied to other family members to express hurt or other feelings, for example if parents or friends have distanced themselves and / or intruding with unwanted opinions or advice.

Improving the couple's sexual relationship

One of the therapeutic goals aims to redefine masculinity and femininity to affirm sexuality and sexual relations as valuable unto themselves, and not just as a means of conceiving children. Some of the techniques that can help are planning sexual intercourse at times other than those ideal for conception, and communication and engagement in foreplay even when they have sexual intercourse for the purpose of conception to maintain the connection between the relationship and intimacy (Myers & Wark 1996). Additionally, some other interventions used in the treatment of sexual dysfunction may be useful. Hawton (1989) recommended that a partner who rejects another partner's proposal for sexual activity should verbally express their reluctance and explain why they are uninterested. This helps to encourage two-way communication between partners and allows partners to freely express their needs and desires, without creating pressure. Hawton also advises that both spouses take responsibility and take the initiative to issue an invitation to have

sex. Overall, it is very important to normalise the occurrence of sexual dysfunction in couples dealing with infertility as something understandable in the midst of facing the considerable changes in life habits during infertility treatment.

Mindfulness for couples dealing with fertility problems

Mindfulness is often used in the latest, third wave of CBT. Although it is rooted in eastern spiritual practices, in recent decades it has increasingly been discussed, practiced and researched in western culture. In many ways mindfulness has opened a door to eastern meditation practices for the western scientific community. Mindfulness is awareness that arises through purposefully, non-judgementally paying attention to the present moment (Kabat-Zinn 2013). It has been found that practicing mindfulness is beneficial in decreasing stress and helps with numerous other emotional and health-related conditions. A number of mindfulness-based programs have been developed and implemented with the aim of reducing symptoms of stress, burnout, anxiety and depression. The most familiar is the Mindfulness Based Stress Reduction program (Kabat-Zinn 2013) which focuses on reducing stress and Mindfulness Based Cognitive Therapy (Williams & Penmann 2011) which was developed to help patients with depression and anxiety disorders. The Mindfulness-Based Program for Infertility (MBPI) was the first mindfulness program developed specifically to target women facing infertility (Galhardo Cunha & Pinto-Gouveia 2013). Through the program, individuals develop the skill of acceptance. They do this by training their attention to be in the present moment and in touch with the experience here and now, with an attitude of openness and non-judgment. Another important skill that individuals learn during MBPI is cognitive defusion or cognitive decentering. This is based on recognising

that our minds tend to create stories about our lives and that it is important for people to become aware of their story only as a story instead of as a set of “truths”. In other words, it involves distancing oneself from the mind and its stories, instead of being absorbed into them. Another important skill is cultivating attitudes of kindness, curiosity, and the will for a person to be present with the ongoing experience, as well as the ability to recognise one’s own experiences as something normal, without judgment, as part of the wider human experience. The goal is to foster the ability to approach difficulties and explore them with openness and curiosity, rather than avoiding problems. Avoidance is an ineffective strategy that increases stress and suffering. Thus, painful thoughts and feelings related to the past (e.g., a previous miscarriage or previous painful treatment experience) or to the future (e.g., “I will never be a mother,” “My life will be meaningless without a child”) are recognised without attempts to suppress or modify them. Galhardo, Cunha & Pinto-Gouveia (2013) found a positive effect of such a program on reducing depressive symptoms, internal and external shame, internal and external entrapment, and defeat.

In conclusion

Couples facing the problem of infertility undoubtedly experience several stressors and demanding emotions, but rarely talk about them. That is why it is important for a healthcare professional or mental health professional to create an environment of trust, understanding and non-judgment, in which couples will be able to express their worries, fears and doubts. Consequently, this can help identifying those who need further psychological help in a form of counselling or psychotherapy.

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Recommendations for designing effective e-content for teaching and guidance in preconception health

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Abstract

Proper use of information and communication technology is vital for the dissemination of preconception health topics to younger adults and adolescents, as many are digital natives. One possible solution is to develop relevant and attractive scenario-based e-content that helps the aforementioned population to acquire and retain crucial knowledge in the field of preconception. In this chapter, five important principles for the development of e-content are presented: guided activity principle, feedback, reflection, pacing, and the pre-training principle. For each principle a practical example of its implementation is presented. These principles are not definitive but still represent a valid reference that can facilitate the effective development of e-content to midwives, health promotion teachers, nurses, etc. Further studies should be performed to define a comprehensive list of recommendations, especially those related to different subgroups of users, in this case adolescents and younger adults for whom preconception health should be a major concern.

Key words: information and communication technology, education, e-learning, preconception health

Povzetek

Primerna uporaba informacijsko komunikacijske tehnologije je ključnega pomena za širjenje vsebin in informacij o reproduktivnem zdravju med mlajšimi odraslimi in mladostniki, saj med njimi je mnogo digitalnih domorodcev. Ena od možnih rešitev je razvoj ustreznih in vsečnih e-vsebin, ki temeljijo na scenarijih. Omenjene e-vsebine omogočajo mlajšim odraslim in mladostnikom pridobiti in ohraniti ključna znanja na področju reproduktivnega zdravja. V tem poglavju je predstavljenih pet principov, ki jih je smiselno upoštevati v fazi razvoja e-vsebin: princip vodene aktivnosti, princip povratne informacije, princip refleksije, princip določanja lastnega ritma spremljanja vsebine in princip predpriprave. Za vsak omenjeni princip je predstavljen praktični primer izvedbe. Predstavljeni principi še zdaleč ne predstavljajo končnega nabora, vendar predstavljajo veljavno referenco, ki lahko olajša učinkovit razvoj e-vsebin babicam, učiteljem promocije zdravja, medicinskim sestram, ipd. Za opredeliti obsežnejši nabor principov in priporočil, zlasti takih, ki se nanašajo na različne podskupine uporabnikov, v tem primeru mlajši odrasli in mladostniki, pri katerih bi morala biti glavna skrb reproduktivno zdravje, je potrebno izvesti še nadaljnje študije na tem področju.

