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**Healthy lifestyle in the prevention of heart diseases and
diabetes**

A literature review

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“The function of protecting and developing health must rank even above that of restoring it when it is impaired.”

Hippocrates

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Thesis Abstract

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This is a systematic literature review which was made for bachelor's thesis' purposes. Its research tasks were to collect data on the topic of prevention of cardiovascular diseases (CVDs) and diabetes (DM 2) through healthy lifestyle and the effectiveness of a lifestyle intervention. Healthy lifestyle in this project is combination of four main areas; adequate physical exercise, physical fitness, balanced diet and non-smoking.

The development of CVDs and DM 2 are closely linked to the lifestyle. High BMI (BMI $\geq 30\text{kg/m}^2$) and sedentary lifestyle are major risk factors in the development of CVDs and DM 2.

The bachelor's thesis was conducted using a systematic approach to the research literature. The database searches returned 13 articles, which were relevant to the project, and were found useful in answering the research questions.

Lifestyle interventions were found to be successful in decreasing the risk of developing CVDs, DM 2 and metabolic syndrome, which often precedes both CVDs and DM 2. The lifestyle intervention, compared to the control groups and baseline scores, was more effective in increasing the amount of physical activity and knowledge in the individuals, improving physical fitness and resulting in more permanent weight loss.

Keywords: prevention, healthy lifestyle, diabetes, heart diseases

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Opinnäytetyön tiivistelmä

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Tämän opinnäytetyönä tehdyn systemaattisen kirjallisuuskatsauksen tarkoituksena oli koota kirjallisuutta terveellisten elämäntapojen käyttöä ja tehokkuutta sydänsairauksien ja diabeteksen ehkäisyssä. Terveellisillä elämäntavoilla tässä projektissa tarkoitetaan seuraavien neljän tekijän yhdistelmää; riittävä liikunta, fyysinen kunto, tasapainoinen ruokavalio ja tupakoimattomuus.

Sydänsairauksien ja diabeteksen kehittymisen riski on läheisesti yhteydessä elämäntapoihin. Korkea painoindeksi (BMI $\geq 30\text{kg/m}^2$) ja liikkumattomuus ovat suurimpia riskitekijöitä.

Opinnäytetyö tehtiin käyttäen systemaattista lähestymistapaa tutkimuskirjallisuuteen. Tietokantahakujen tuloksena saatiin 13 projektille oleellista artikkelia, jotka katsottiin hyödyllisiksi tutkimuskysymyksiin vastausta haettaessa.

Elämäntapainterventiot olivat menestyksekkäitä sydänsairauksien, diabeteksen ehkäisyssä. Myös metabolisen oireyhtymän, joka usein edeltää sydänsairauksia ja diabetesta, riski laski. Verrattuna kontrolliryhmiin ja alkutilanteeseen, elämäntapainterventio oli tehokkaampi yksilöiden liikunnan ja tiedon lisäämisessä, fyysisen kunnon parantamisessa ja se johti kestävämpään painonpudotukseen.

Asiasanat: ennaltaehkäisy, terveelliset elämäntavat, diabetes, sydänsairaudet

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Terms and abbreviations

ADA	American Diabetes Association
BMI	Body mass index
CHD	Coronary heart disease
CVD	Cardiovascular disease
DM 2	Type 2 diabetes mellitus
HDL	High-density lipoprotein
HE	Health education
HT	Hormone therapy
IGT	Impaired glucose tolerance
LC	Lifestyle change
LDL	Low-density lipoprotein
LTPA	Leisure-time physical activity
NCD	Non-communicable disease
WHO	World Health Organization
WISEWOMAN	Well-Integrated Screening and Evaluation for Women Across the Nation
WOMAN	Women On the Move through Activity And Nutrition

INTRODUCTION

This is a bachelor's thesis on lifestyle interventions and their effectiveness on heart diseases and diabetes. Type 2 diabetes (DM 2) and cardiovascular diseases (CVDs) are a major cause of death worldwide. The risk of these morbidities can be reduced with lifestyle intervention. (Arnoldi 2004, xvii.)

Increased caloric intake, excessive bodyweight and sedentary lifestyle contribute to the development of non-communicable diseases, such as CVD or DM2. The prevention of these diseases, also through lifestyle interventions has been studied increasingly during the recent years because the occurrence of diabetes is greater than ever. (Madden, Loeb, & Smith 2008, 2244.)

Chronic non-communicable diseases (NCDs) are a significant reason for the increasing costs of the health care system. At the moment, preventative methods are still small in comparison with the treatment that is required.

In low-income countries, the increasing amount of NCDs in poor countries is thought to delay the reduction of poverty. The reason behind this is especially the increased personal health care costs. 100 million people every year are forced into poverty by the costs of NCDs, because the treatment is often costly and long.

The people in low-income countries are being subjected to what is considered unhealthy lifestyle, thus are sicker and die younger. Not being able to access the services provided by the health care, alongside with unhealthy practice of smoking tobacco and imbalanced nutrition contribute to the increased morbidity and mortality.

