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THE INFLUENCE OF LIFESTYLE ON FEMALE FERTILITY. REVIEW OF THE LITERATURE.

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Abstract

Women who want to get pregnant soon often ask their doctors how to prepare best. During such a visit, doctors usually mention folic acid supplementation, a check-up with the dentist and gynaecologist or vaccinations. However, it is also worth pointing out the importance of lifestyle factors that affect fertility and fetal development. Modifying daily habits can improve fertility naturally and make getting pregnant faster. An increasing number of studies are being published on the importance of nutrition, physical activity, sleep, stress, stimulants and other factors on women's reproductive health. This article is a summary of the current state of knowledge in this area.

Aim of the study

The aim of this study is to review the literature and summarize current state of knowledge on the association between lifestyle factors and female reproductive function.

Material and methods of research

This literature review based on research from PubMed platform. We searched articles describing connection between potentially modifiable lifestyle factors and women's fertility. Search terms included keywords: „lifestyle", „female fertility", „obesity", „sleep", „nutrition", „diet", „stress", „physical activity", „smoking", „alcohol", „weight loss", „reproductive health".

Keywords: lifestyle; fertility; nutrition; weight loss; reproductive impairment; reproductive health

Introduction

Nutrition, physical activity and associated with that body weight

The study showed that the lifestyles of fertile and infertile women differed, particularly in terms of diet and activity. These two aspects appear to have the most significant impact on women's reproductive capacity among lifestyle factors. Poorly balanced diets, both low-calorie and low-protein and hypercaloric leading to significant underweight or overweight, affect ovarian function and increase the risk of infertility in women. In the context of nutrition, it is not only the quantity of food consumed that is important, but also its quality.

First, it is important to pay attention to the index and glycaemic load of the foods consumed. Studies have shown that a diet containing high glycaemic index foods and high glycaemic load meals can cause metabolic disturbances and lead to insulin resistance and hyperinsulinaemia, which worsens fertility.This is because they affect tissue sensitivity to insulin. Hyperinsulinaemia and insulin resistance are also associated with higher IGF-1 and androgen concentrations and this can lead to impaired oocyte development. Insulin influences ovarian function and ovulation by participating in the follicular response to gonadotropin. Therefore, glucose metabolism and insulin sensitivity play an important role in the regulation of female fertility.

The type of fats consumed is also key. Trans fatty acids and saturated fatty acids appear to have the most adverse effects on female fertility. Research shows that choosing trans fats over monounsaturated fats greatly increases the risk of ovulatory infertility. Trans fatty acids have been shown to contribute to the development of insulin resistance, as well as other metabolic disorders, including PCOS, which also negatively affect reproductive health. Furthermore, consuming them in excess causes an increase in inflammatory markers. The opposite effect is shown by monounsaturated fats (MUFA). These fats can bind to the PPAR-γ receptor, thereby reducing inflammation and having a positive effect on fertility. Polyunsaturated fatty acids (PUFAs) also support female reproductive function. PUFAs influence LH and FSH concentrations, dominant follicle maturation, oocyte quality and ovulation induction. Polyunsaturated fatty acids are precursors of prostaglandins, which are important for successful implantation. A diet containing omega-3 fatty acids from oily sea fish has been linked to an increase in progesterone levels, while one containing docosapentaenoic acid has been linked to a lower risk of not ovulating. It was shown that women who consumed higher amounts of omega-6, linoleic acid and omega-3 fatty acids were more likely to become pregnant than those whose diets were deficient in these components. A low dietary intake of omega-3 fatty acids and a high intake of trans fatty acids were associated with lower fertility among women.

Dietary protein sources are also important. Studies have shown that protein from red meat and poultry significantly increases the risk of non-ovulatory infertility. For fish and egg proteins, no adverse effects have been described. Besides, studies show that a higher proportion of plant protein in the diet than animal protein is beneficial for female fertility. Consuming 5% of energy from plant protein instead of animal protein has been shown to reduce the risk of infertility from lack of ovulation by more than 50%. This may be due to the different effects of plant and animal proteins on the secretion of insulin and insulin-like growth factor IGF-1. The insulin response is lower with the consumption of plant protein than with the consumption of animal protein.