Ključne besede: informacijsko komunikacijska tehnologija, poučevanje, e-izobraževanje, reproduktivno zdravje

Introduction

The use of information and communication technology (ICT) in healthcare education is on the rise. ICT can be used effectively to deliver customised health education (Haluzá & Jungwirth 2015), thus providing the basis for ICT-supported health education. This can be delivered via properly designed, attractive and effective e-content. However, according to the results of our literature review, there are not many examples of the use of ICT in the field of preconception health education. The few identified references

emphasise an ICT-based preconception care system which uses a virtual patient advocate or conversational agent technology (Gardiner et al. 2013; Jack et al. 2015; Walker et al. 2020).

According to our experiences in the use of ICT in healthcare education, health promotion educators are not adequately trained in the development of e-content. There are many reasons for this: (1) in their formal education they did not acquire the knowledge and skills necessary for the development of this content; (2) ICT tools for developing e-content are continuously evolving; and (3) there is a lack of widely accepted pedagogical recommendations for developing e-content in the field of health promotion and thus, also preconception.

A review of the literature was done in order to identify the recommendations for designing effective e-content for teaching and guidance in preconception health. The recommendations are summarised as key principles that teachers developing e-content should consider. The presented principles can also be applied to other fields of healthcare. The identified principles are relevant elements that foster knowledge retention and are based on the cognitive theory of multimedia learning (Maye, 2009), a theory commonly examined by studies examining e-learning use in healthcare (e.g. De Leeuw et al. 2016; Avari et al. 2018; Cloonan & Fingeret 2020). Furthermore, Moreno, and Mayer (2007) present principles for the design of interactive multimodal learning environments.

The identified principles are presented in the continuation of the chapter along with practical examples of their implementation in the field of preconception health. These principles can be implemented independently or in combination with others.

Guided activity principle

To organise and integrate new information, learners should effectively be directed through the knowledge acquisition process (Moreno & Mayer 2007). This can be achieved through interaction with an actual person (Vlachopoulos & Hatzigianni 2017) who guides the learners through different study materials. However, in the case of e-content, guidance can be implemented in different forms by using plain text, speech, visual / earcon modalities, and in an advanced form of virtual pedagogical agent(s) (VPA) (Plass & Kaplan 2016; Makransky & Lilleholt 2018). VPAs are often represented as avatars, i.e. a graphical representation of a teacher or facilitator incorporated in e-content to offer a visual and listening realm (Ayad 2011). Avatars' goals are to guide users through the e-content, pointing out important pieces of information or other events (e.g. successful accomplishment of tasks, responses to questions, etc.).

Example 1: Implementation of the guided activity principle

This subchapter presents the implementation of this principle in e-content. In the following example the guided activity principle is implemented by using an avatar, i.e. a female nutritionist, who greets the learners and introduces them to the issues of eating habits before planning a pregnancy and the impact of food on increasing the chances of pregnancy (Figure 1).

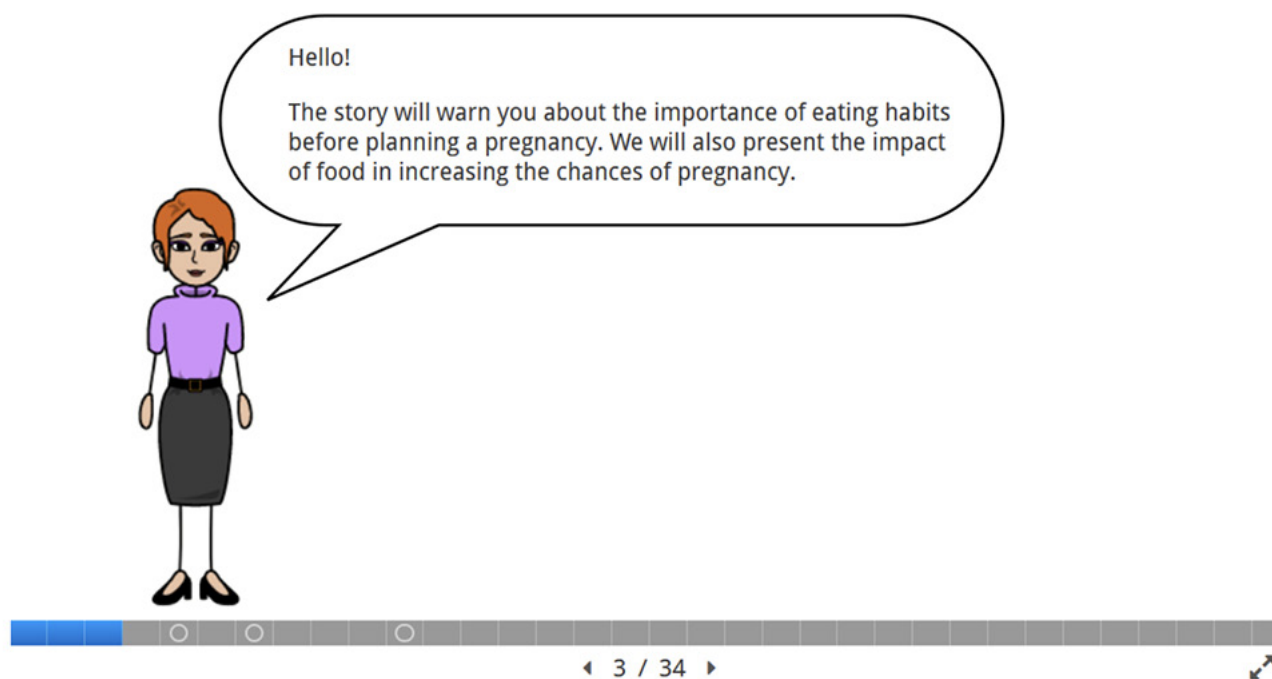


Figure 1: Female – nutritionist - an example of an avatar (Gregorc, Benigar & Žvanut, n. d.)

Feedback principle

Adwan (2016) and Sinclair et al. (2017) emphasise the importance of feedback in e-learning environments. Explanatory feedback, as opposed to corrective, can stimulate neural processes: when positive, it represents a clear indication for learners that learning has indeed taken place; when negative it encourages learners to acquire the missed information and to correct the response (Meylani, Bitter & Legacy 2015). The implementation of this principle is very important in asynchronous e-learning environments: (1) it allows the learners to interact with the e-content; (2) it can be used to direct further knowledge acquisition processes; (3) it can provide valid information about the efficiency of e-content use.