Unhealthy lifestyle practices are present in the high-income countries too. The difference in the morbidity and mortality rate compared to low-income countries is, that people in high-income countries have an access to health services. (World Health Organization 2011a.)

According to World Health Organization (2011a) the aim should be in the prevention of the NCDs. Cost-effective prevention methods on risk factor reduction exist and the best outcome would be achieved by making public health policies,

which enable an early recognition of NCDs. Early recognition is crucial in lowering the costs of treatment. Most cost-effective would be good prevention plans, which would not allow the disease to even develop. (WHO 2011a.)

1 CONCEPTS ASSOCIATED WITH THE STUDY

1.1 Healthy lifestyle

Deciding on the definition of healthy lifestyle which would be used in the review was a challenging process. Depending on the source, a healthy lifestyle can be defined in many ways. In this thesis, a healthy lifestyle comprises of four areas, which repeatedly came up in the reviewed articles. The four areas of healthy lifestyle are an adequate physical activity, physical fitness, balanced diet and non-smoking.

1.1.1 Adequate physical activity

According to World Health Organization (2012a), an adequate amount of physical activity can decrease the risk of developing heart diseases, diabetes, some cancers and depression (WHO 2012a). Physical inactivity is one of the biggest contributors for deaths worldwide, accounting for nearly 3,2 million deaths every year worldwide. The reason behind the increased physical inactivity can lay in the changed way of living. Work is less physical, transportation means that require physical input have decreased and partaking in physical activity during free time is not adequate. (WHO 2012b.)

According to Caspersen, Powell & Christenson (1985) “Physical activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure.” (Caspersen, Powell & Christenson 1985.) Calories are used to measure how much energy the activity requires.

Terms physical activity and exercise are sometimes used to refer to same thing, and although they do have multiple characteristics in common, they do not mean the same thing. Exercise in fact is a sub-category of physical activity. While physical activity is any movement which is created by skeletal muscles, exercise is always planned, recurring physical activity that has a structure and is undertaken with the purpose of improving the physical fitness. (Caspersen et al 1985.)

1.1.2 Physical fitness

Physical fitness in this literature review refers to the composition of the body. Like Caspersen et al (1985) wrote, it is “a set of attributes that people have or achieve.” (Caspersen et al 1985, 128.) Physical fitness has been previously defined with measures which are rather subjective and not easily evaluated (Caspersen et al 1985, 128).

Physical exercise and physical fitness are closely related. They have an impact on one another, as the state of individual’s fitness can influence the intensity of the exercise that can be undertaken. (Barnett & Kumar 2005, 34.)

1.1.3 Balanced diet

Diet that does not meet the recommendation of nutrition is a significant risk for chronic diseases. Healthy diet should be individualized to meet the energy needs of the individual. This is necessary in order to achieve or maintain the ideal weight.

Recommended diets provide sufficient amount of essential nutrients, while staying moderate on parts that in excessive amounts are harmful. The sodium intake, use of sugars, trans-fats and saturated fats should be limited. Balanced diet is rich in fruits and vegetables, low-fat milk products, fish, unrefined grains, legumes and nuts. The sodium used is ideally iodized and consumed fat is unsaturated.

Diet is heavily linked to the culture. This should be taken into consideration when making diet plans and recommendations. (Arnoldi 2004, xvii; World Health Organization 2012c.)

Arnoldi (2004) claims, that the recommended diet is, however, not what the average people in Western consume. The argues, that the reason for this lies in the fact that people are not ready to invest in healthy eating to gain long-term benefits, if it does not taste good. (Arnoldi 2004, xvii.)

1.1.4 Non-smoking

Tobacco is a big killer; almost six million people die each year due to tobacco. Over five million of them are tobacco users or have a history of tobacco using. Second-hand smoking accounts for about 600 000 untimely deaths each year. Public places, such as restaurants can expose an individual to second-hand smoke. It is smoke that fills closed places where people smoke tobacco products. Second-hand smoke puts non-smoking people in a similar risk of tobacco related diseases as tobacco users.

This is why the tobacco epidemic is so hazardous to the public health in the world. Nearly 80% of smokers live in low or medium income countries, in which the weight of tobacco related diseases and death is the greatest.

Tobacco caused 100 million deaths in last century and is believed to kill over one billion in 21st century if the same rate persists. Up to half of the deaths of smokers are caused by smoking related diseases. Approximately one out of 10 deaths is accounted for tobacco use; about every six seconds a person dies due to tobacco smoking.

The epidemic caused by tobacco smoking is not well monitored in the world; only 59 countries worldwide makes tobacco related surveys on regular basis. (WHO 2012d)

1.2 Heart diseases

In this study, heart diseases refer to cardiovascular diseases. CVDs are diseases which affect the heart, brain and blood vessels. (Mendis, Puska & Norrving 2011, 3.)