An unhealthy hypercaloric diet, consumption of trans-fatty acids and saturated fatty acids in excessive amounts and a high glycaemic index can lead to an increase in oxidative stress, which causes disturbances in carbohydrate metabolism and therefore increases the risk of infertility.

When discussing diet, it is also important to look at fibre content. It turns out that both too little and too much of it can negatively affect women's reproductive health. Studies have shown that consuming fibre more than the recommended dose is associated with a higher risk of not ovulating. On the other hand, it was discovered that the intake of fibre-rich foods was too low among infertile women.

The Mediterranean diet has been observed to have a positive effect on fertility. It presupposes the consumption of large amounts of plant-based foods (vegetables, fruit, nuts, cereals, olive oil), low-fat dairy products and oily seafood, and a low intake of products containing large amounts of simple sugars such as sweets. Such a diet may also reduce the risk of weight gain and, consequently, insulin resistance. On the contrery the western dietary model, which includes the consumption of foods with a high glycaemic index, high amounts of animal protein (especially red meat), products rich in saturated fatty acids and trans fatty acids with a low intake of vegetables and fruit. This kind of eating habits has been shown to adversely affect women's reproductive capacity through negative effects on endocrine metabolism. Based on this data, a ‘fertility diet’ pattern was created, which is based on a lower intake of animal protein relative to plant protein, the consumption of foods rich in iron, monounsaturated fatty acids, the restriction of trans fatty acids, the consumption of high-fat dairy products and carbohydrates with a low glycaemic index.

Physical activity also influences fertility. However, what is important is its intensity. Moderate physical activity has a positive impact on women's reproductive health, especially in those who are overweight or obese, as it helps to reduce body weight and especially abdominal fat, lower blood glucose, lipids and insulin resistance. The result is a reduction in testosterone levels and an increase in sex hormone-binding globulin (SHBG), leading to the regulation of menstrual cyclicity and ovulation and increasing the chances of conception. However, excessive exercise can harm fertility. When it comes to intense physical activity, it is easier to generate a negative energy balance and lead to a low BMI, which can result in hypothalamic dysfunction, changes in gonadotropin-releasing hormone (GnRH) pulsation and low estrogen levels through which menstrual disorders occur. This can be observed among athletes, who sometimes develop the ‘sportswoman triad’, a syndrome characterised by amenorrhoea, osteoporosis and eating disorders. Rigorous exercise increases the risk of non-ovulatory infertility and can cause implantation defects.

Diet and physical activity translate into body weight, which is an important aspect in the context of reproduction. As mentioned above- low body weight can cause endocrine dysfunction. It has been shown that compared to women with a normal BMI, underweight women take four times longer to become pregnant. Similar adverse effects have been observed in cases of overweight or obesity. The time to conception was also prolonged in these women. Women who are overweight often have a disorder of the hypothalamic-pituitary-ovarian axis, which leads to irregular menstrual cycles and lack of ovulation, resulting in infertility. It has been documented that obesity reduces natural fertility and that obese women have more than twice as high the risk of infertility due to ovulation disorders compared to normal body weight women. In addition, obese women have been found to have a higher incidence of endometrial pathologies and implantation disorders. Excess weight is also associated with poorer oocyte quality. The negative impact of obesity on fertility is due to the fact that adipocytes act as an endocrine organ. Adipose tissue releases adipokines that influence processes such as glucose and lipid metabolism, oocyte differentiation and maturation or the development of inflammation. Proper levels of adipokines are crucial for the correct functioning of the hypothalamic-pituitary-gonadal axis. Some studies have shown an inverse relationship of fertility in relation to an increase in BMI. In addition, the probability of spontaneous conception appeared to decrease linearly with each BMI>29 kg/m2 point in obese women with eumenorrhoea. The results of one study suggest that abdominal fat accumulation measured by waist circumference is the most important predictor of hypomenorrhea in apparently fertile women. Early signs of endocrine disruption such as scanty or irregular periods should therefore be a warning sign for women who are overweight or obese. Such women should be encouraged to reduce their body weight, as it is able to improve fertility by, among other things, restoring normal ovulation.