Example 2: Implementation of the feedback principle

In this subchapter a practical implementation of the feedback principle is presented, more precisely the difference between corrective and explanatory feedback. In Figure 2, the response *Physical activity* has adequate explanatory feedback, which helps

the learners to understand the rationale for the correct responses. On the other hand, other responses are accompanied solely by corrective feedback. In this case, a significant opportunity to improve the participants' knowledge has been missed. Furthermore, such responses can confuse learners due to the lack of a provided explanation.

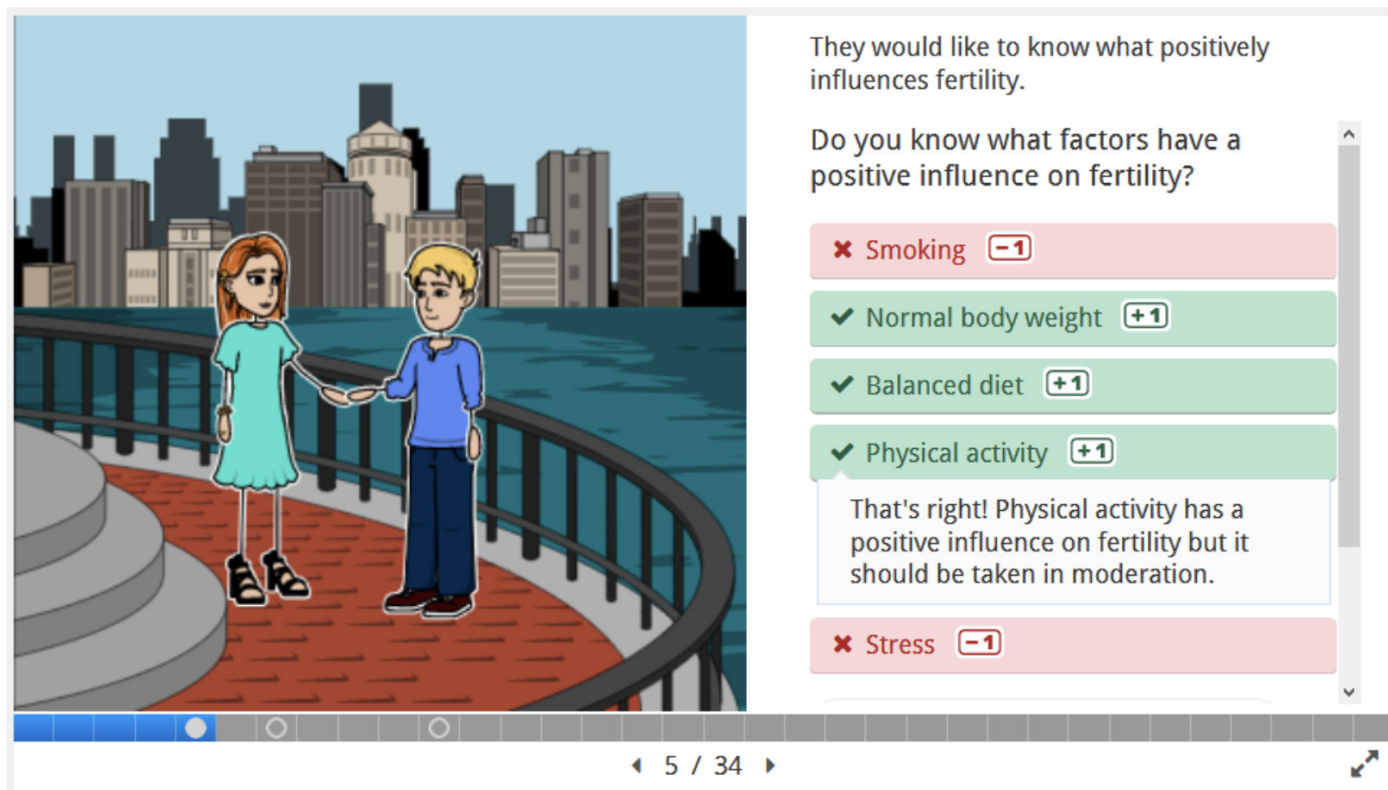


Figure 2: Corrective vs. explanatory feedback (Gregorc, Benigar & Žvanut, n. d.)

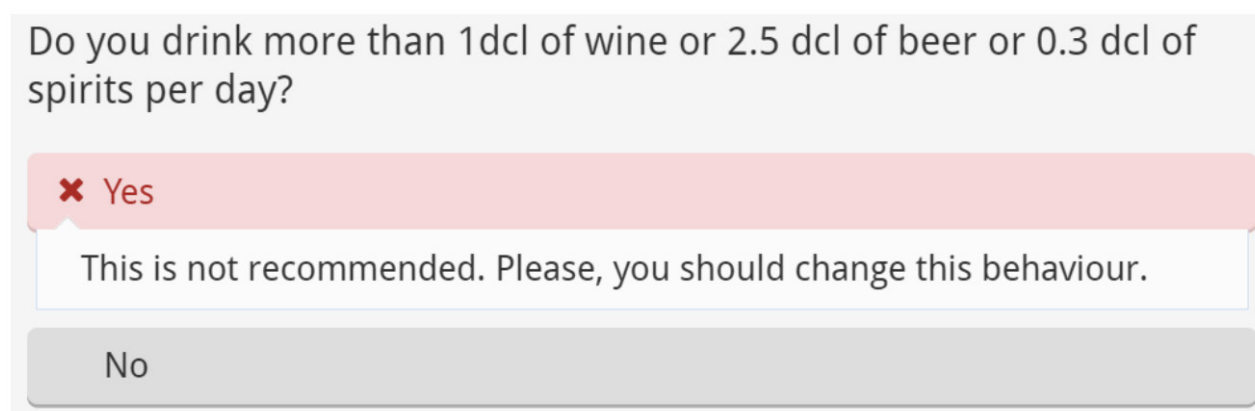
Reflection principle

When encouraged to reflect on the studied material, learners can improve their knowledge acquisition. In-depth reflection encourages more active organisation and the integration of new information (Moreno & Mayer 2007). The reflection principle can be implemented in e-content as simple tasks, where learners can be triggered to reflect on the learned content. However, an assessment of the reflection is not often done or is left to the individual. Another possibility to implement the reflection principle in an asynchronous e-learning environment is by combining it with automated feedback, thus, combining the

reflection and feedback principles (Sinclair et al. 2017). Properly designed explanatory feedback prompts learners to mindfully interact with or reflect upon the learning material (Mettiäinen 2015; Clark & Mayer 2016).