Cardiovascular diseases cause more deaths worldwide every year than any other cause. Majority of these deaths happen in low- and middle-income countries. In 2008; approximately 17,3 million people died of CVDs. This accounted for 30% of all the deaths globally. It is estimated that by the year 2030, the death of nearly 23,6 million people will be caused by CVDs. (WHO 2011c.)

The CVD risk can be significantly increased by diet. Hyperlipidaemia, which increases the risk of atherosclerosis, is the main condition that can both be caused and treated by nutrition. (Carroll 1990, 54.)

1.3 Diabetes

Diabetes in this study refers to the type 2 diabetes mellitus in which the body uses insulin ineffectively, previously also called non-insulin dependent or adult-set diabetes. Individuals with DM 2 either have malfunctioning insulin secretion which causes the amount of insulin being inadequate or the insulin is not used effectively. According to the World Health Organization, nine out of ten diabetics has the type 2 diabetes. The major causes for type 2 diabetes are an inactive lifestyle and obesity. Obesity itself also causes insulin resistance to a degree. (American Diabetes Association 2010; Arnoldi 2004, 128; WHO 2011b.)

DM 2 is often preceded by large waist circumference (WC), insulin resistance, high LDL, low HDL, elevated levels of blood pressure and fasting glucose (Arnoldi 2004, 128). An increased amount of fat in stomach area is a risk factor even if the individual would not otherwise be considered obese by BMI (ADA 2010).

Diabetes, if left untreated, can lead to multiple complications. Most of the damage caused by excessive levels of blood glucose are irreversible or have a long-term effect. Particularly kidneys, heart, eyes, and veins are in danger. Furthermore, complications associated with diabetes can lead to a loss of eyesight, renal failure, damage in peripheral nervous system which can lead to different degree leg amputations. Diabetes can also negatively affect sexual function. LDL and HDL deviations alongside of hypertension are common with diabetics. DM 2 is often preceded by large waist circumference (WC), insulin resistance, high LDL, low HDL, elevated levels of blood pressure and fasting glucose. (ADA 2010; Arnoldi 2004, 128; The Power of Prevention: Chronic disease... the public health challenge of the 21st century 2010.)

Because the development of DM 2 is slow and moderate, it can remain unnoticed for years. Symptoms like polydipsia and polyuria in mild hyperglycaemia may not be severe enough to be recognised by the pre-diabetic individual. These people however have an increased risk of developing vascular complications. (ADA 2010.)

There are multiple risk factors that can lead to the development of DM 2. Sedentary lifestyle, obesity (body mass index [BMI] $\geq 30\text{kg/m}^2$), advanced age, gestational diabetes, family history of diabetes and impaired glucose tolerance (IGT) are most notable of them. Additionally, according to Arnoldi (2004) the race can be a risk factor; higher risk of developing a DM 2 has been observed in African Americans, Hispanic/Latino Americans, American Indians, Asian Americans and Pacific Islanders. (ADA 2010; Arnoldi 2004, 128-129.)

1.4 Prevention

According to Kones (2011); "Prevention may refer generally to screening and immunizations to detect, forestall, or limit serious disease." (Kones 2011, 327.)

Prevention can be divided in three categories; primary, secondary and tertiary. Primary prevention takes place before the onset of the disease; it aims to postpone or altogether prevent the initial falling ill.

Secondary prevention refers to preventive actions which take place after the first event of the illness or disease. Secondary prevention takes place after the onset of the disease itself, but is practiced before the diagnosed disease has caused further complications or suffering. (Gordon 1983, 107; Kones 2011, 327-328.)

Tertiary prevention refers to the prevention that is practiced once complications or suffering has been experienced, in order to avoid further decline. (Gordon 1983, 107.)

Kones (2011) talks about primordial prevention. According to him this concept was first suggested by Strasser in 1978 in "Reflections of Cardiovascular Diseases". It proposes, that if certain level of health is achieved through personal modifications

in individual's lifestyle, the achieved health would not allow conditions that are needed for risk factors to rise, to even appear in the first place. (Kones 2011, 327-328.)

2 PURPOSE OF THE LITERATURE REVIEW AND RESEARCH QUESTION

2.1 Purpose

The purpose of this project was to make a comprehensive review on lifestyle modifications that can be adopted in order to prevent diabetes and heart diseases. In addition the goal was to find out in what way the changes in lifestyle affect the risk. DM 2 and CVDs prevention has been studied a lot previously, but the focus is usually been on either one of the subject. This is understandable as they both are wide areas and difficult to cover. The connection between DM 2 and CVDs has however been noted in the studies.

2.2 Research questions

1. What kind of lifestyle interventions can be implemented to prevent heart diseases and diabetes?
2. How effective are these interventions?

