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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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