Example 3: Implementation of the reflection principle

The implementation of the reflection principle in combination with the feedback principle is presented in this subchapter. The response provided in Figure 3 is modest. The e-content developer missed a good opportunity to invite the learner to reflect on his/her response.



Do you drink more than 1dcl of wine or 2.5 dcl of beer or 0.3 dcl of spirits per day?

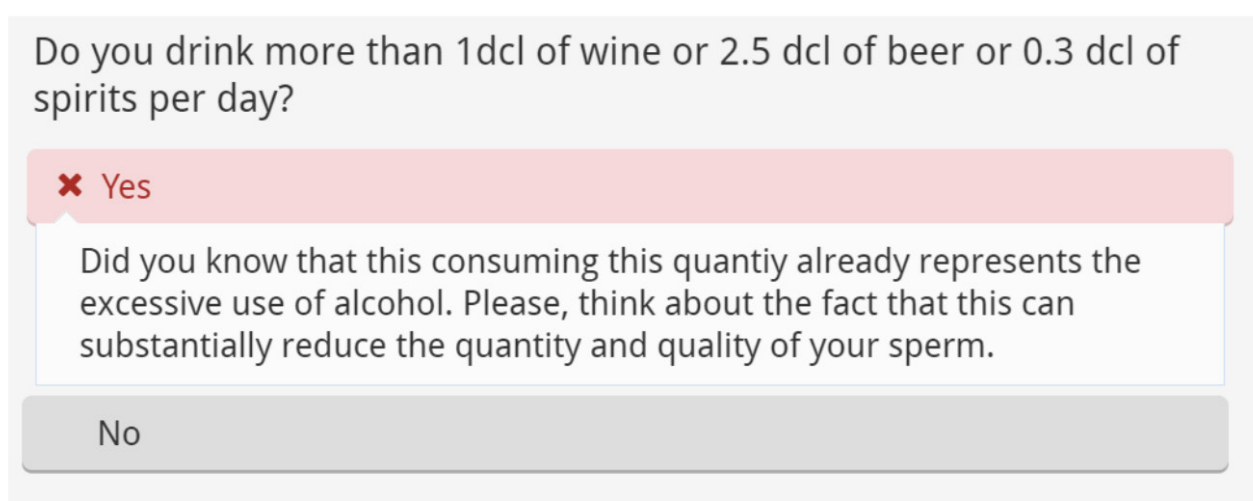
✘ Yes

This is not recommended. Please, you should change this behaviour.

No

Figure 3: A lost opportunity to invite the learner to reflect

In Figure 4, the same example is improved upon by including a sentence which aims to trigger the learner to reflect on excessive alcohol use. In fact, the following example represents a combination of the feedback and reflection principles.



Do you drink more than 1dcl of wine or 2.5 dcl of beer or 0.3 dcl of spirits per day?

✘ Yes

Did you know that this consuming this quantity already represents the excessive use of alcohol. Please, think about the fact that this can substantially reduce the quantity and quality of your sperm.

No

Figure 4: An example of feedback that can trigger the learners' reflection

Pacing principle

The possibility to control the pace of the presented content helps learners to process minor chunks of material and information (Mayer 2009). Whenever possible, e-content should be designed to allow learners to review and study the materials at their own speed and intensity. This facilitates the processing of acquired information from working memory to long-term memory, which is a prerequisite for knowledge retention (Rey & Diehl 2010; Meylani, Bitter & Legacy 2015). In e-content the pacing principle can be implemented in different ways: as navigation buttons (as the example in the next subchapter), buttons to control video playback (play, pause, replay, slow down, speed up), etc.

Example 4: Implementation of the pacing principle

Several tools for the development of e-content allow the inclusion of different navigation elements. In Figure 5, an example of navigation buttons (marked in the red square) allows participants to navigate through the e-content at their own convenience.