3 SYSTEMATIC LITERATURE REVIEW AND CONTENT ANALYSIS

3.1 Systematic literature review

The work was made using the systematic literature review as a method. A systematic literature review is an organized, specified and strictly limited data collection process, which is reproducible (Johansson, Axelin, Stolt & Ääri 2007, 10). Based on Higgins & Green (2009), a systematic review has some important properties. The Cochrane Handbook for Systematic Reviews of Interventions lists these elements which are to be found, as:

a clearly stated set of objectives with pre-defined eligibility criteria for studies; an explicit, reproducible methodology; a systematic search that attempts to identify all studies that would meet the eligibility criteria; an assessment of the validity of the findings of the included studies, for example through the assessment of risk of bias; and a systematic presentation, and synthesis, of the characteristics and findings of the included studies. (Higgins & Green 2009)

While the Cochrane Collaboration method of producing a systematic literature review is the best known, it is at the same time the strictest set of guidelines for conducting a systematic literature review. A systematic literature review does not need to be conducted using the Cochrane Collaboration method to be systematic, if the approach to the literature has been systematic. A systemic approach to the review is vital in order to gather all the available information. The aim of a systematic review is to provide synthesised information on its subject. (Aveyard 2010, 14-15.)

Time limitations and the systematic literature review being conducted for bachelor's thesis purposes were ultimately the reasons, why the Cochrane Collaboration method was not adopted.

3.2 Literature search

The systematic literature review began with determining the research task. The literature searches were made in CINAHL database, PubMed Medline database and Medic database. The search words used in the databases were diabetes, prevent, prevention, health*, lifestyle and heart disease. The search words were used as different combinations, with an aim to have as inclusive sampling as possible. The search words were derived from the research question. The results were evaluated first based on the titles and the abstracts, inclusion and exclusion criteria, full texts and finally based on the quality of the full texts.

The figure (Figure 1.) below shows the search process in detail. The searches resulted in a total of 373 articles, 125 articles from the Finnish Medic, 154 from PubMed Medline and 94 from CINAHL. The searches were made in two sets in all of the databases, the combination of search words used in the first set was “diabetes AND health* AND lifestyle AND prevent*”. The combination of search words in the second set was “heart disease AND health* and lifestyle AND prevent*”. Additional searches to CINAHL were made with combinations “diabetes AND lifestyle AND prevention” and “heart disease AND lifestyle AND prevention”, but they did not result in new articles being introduced to the review.

Limiters and filters provided by the databases were used according to the inclusion and exclusion criteria (Figure 2.), as they were available. The filters helped to narrow down the amount of articles to those that were written in English or Finnish language, available free in full, and published between the years 2000-2012. Stricter use of inclusion and exclusion criteria was adopted in the manual evaluation of the articles.

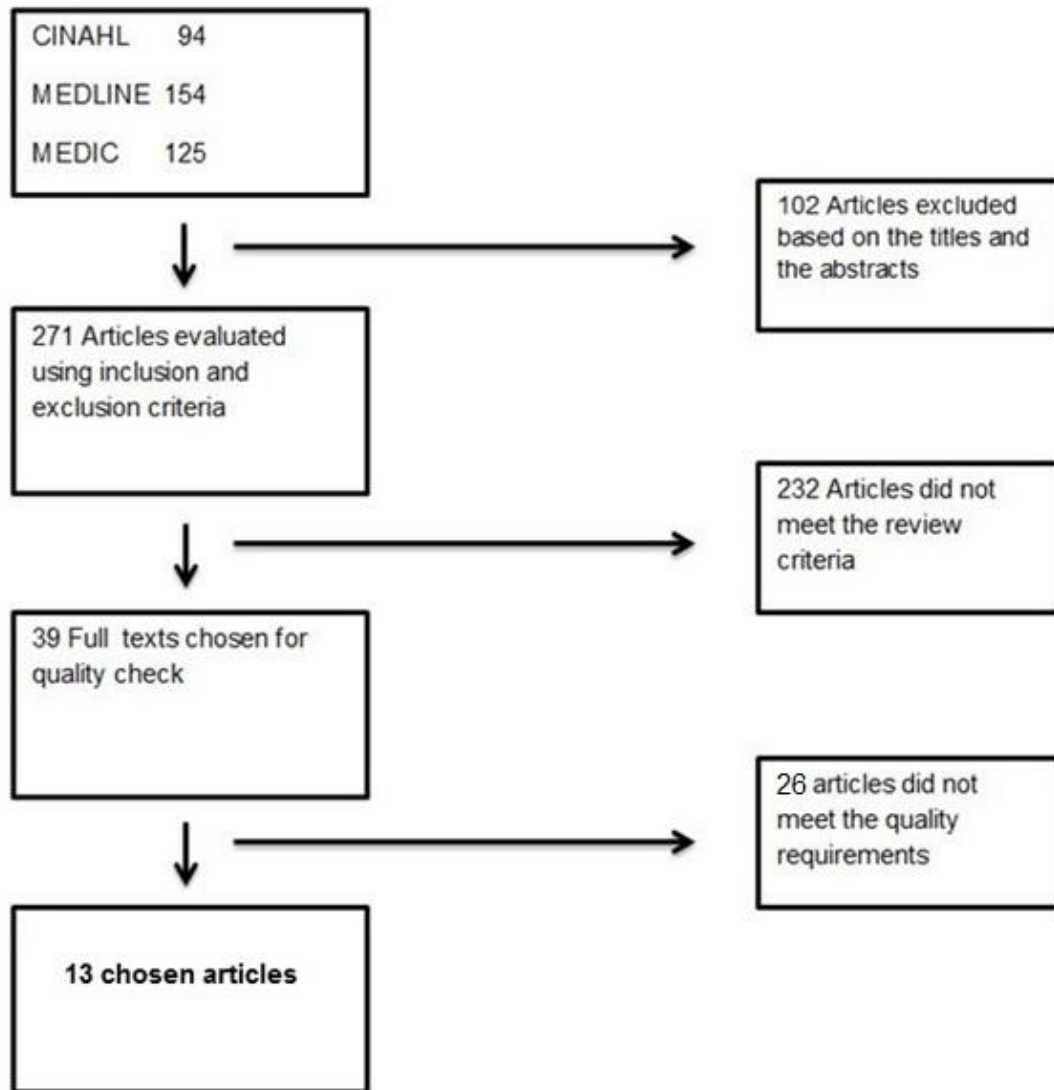


Figure 1. Database searches

Initially, the goal was to find a large quantity of good quality articles, which would answer the research question and fill the task. Database searches showed that there is a considerable amount of research done in the prevention of both heart diseases and diabetes. However, many of these articles did not meet the review requirements. Several articles used methods such as comparing the effectiveness of medical intervention to lifestyle intervention, cost-effectiveness of lifestyle modifications, management of existing diabetes or CVD or the motivation of making a lifestyle change after an intervention. (Andrawes et al, 2005; Herman et al, 2003; Jallinoja et al, 2008; Klein et al, 2004; Korkiakangas et al, 2011; Lingfors et al, 2003; Sanz et al, 2010; Whittemore et al, 2003). Themes mentioned above

were agreed to be excluded from the body of articles in the dissertation planning process and thus did not make it in to the systematic review.

3.3 Data screening

The search was limited to articles published from 2000 to date (August 1st, 2012). The publications were limited to English and Finnish language. Finnish language was taken into the inclusion criteria next to English language to avoid the language bias. A language bias is possible, if the data is exclusively in English (Johansson et al 2007, 53). The articles were to be available in full and free, and relevant to the research task. The publications that weren't excluded were taken into a more profound evaluation.

INCLUSION	EXCLUSION
Studies published after year 2000	Studies published before year 2000
Studies written in English or Finnish language	Studies written in languages other than English or Finnish
Studies relevant to the research task	Studies not relevant to the research task
Studies that are evidence based and peer reviewed	Studies that are not evidence based or peer reviewed
Full text available	No full text available

Figure 2. Inclusion and exclusion criteria

3.4 Data analysis

The content of the data that was derived from the searches was analysed using the research question and the quality of the literature.

As stated by Aveyard (2010), there are three “advanced” ways of making a summary of the articles; meta-analysis, meta-ethnography and meta-study. None of these methods can be used jointly to summarise qualitative, quantitative and discussion articles. Students will unlikely have the experience to undertake any of these methods. They are also likely to come across various types of researches as opposed to just one. Students can adopt a simplified version of making a summary. It is a tool to sum up results from articles that use varying research methods. (Aveyard 2010, 125-127.) This summary of information can be found in the Appendices section (Appendix 1.).

The abstraction was done in order to connect the articles together by creating sub categories and main categories.

The findings in the used articles were read through carefully, in order to find repeating themes and terms. These terms were gathered and the ones that were most frequently present in the articles were then chosen to be the sub categories. Similar sub categories were put together to form main categories.

These main categories were then used as titles in the presentation of the review findings.

4 FINDINGS

4.1 Physical activity

Increased physical activity was one of the most common lifestyle interventions used. The motivation and dedication to be more active physically and take on structured exercise was higher in the intervention groups than the control groups or baseline measures. (Moore, Hardie, Hackworth, Critchley, Kyrios, Buzwell, Crafti 2011, 491-492.)

Some articles could not produce reliable information on the constancy of the results of physical activity intervention. The reason behind this was the error in the measurements. However, the error would be inclined to rather underestimate the effectiveness than overestimate. (Stampfer, Hu, Manson, Rimm & Willett 2000, 20.)

Being physically active correlated with the absence of metabolic syndrome. Men, who had kept active had a 22,8% risk of developing a metabolic syndrome. Those who had become active or inactive after the beginning of the intervention three years prior, had a risk of 25,9% and those who had been and remained inactive, had a 33% risk of metabolic syndrome. (Wannamethee, Shaper & Whincup 2006, 1910-1912.)

Leisure-time physical activity (LTPA) on low-intensity together with changes in lifestyle decreased the risk of diabetes. It is possible, that rather than the intensity of the physical activity, more important is the time spent on it. (Laaksonen, Lindström, Lakka, Eriksson, Niskanen, Wikström, Aunola, Keinänen-Kiukaanniemi, Laakso, Valle, Ilanne-Parikka, Louheranta, Hämäläinen, Rastas, Salminen, Sundvall, Tuomilehto & Uusitupa 2005., 159-164.)