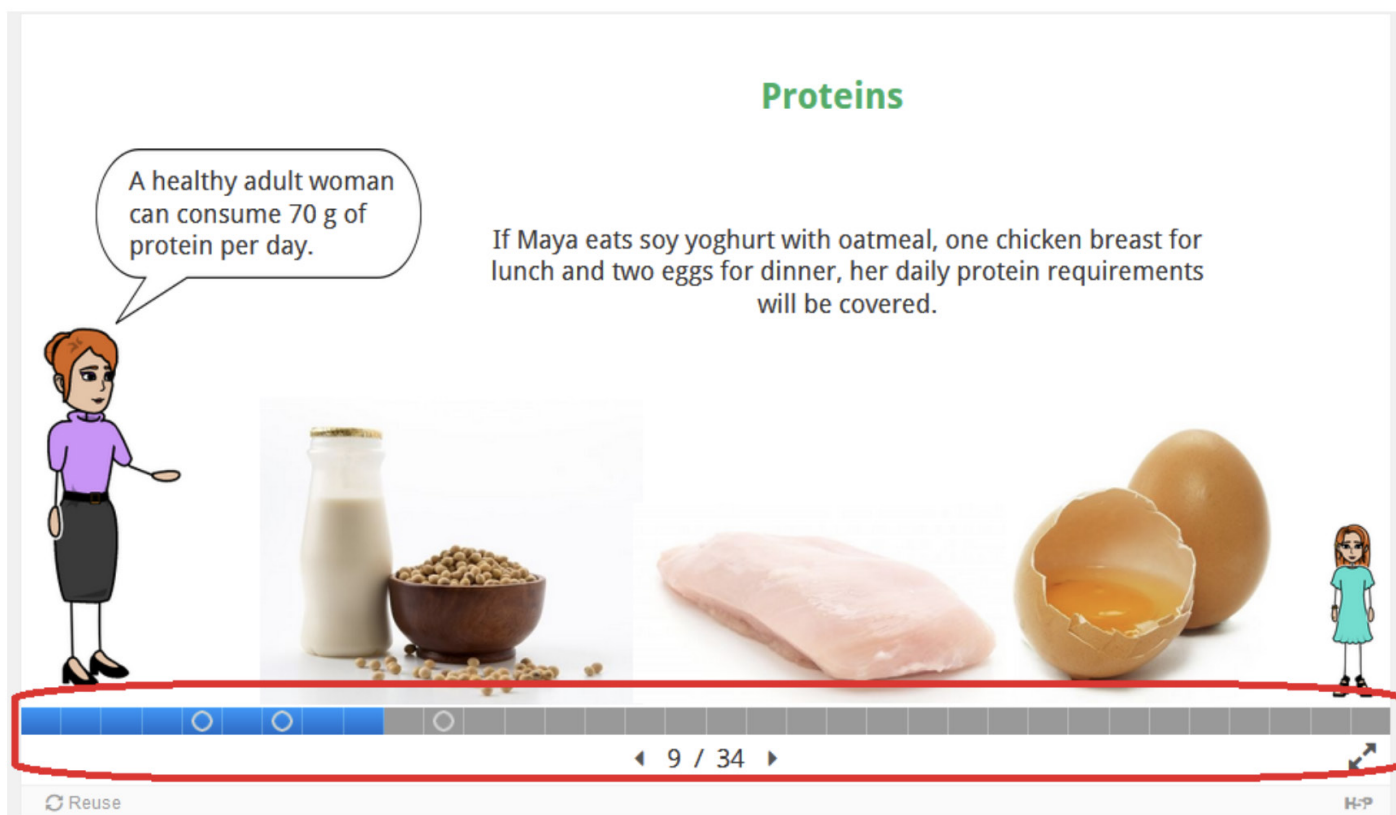


Figure 5: An example of implementation of the pacing principle (Gregorc, Benigar & Žvanut, n. d.)

Pre-training principle

E-content can be designed as independent study materials that allow learners to acquire new knowledge without any intervention on the part of a teacher or facilitator. On the other hand, e-content can also be used as pre-training study materials (Drummond et al. 2017; Mayer 2017), which according to the pre-training principle (Moreno & Mayer 2007), provide prior knowledge to be integrated with incoming information delivered in the core training. To be designed as pre-training materials, e-content should provide valid information which will stimulate learners' curiosity and trigger new questions that can serve as reference points in the core training.

Example 5: Implementation of the pre-training principle

An example of the pre-training principle combined with the feedback principle is presented in this subchapter. In this example, a part of the e-content called Self-Assessment is designed as pre-training to the main content, in this case the Tutorial. By doing the Self-Assessment participants become aware of the signs of ovulation which are presented in detail in the continuation (Figure 6).

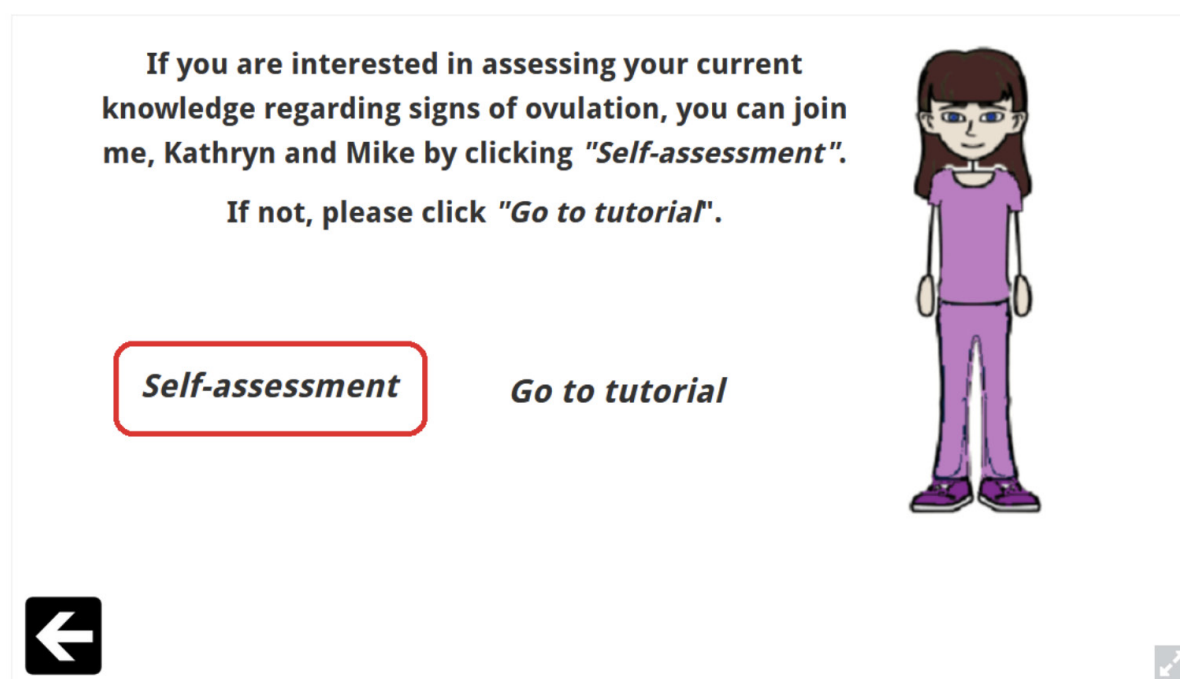


Figure 6: An example of the implementation of the pre-training principle (Rezaeinamini, n.d.)

Conclusion

The recommendations for developing e-content for preconception health presented in this chapter are vital for the effective delivery of information and experiences and the development and retention of knowledge. However, the presented principles are not definitive. Further studies should be performed to define a comprehensive list of recommendations, especially those related to different subgroups of users, in this case adolescents and younger adults for whom preconception health should be a major concern.

Last, but not least, even though the use of e-learning and e-content is a valid approach in health promotion for different populations, there is a lack of trained healthcare experts capable of developing effective e-content. In the future, competences such as the development of e-content or even e-learning modules with healthcare themes should be considered as a required or at least recommended competence of these experts. In fact, health care educators should not simply ignore the fact that digital natives acquire knowledge via different digital communication channels. To gain the attention of digital natives, a step toward the dissemination of knowledge in preconception health and other health promotion issues via these channels should become a requirement.