4.2 Physical fitness

Good results in the other health influencing factors supported the weight loss, reduction in BMI and WC. (Moore et al 2011, 493-495.)

The low-density lipoprotein (LDL) and high-density lipoprotein (HDL) along with fasting glucose levels and diastolic blood pressure were improved with the intervention. (Kuller, Kinzel, Pettee, Kriska, Simkin-Silverman, Conroy, Averbach, Pappert & Johnson 2006., 966-971; Moore et al, 2011, 495; Richardson, van Hoerden, Morgan, Edwards, Harries, Hancock, Sroczynsk & Bowley 2008.)

Interestingly, in Richardson et al (2008) research, at the same time as significant improvement was seen in cholesterol levels, blood pressure, pulse and glucose tolerance, the body weight, BMI and WC got worse after the intervention. (Richardson et al 2008.)

Peer-led lifestyle change programmes were found to be effective (Parikh, Simon, Fei, Looker, Goytia & Horowitz 2010, 236). A community-based peer-led intervention was studied using an intervention group and a control group. The intervention group lost a substantial amount of weight compared to the control group, in which the weight loss was very minor. Despite of the big reduction in weight, intervention group did not adopt many lifestyle changes. (Parikh et al 2010, 232-234.)

4.3 Diet

Nutritional modifications were in an important role; diet was discussed in detail in several of the analysed articles (Kuller et al 2006; Moore et al 2011; Swain, McCarron, Hamilton, Sacks & Appel 2008; Stampfer et al 2000; Thomas et al 2003; Tuomilehto, Lindström, Eriksson, Valle, Hämäläinen, Ilanne-Parikka, Keinänen-Kiukaanniemi, Laakso, Louheranta, Rastas, Salminen & Uusitupa 2001; Wannamethee et al 2006; Williams & Hoffman 2009.)

Swain et al (2008) showed that there were options when it came to picking a diet that works with the individual. Study on macro- and micronutrient diets in heart health showed, that the composition of the diet can be changed and still reach a reduction in a CVD risk by 16% to 21%. Further reduction of the risk was reached by substituting a part of the carbohydrates in the diet with either unsaturated fats or proteins. (Swain et al 2008, 2.)

In the study of Swain et al. (2008), three different kinds of diets were tested; carbohydrate-rich diet, protein-rich diet and higher unsaturated fat diet. All the diets had 2,3mg of sodium per day and 2100kcal. Compared to the baseline diet, the reduction in the sodium intake improved the LDL cholesterol levels and decreased the blood pressure, hence reducing the risk of CVDs. (Swain et al 2008, 2-6.)

An excessive amount of carbohydrates was found to be connected with increased probability of metabolic syndrome, which often precedes both CVDs and DM 2. (Wannamethee et al 2006, 1910-1912.)

4.4 Smoking status

Tobacco was found to be a major risk factor for CVDs. The risk of coronary events was 5,48 times higher on women who smoked than non-smoking women. (Stampfer et al 2000, 18) Similar rise was seen in smoking men; an increased risk of metabolic syndrome was associated with tobacco smoking. Long-term ex-smokers (≥ 15 years) and recent ex-smokers (< 15 years) had a decreased risk, but not as low as people who had never smoked tobacco. (Wannamethee et al 2006, 1912-1913.)

4.5 Sleep duration

There was only article discussing the connection of sleep duration and the incidence of DM 2 (Tuomilehto, Peltonen, Partinen, Lavigne, Eriksson, Herder, Aunola, Keinänen-Kiukaanniemi, Ilanne-Parikka, Uusitupa, Tuomilehto & Lindström 2009.) Individuals, who are habitual long sleepers (≥ 10 h) were found to have an increased incidence of DM 2. The group of long sleepers in the research had a tendency to also sleep during the day and be on antihypertensive medication. Unlike the other groups, long sleepers were similarly more likely to regularly use tobacco and alcohol products. Moreover, long sleeper were more

frequent in physical activity, than other groups. Similarly, individuals with short sleep ($\leq 6,5$ h) had an elevated risk of developing DM 2.

The lifestyle interventions resulted weight-loss and better insulin sensitivity and decreased sleeping times in the long sleepers of the intervention group. In spite of this, the reduction was not big enough to move them to another sleep time group. On the contrast, the long sleepers of the control group slept even longer than previously. It was noted that the percentage of day time sleepers among the long sleeping group had decreases to 30% from previous 74%. The article proposes that long sleep could be connected to obesity, weight gain, sedentary lifestyle and a feeling of weakness. (Tuomilehto et al 2009, 1666–1970.)

4.6 Effect on the risk

Several articles that studied the risk reduction through lifestyle interventions, found out that not only were the changes in the lifestyle successful, but also that the difference to the baseline risk or the control group risk was great (Hayashi et al 2010, 1129; Kuller et al 2006, 962; Laaksonen et al 2005, 162-163; Moore et al 2011, 492-495; Swain et al 2008, 6-7; Tuomilehto et al 2001, 1343; Wannamethee et al 2006, 1910-1912).