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What can be discussed in a preconception consultation? Important themes in preconception care

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Abstract

Although there is a lack of international guidelines on preconception care, there is an agreement to discuss a couple of issues with future parents. The main issues are: nutrition, lifestyle (including substance abuse and weight), family planning, infections, medical issues, environmental exposures and occupational and social environment. In the next chapter we will discuss why these themes are of importance in the preconception period and why midwives should address these issues in preconception counseling.

Keywords: nutrition, lifestyle, infections, environment, preconception care

Abstract

Er zijn momenteel nog niet veel internationale richtlijnen rond preconceptiezorg beschikbaar. Toch is er duidelijkheid rond een aantal thema's die met toekomstige ouders besproken kunnen worden. Deze topics zijn: voeding, leefstijl (bijvoorbeeld middelengebruik en gewicht), family planning, infecties, medische voorgeschiedenis, omgevingsinvloeden en sociale invloeden. In het volgende hoofdstuk wordt besproken waarom deze thema's belangrijk zijn in de preconceptieconsultatie.

Trefwoorden: voeding, leefstijl, infecties, milieu, preconceptiezorg

Introduction

In 2006 an American clinical workgroup suggested that preconception care should include tailored health education, a thorough risk assessment and adjusted actions towards patients at risk for morbidity in future pregnancies (Jack et al. 2008). Jack and colleagues assessed 80 preconception – related topics for evidence to include in preconception care. This extensive work is still the standard for preconception care. The topics are discussed below with their level of evidence. Level A means there is good evidence to support the recommendation in preconception care, level B stands for fair evidence to support the recommendation, level C for insufficient evidence to recommend for or against the inclusion of the condition in a preconception care context, but recommendation to include or exclude may be made on other grounds, level D stands for fair evidence to support the recommendation to exclude from preconception care and level E for good evidence to support the recommendation to exclude from preconception care.

Next to that Roman numbers indicate how the evidence was obtained. Level I-a means that the evidence is obtained from 1 RCT before pregnancy; level I-b that evidence is obtained from 1 RCT before or after pregnancy. Level II-1 stands for evidence obtained from well-designed controlled trials without randomisation and level II-2 for evidence from well-designed cohort or case-control studies, preferably from more than one centre or research group. Furthermore, level II-3 means there is evidence from multiple time series, with or without intervention and finally, level III includes opinions from respected authorities, based on clinical experience, descriptive studies and case reports or reports of expert committees.

Evaluation of topics

Family planning and reproductive life plan (A/III):

This includes: screening for intentions to become pregnant or not and risk for unplanned pregnancy, encourage talking about a reproductive life plan and contraceptive decision making and counseling about contraception and emergency contraception. According to the assessment of Jack et al. (2008), there is good evidence to include family planning and discussion of the reproductive life plan in preconception care.

Physical activity (C/II-2)

This includes providing tailored recommendations according to physical abilities. If there is enough time, this can be included in a preconception care consultation, but it is not mandatory.

Weight status (A/III)

An annually assessment of the Body Mass Index (BMI) and appropriate counselling if the BMI exceeds the normal limits is recommended within preconception care. If the BMI exceeds 26 kg/m², information about risks should be provided and behavioural strategies to decrease calory intake and increase physical activity should be discussed. If the BMI is lower than 19.8 kg/m², information about risks can be provided and the patient should be counselled for eating disorders and low body image. Patients should be referred to specialist care when necessary.

Nutrient intake (A/III)

It is highly recommended to assess for the quality of nutritional intake in preconception care and to provide information on recommended food.

Folic acid intake (A/I-a)

It is highly recommended, based on Randomized Controlled Trials before pregnancy, that women who want to become pregnant take a daily folic acid supplement (400 μg). They preferably start to take folic acid from four weeks before pregnancy until 12 weeks of pregnancy. Women at risk to have a child with neural tube defects, can be advised to take 4g of folic acid for a couple of months and under medical supervision. Provision of folic acid and information on folic acid in women with the intention to become pregnant may be successful to increase intake (I-a, II-2) (Temel et al. 2013).

Immunizations (A/III)

An annual assessment for vaccination status is recommended in women of reproductive age. Indicated immunizations should be offered according to vaccination status and risks (e.g. occupational).

- Human papillomavirus (B/II-2): there is fair evidence for routine screening for abnormalities of the cervix. Immunization is now offered in young people to prevent for HPV.
- Hepatitis B (A/III): there is good evidence for vaccination for women at high-risk before pregnancy. Chronic carriers should be instructed to prevent vertical transmission to their baby.
- Varicella (B/III): vaccination against varicella is recommended for all women of reproductive age, as it is a teratogenic infection and vaccination during pregnancy is not recommended.

- Measles, mumps and rubella (A/II-3): also this vaccination is recommended for all women of reproductive age. After receiving the vaccination, women should be counseled not to become pregnant the next three months.
- Influenza (C/III): there is no evidence to vaccinate in preconception care. Probably vaccination during pregnancy is more effective to protect the unborn infant, particularly late in pregnancy (Cunningham et al. 2019; Quach, Mallis & Cordero 2020; Restivo et al. 2018). Also, pregnant woman have a higher risk to develop complications which can often be dangerous. Vaccination can occur during pregnancy.
- Diphtheria, tetanus and pertussis (B/III): this immunization should be up to date in women of reproductive age. Passive immunity of the pregnant woman to tetanus can possibly protect the fetus for neonatal tetanus. Vaccination for pertussis during pregnancy also protects the baby during the first months after birth.

Substance use (A/II-2, A/III)

Assessment for use of tobacco and alcohol and appropriate counselling is recommended at every encounter with women of reproductive age. It is useful to inform these women about the risks of these substances on health and on a potential pregnancy. Women/couples can be referred for help when necessary.

Sexually transmitted infections (A/III)

There is good evidence to regularly assess STI's and to provide immunizations in order to prevent for them. Of course, treatment should be provided when necessary.

Infectious diseases

- HIV (A/I-b): HIV-status of the couple should be known before pregnancy. If a test is positive, counseling should be provided to avoid vertical transmission.
- Hepatitis C (C/III): only screening in high-risk women is recommended. Women positive for Hepatitis C should be counselled, woman treated for hepatitis C should use contraception during therapy and postpone reproductive plans.
- Tuberculosis (B/II-2): high-risk women should be screened and treated before pregnancy.
- Toxoplasmosis (C/III): there is no evidence for routinely testing. If preconception testing is positive, women can be assured that there is no risk of a toxoplasmosis infection during pregnancy. All other women should be counseled to take hygienic measures to avoid infection during pregnancy.
- Cytomegalovirus (C/II-2): hygienic measures should be taken during pregnancy to avoid infection with cytomegalovirus, particularly in women with young children or women who work with young children.
- Listeriosis (C/III): during pregnancy, all women should take preventive measures and avoid some food, such as cheese with non-pasteurized milk.
- Parvovirus (E/III): there is no evidence for screening. Preventive measures should be taken by all pregnant women.
- Malaria (C/III): traveling to malaria-endemic regions is contra-indicated during pregnancy, otherwise safe antimalarial chemoprophylaxis should be provided.

- Gonorrhea (B/II-2); women at risk should be screened and treated if necessary.
- Chlamydia (A/I-a): screening should occur at routine encounters in sexually active women before pregnancy.
- Syphilis (A/I-1): high-risk women should be screened before pregnancy and treated if necessary.
- Herpes simplex virus (B/II-1): women with a history of HSV should be informed about the risk of vertical transmission. Testing of asymptomatic partners of positive patients is recommended.
- Asymptomatic bacteriuria (E/II-1): only women with a previous asymptomatic and treated bacteriuria should be screened again during pregnancy.
- Periodontal disease (C/I-b): there is currently no evidence to screen routinely for periodontal disease before pregnancy. However, good dental hygiene is recommended for everybody.
- Bacterial vaginosis, particularly in women with preterm delivery (D/I-b, C): there is currently no evidence for routinely screening on bacterial vaginosis (Kahwati et al. 2020). Results of studies in women with a previous preterm delivery are inconsistent. For women with symptomatic bacterial vaginosis, treatment is recommended before and during pregnancy.
- Group B streptococcus (E/I-2): screening before pregnancy is currently not recommended.

Medical conditions

- Diabetes mellitus (A/I, B/II-2 for overweight and obese adults): it is important that women at reproductive age with diabetes mellitus are aware of the importance of optimisation of weight, self-glucose monitoring and exercise before pregnancy. Effective birth control should be recommended as long as there is poor control. Preconceptionally, near-normal glycemia should be achieved in order to prevent for congenital anomalies. Screening is recommended in asymptomatic women with overweight and one additional risk factor for diabetes (e.g. genetic or previous gestational diabetes mellitus).
- Thyroid disease (A/I-1): optimal replacement therapy should be achieved before pregnancy. Screening is recommended in symptomatic women and therapy should be provided when necessary.
- Phenylketonuria (A/I-1): counseling about the importance of a low phenylalanine level is recommended when women with phenylketonuria want to become pregnant.
- Seizure disorders (A/II-2): counseling about the risks of increased seizures during pregnancy, the potential effects of seizures and anticonvulsant medication on pregnancy outcome and referral to specialist care when planning a pregnancy is highly recommended.
- Hypertension (A/II-2): counseling about the risk of hypertension to pregnancy outcome and referral to specialistic care is highly recommended.
- Rheumatoid arthritis (A/III): counseling about the development of disease during pregnancy and after is recommended, as is the review of current medication.

- Lupus (B/II-2): there is fair evidence for counseling about the risk of lupus during pregnancy and referral to specialist care.
- Renal disease (B/II-2): there is also fair evidence for counseling about progression of renal disease, increased risk for offspring and importance of achieving normal blood pressure. Some medication is contra-indicated, so safer medication is advised if possible.
- Cardiovascular disease (B/III-3): counseling about extra risk of cardiovascular disease on pregnancy is recommended. The condition should be optimized before pregnancy, until then contraception is advised. If Warfarin is taken, it is recommended to change to a different anticoagulant before conception, because this medication is teratogenic. Specialist care is recommended and genetic counseling is advised for women with a congenital cardiac condition.
- Thrombophilia (C/III): screening and counseling is only recommend for women who want to become pregnant with thrombophilia in the personal or family history. See above for recommendation of Warfarin.
- Asthma (B/II-3): counseling about the risk that asthma will get less under control during pregnancy is recommended. With the aid of medical management, the condition can be optimized before pregnancy and triggers avoided.
- Psychiatric conditions:
 - Depression/ anxiety (B/III): negative outcomes may be prevented if depression or anxiety are treated before pregnancy. Therefore screening and vigilance is recommended in women of reproductive age.

- Bipolar disease (B / III): pregnancy is a period at risk for relapse, particularly after discontinuation of treatment. Women should be counselled on this and on strategies to optimize the condition should be outlined before pregnancy.

- Schizophrenia (B / III): counseling together with partner or relative about the risks of pregnancy on the condition and on pregnancy related outcomes is recommended. Also for these patients a strategy to optimize the condition should be outlined when a patient wants to become pregnant.

Exposure:

- Alcohol (B / I-a): screening should occur in all women of reproductive age. Women should be informed about the adverse effects on their health and for pregnancy outcome. Referral to help is advised whenever needed. A prevention program with personalized feedback and goal setting may be helpful to avoid alcohol (I-a) (Temel et al. 2013).

- Tobacco (A / I-a): screening should occur in all women of reproductive age. Women should be informed about the adverse effects on their health and for pregnancy outcome. Referral to help is advised whenever needed, particularly when a woman wants to become pregnant. Programs to stop smoking have been reported with various success rates (I-a, II-2) (Temel et al. 2013).

- Illicit substances (C / III): careful screening for the use of illicit substances is part of the preconception risk assessment. Counselling to the couple should be provided on the risk of illicit drugs before and during pregnancy and the couple should receive information on programs to support abstinence.