The research of Hayashi et al (2010) indicated that the most significant improvement in the CHD risk in women was achieved in those women, whose risk of CHD was higher at baseline. At the same time, the intervention provided close to no improvement in the reduction of CHD risk for those women, whose CHD risk at the baseline was small. (Hayashi et al 2010, 1129.)

The risk of coronary heart disease (CHD) was found to be present in children and adolescents too, yet the connection with lifestyle measures was not clear (Thomas et al 2003, 645).

Laaksonen et al (2005) found out in their study, that the on minimum 2,5h of walking per week decreased the risk of diabetes by 63% to 69%. This reduction of risk however was likely due to the decreased BMI and weight loss instead of directly due to the walking itself. (Laaksonen et al 2005, 159-164.)

Richardson et al (2008) stated that although the risk factors of CVD can be changed with lifestyle interventions, many people do not have an access in getting to know their risk levels. User-friendly questionnaire was sent to a relevant age group. After their self-assessment further assessment on their 10-year CHD risk was made. Study showed that assessing their 10-year CHD risk at baseline reduced the 10-year CHD risk which was measured a year later. (Richardson et al 2008.)

5 DISCUSSION

5.1 Assessment of the results

The literature analysis gave similar results as were hypothesised before and during conducting the searches. Before making the plan for the work, in the beginning of the project mind maps were made in order to examine what healthy lifestyle actually includes. Different compositions were tested in peer seminars and the final definition of healthy lifestyle was comprised of five different factors; physical exercise, diet, non-smoking, physical fitness and mental health.

Main difference with the findings and the hypothesis were the absence of mental health measures. Mental health was initially thought to contribute to the “healthy lifestyle” concept. However, because it, or factors influencing mental health, such as stress, were not mentioned in the body of literature that was achieved with the search words, it was decided to be left out.

Findings that fit together perfectly are not common (Aveyard 2010, 133). The results in most parts seem cohesive. Although absolute opposites were not found in the results of the studies, not all the findings were parallel.

5.2 Limitations

The literature review has many limitations. The literature review is limited in regards of the sources and languages of the articles used. As only electronic databases were utilised for the searches, it could have resulted in essential literature being left out of the work. Because of limited resources, only free articles were included in the review. The entire spectrum of sources could not be exploited.

The theme and topic for the thesis and conducting method were assigned as they were presented in the final project. There was a possibility to slightly edit the topic to while determining the research questions. I learnt a lot about making a systematic literature review while working on this project. It was evident from the

beginning, that good planning, organisation skills and time management are vital in completing the review satisfactorily. Other skills necessary in making a literature review, such as searching for the literature, academic writing and avoiding plagiarism were acquired during the process.

While evaluating the quality of the work, it should be considered that the project was undertaken by a novice researcher and it was used as a learning tool. The data was also analysed by one person, which can make it biased.

Time was a limiting factor, as well as the lack of experience of the analyser when it came to the synthesis of the results. There is undoubtedly information missing from the results that was not possible to be included due to the lack of experience in research results interpreting.

5.3 Future research

Further research in the future should be made of the motivation to maintain the lifestyle changes implemented in the intervention.

It would be advisable to conduct research on the mental health factors affecting on the prevention of CVDs and DM 2. According to the Power of Prevention (2010) mental ill-health and CVDs and DM 2 are strongly connected. Not only can mental health problems lead to CVDs and DM 2, they can worsen the symptoms of the existing mental illness. (The Power of Prevention: Chronic disease... the public health challenge of the 21st century. 2010). Mental health and mental ill-health are substantial themes. Considering this, mental health was not included in the definition of healthy lifestyle in this dissertation.

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APPENDICES

APPENDIX 1. Summary of the research articles

	Author and the year of publication	Title of the article	Publication	Method of data collection	Key findings
1.	Hayashi T., Farrell M.A., Chaput L.A., Rocha D.A., Hernandez M. (2010)	Lifestyle Intervention, Behavioral Changes, and Improvement in Cardiovascular Risk Profiles in the California WISEWOMAN Project	Journal of Women's Health	Within-site randomized controlled study with an enhanced intervention group and usual care group.	Enhanced intervention group had bigger improvements in health behaviours. Improvement in 10-year CHD risk was greater aswell.
2.	Laaksonen D.E., Lindström J., Lakka T.A., Eriksson J.G., Niskanen L., Wikström K., Aunola S.,	Physical Activity in the Prevention of Type 2 Diabetes: The Finnish Diabetes Prevention Study	Diabetes	Multicentered, randomized, controlled trial.	Intervention group increased the strenuous, structured LTPA other than walking 62%.