- Family and genetic history
 - For everyone (B/III): a complete screening of the (family) history is recommended for all women who consider a pregnancy. Referral to specific genetic counseling may be recommended.
 - Ethnicity based (B/II-3): people who are at risk for ethnicity-based conditions may be referred to a genetic specialist, according to the preference of the couple.
 - Family history (B/II-3): referral to specific genetic counseling if necessary is recommended.
 - Previous pregnancies (C/III): in vitro fertilisation with preimplantation genetic diagnosis can be discussed if at least one of the partners has a chromosomal anomaly.
 - Known genetic disorders (B/II-3): it is recommended to manage known genetic disorders before pregnancy.

Nutrition

Preconception nutrition counselling programs have been proven effective in low income women and women nutritionally at risk (II-2, I-a) (Temel et al. 2013).

- Dietary supplements (C/III): women of reproductive age should be asked about eventual dietary supplements and counseled about their safety and impact.
- Vitamin A (B/III): during pregnancy, there is a risk that women exceed the tolerable upper intake level. Counselling is needed.
- Folic acid (A/I-a): see earlier.
- Multivitamins (A/II-2): in American literature, the use of multivitamins containing folic acid is supported (Jack et al.

2008). Wolf et al. (2017) advise that multivitamins can be used during pregnancy when there is poor-quality diet with a low nutritional value, but with caution, because the low quality of evidence.

- Vitamin D (B/II-3): shortage of vitamin D is common in pregnant women, living in countries with limited UV exposure and where there is no fortification of dairy products. Supplementation in pregnancy may be recommended, but there is no evidence for routine screening.
- Calcium (A/I-b): counseling about importance of calcium during pregnancy is recommended.
- Iron (A/I-b): women at risk should be screened during a preconception visit in order to improve perinatal outcome.
- Essential fatty acids (B/I-b): counseling on importance to eat sufficient essential fatty acids is recommended.
- Iodine (A/II-b): iodine deficiency is a risk for adverse pregnancy outcome. Women should be counselled on this and take supplements when needed.
- Overweight (A/I-b): see earlier
- Underweight (A/III): see earlier.
- Eating disorders (A/III): women should be informed about the risk of eating disorders in relation to fertility and pregnancy outcome and they should be encouraged to seek specialist help before pregnancy.

Environmental exposure

- Mercury (B/III): as fish contains a lot of essential fatty acids, it should be consumed sufficiently (two times a week). However, consumption of some fish (shark, swordfish, King mackerel and tile fish) should be avoided because its high mercury concentration.
- Lead (C/II-a): there is lack of evidence to screen every woman; however, women who are exposed to high levels of lead or have high blood lead levels can be screened and high levels of lead can be managed before conception.
- Endocrine disruptors: this was not studied by Jack et al. (2008) yet, but this topic is increasingly important to address in women who want to become pregnant. Within preconception care, women can be advised to avoid Bisphenol A and other endocrine disruptors.
- Workplace exposure (B/III): when women want to become pregnant, they can be asked about their work environment and referred to occupational medicine when necessary.
- Household exposure (A/III): when women want to become pregnant, they can be asked about the home environment and referred to occupational medicine for recommendations of modification.

Psychosocial risks

- Inadequate financial resources (C/III): if women struggle financially, they should be referred to social assistance.
- Access to care (C/III): women should be asked about their health insurance and access to care.
- Physical/sexual abuse (C/III): discrete screening is advised and every health care provider who works with women should have a list of agencies available to refer women to for help.

Medication

- Prescription (A/II-2): all women who want to become pregnant should be screened for the use of teratogenic medication and should receive counseling about the impact of medication on pregnancy outcome.
- Over-the-counter medication (A/III): counseling about over-the-counter medicine is recommended. Women should seek advice on this when they are pregnant (e.g. aspirin is not safe to take during pregnancy).

Dietary supplements (A/II-c): see earlier

Reproductive history

- Prior preterm birth infant (A/I-a): evaluation of remediable causes is recommended for a next pregnancy
- Prior cesarean delivery (A/I-a): it is recommended to advise women to wait at least 18 months for a subsequent pregnancy. This counseling should start immediately after the cesarean delivery.
- Prior miscarriage (A/I-a): when a woman has one to three miscarriages, she can be reassured. If a woman has had more than three miscarriages, she should be offered counseling to identify a cause and therapy.
- Prior stillbirth (B/II-2): a thorough examination is recommended to examine the cause of stillbirth. Clear communication with the couple about the cause is also important. Risk factors can be modified before a next pregnancy.
- Uterine anomalies (B/II-3): anomalies should be delineated and treated (e.g. surgery for septum) before pregnancy. Higher surveillance may be recommended during pregnancy.

Special populations

- Women with disabilities (B/III): women with disabilities should be counseled about safe medication and about medical, social and psychological issues before pregnancy. If appropriate, the woman should be referred for genetic counseling.
- Immigrant and refugee populations (B/III): again, it is important to consider preconceptional concerns as part of every health care encounter in women of reproductive care, particularly in immigrant and refugee populations, as they may face a higher threshold to seek for preconception or prenatal care. It may be helpful to refer these women to primary care that is socially, culturally and linguistically competent. Next to that, it is advised to work with written material in their language or to use pictures. Screen immigrants at high risk for tuberculosis and hepatitis B and treat them if indicated.
- Cancerpatients (A/III): fertility preservation should be offered in newly diagnosed cancer patients and they should be counselled about the potential reproductive effects of cancer treatments on fertility and pregnancy. Reliable nonhormonal contraception should be used during treatment.
- Men (B/III): a medical evaluation is advised for men who are planning to conceive. As such, high-risk behaviours or poorly controlled diseases can be managed before conception.

Conclusion

In conclusion, within a preconception consultation it is highly recommended to discuss family planning, weight status, nutrient intake (particularly folic acid intake), vaccination status and substance use. Information on preventive measures and the effects of a hazardous lifestyle on health and pregnancy is very useful.

It is also recommended to assess eventual sexually transmitted infections and other infectious diseases. It is not recommended to screen for every infectious disease during pregnancy, but women should be informed about hygienic measures to avoid infections.

Medical conditions should be assessed, medication should be customized before pregnancy and referral to specialist care is recommended for a large number of medical conditions. Also the family, reproductive and genetic history may result in referral to specific care or higher surveillance.

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