	Keinänen-Kiukaanniemi S., Laakso M., Valle T.T., Ilanne-Parikka P., Louheranta A., Hämäläinen H., Rastas M., Salminen V., Sundvall J., Tuomilehto J., Uusitupa M. (2005)				Intervention group also had 62% increase in the $\geq 2,5$ h/week exercise group while control group increased it 46%. They were 44% less likely to develop DM 2 than sedentary people.
3.	Kuller, L. H., Kinzel L.S., Pettee K.K., Kriska A.M., Simkin-Silverman L.R., Conroy M.B., Averbach F., Pappert S., Johnson B.D. (2006)	Lifestyle Intervention and Coronary Heart Disease Risk Factor Changes over 18 Months in Postmenopausal Women: The Women On the Move through Activity And Nutrition (WOMAN Study) Clinical Trial	Journal of Women's Health	Randomized clinical trial	Best long-term results were achieved using lifestyle change (LC). There were noteworthy differences in the changes of risk factors between LC group and health education (HE) group.

4.	Moore S.M., Hardie E.A., Hackworth N.J., Critchley C.R. Kyrios M., Buzwell S.A., Crafti N.A. (2011)	Can the onset of type 2 diabetes be delayed by a group-based lifestyle intervention? A randomised control trial	Psychology and Health	Randomized control trial with a waiting control group.	Intervention group had a significant improvement in the measured factors, as compared to the control group. They also were more successful than the control group in reversing their pre-diabetic status, 43% vs. 26%, respectively.
5.	Parikh P., Simon E.P., Fei K., Looker H., Goytia C., Horowitz C.R. (2010)	Results of a Pilot Diabetes Prevention Intervention in East Harlem, New York City: Project HEED	American Journal of Public Health	Questionnaire.	Intervention group had greater weight loss than the control group. They also kept the weight off for 12 months. The results suggest that best results may be

					achieved using cost effective, peer-led programmes.
6.	Richardson G., van Hoerden H.G., Morgan L., Edwards R., Harries M., Hancock E., Sroczynsk S., Bowley M. (2008)	Healthy Hearths – A community-based primary prevention programme to reduce coronary heart disease	BioMed Central Cardiovascular Disorders	Self-screening questionnaire.	Inviting men and women who did not have a coronary heart disease (CHD) and assessing their 10-year risk, giving advices and further referrals decreased the 10-year risk of CHD.
7.	Stampfer M.J., Hu F.B., Manson J.E., Rimm E.B., Willett W.C. (2000)	Primary prevention of coronary heart disease in women through diet and lifestyle	The New England Journal of Medicine	Follow-up questionnaire in The Nurse's Health Study cohort in 1976.	Adhering the lifestyle plans concerning physical activity, non-smoking and diet related to low risk of CHD.

8.	Swain J.F., McCarron P.B., Hamilton E.F., Sacks F.M., Appel L.J. (2008)	Characteristics of the Diet Patterns Tested in the Optimal Macronutrient Intake Trial to Prevent Heart Disease (Omniheart): Options for a Heart-Healthy Diet	Journal of the American Dietetic Association	Randomized, three-period crossover controlled feeding trial.	CVD risk was reduced in all three diets compared to the baseline risk. Lowering the amount of carbohydrates further decreased the risk of CVDs.
9.	Thomas N.E., Baker J.S., Davies B. (2003)	Established and Recently Identified Coronary Heart Disease Risk Factors in Young People: The Influence of Physical Activity and Physical Fitness	Sports Medicine	Systematic literature review	The connection between the existing CHD risk factors in young people and physical exercise, fitness and nutrition is unclear.
10.	Tuomilehto H.,	Sleep Duration,	Diabetes Care	Lifestyle intervention	Long sleep was found

	Peltonen M., Partinen M., Lavigne G., Eriksson J.G., Herder C., Aunola S., Keikänen-Kiukaanniemi S., Ilanne-Parikka P., Uusitupa M., Tuomilehto J., Lindström J. (2009)	Lifestyle Intervention, and Incidence of type 2 Diabetes in Impaired Glucose Tolerance: The Finnish Diabetes Prevention Study		trial	to be connected with an increased risk of DM 2. It is suggested, that lifestyle interventions could reduce the risk.
11.	Tuomilehto J., Lindström J., Eriksson J.G., Valle T.T., Hämäläinen H., Ilanne-Parikka P., Keinänen-Kiukaanniemi S., Laakso M., Louheranta A., Rastas M., Salminen V., Uusitupa M. (2001)	Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance	The New England Journal of Medicine	Randomized trial with intervention group and a control group.	Diabetes occurrence was down to 58% during the trial. The change directly correlated with the intervention.

12.	Wannamathee S.G., Shaper A.G., Whincup P.H. (2006)	Modifiable Lifestyle Factors and the Metabolic Syndrome in Older Men: Effects of Lifestyle Changes	Journal of the American Geriatrics Society	Cross-sectional and longitudinal analyses of cohort study.	Lifestyle changes done, even in older age, are potentially beneficial in reducing the risk of metabolic syndrome.
13.	Williams P.T., Hoffman K.M. (2009)	Optimal Body weight for the Prevention of Coronary Heart Disease in Normal- weight Physically Active Men	Obesity	Questionnaire.	For reducing the risk of CHD to the minimum, it was found that the ideal BMI is around $<22\text{kg/m}^2$.