The role of rest

Nowadays, people live in a constant rush, are often exposed to stress and neglect their sleep, for example because of their high workload. However, it is important to remember that this is not indifferent to health, including reproductive health. Studies have shown that chronic stress can alter the physiological maturation of oocytes and can lead to impaired gonadotropin release, low serotonin secretion and elevated prolactin levels. It can also cause abnormal functioning of the immune system, which can adversely affect antibodies related to fertility. Besides, it was observed that stress levels were significantly higher in the group of infertile

women. Nevertheless, it should be considered that the stress among these women may be partly due to the diagnosis and treatment of infertility. It was shown that women who received counselling on how to effectively cope with stress (through a cognitive-behavioural intervention) or were given support had a higher conception rate than women who did not receive any help with stress relief. This means that women who receive support and counselling can reduce their anxiety and depression levels and therefore increase their chances of becoming pregnant.

Furthermore, it was found that women who had a job and worked more than 32 hours a week had a longer time to conception compared to women who worked between 16 and 32 hours a week. When it came to the link between sleep and fertility in women, the results of studies were inconclusive, but many found that inadequate sleep was associated with an alteration of the circadian rhythm of hormone secretion, resulting in impaired function of the HPG axis (hypothalamic-pituitary-hormone axis) and thus leading to impaired reproductive processes. Sleep disorders increase the risk of irregular menstrual cycles. Some studies have shown that less than six hours of sleep per day was associated with reduced fertility. The number of hours of sleep per day was significantly lower among the infertile group of women compared to the fertile group studied.

While more high-quality research in this area is needed, it is worth bearing in mind that in order to improve fertility, stress reduction and adequate sleep duration should also be taken care of.

Drugs

It is widely acknowledged that stimulants are harmful to health, but not everyone knows that they also negatively affect fertility. Chronic smoking has been proven to reduce the number of ovarian follicles and delay and reduce the chances of conception. Other studies have shown that women's smoking can lead to an increase in the thickness of the transparent coat, making sperm penetration more difficult. In addition, menopause was found to occur 1-4 years earlier in female smokers than in non-smokers. It has also been shown that smoking can alter fertility potential by affecting the function of the fallopian tubes and uterus, which mediate the transport of gametes and embryos. Another possible mechanism could be leading to endocrinopathies, which can cause menstrual disorders. This is because cigarettes contain harmful substances

such as cotinine or cadmium, which cause changes in hormone levels during the luteal phase and can affect the developing follicle.

Similar adverse effects on female fertility have been described for alcohol. In women who abuse alcohol, metabolic changes in the liver and/or psychoneurological damage co-occur with stress factors that inhibit oocyte maturation. As with cigarette smoking, changes in the regularity of menstrual cycles, a decrease in ovarian reserve and an earlier age of onset of menopause were observed with chronic alcohol consumption. The study showed that markers of ovarian reserve and fertility potential (FSH, AMH and antral follicle count) were lower among women who consumed alcohol than among those who did not. One study described that women's consumption of between one drink per week and five units per day resulted in increased time to pregnancy, reduced the likelihood of conception by more than 50%, reduced implantation rates, and increased the risk of spontaneous abortion. However, many mechanisms are still unknown.

For ethical reasons, there are few studies describing the effects of drugs on female fertility, and those available are biased because they are related to certain characteristics of the study population such as low socioeconomic status and inadequate prenatal care. Nevertheless, drugs seem to have a negative impact on fertility. Heroin and methadone consumption have been linked to the occurrence of amenorrhea. Cannabis use can cause hormonal misregulation and, in addition, cannabis contains cannabinoids, which bind to receptors located on reproductive structures and adversely affect movement through the fallopian tubes and placental development. For cocaine, impaired ovarian reactivity to gonadotropins has been reported.

Conclusion

Lifestyle undoubtedly has an impact on female fertility. Particularly important in this aspect are nutrition and physical activity to ensure adequate body weight. This is because obesity is an especially unfavourable factor affecting women's reproductive capacity. This condition involves changes in metabolic pathways and inflammatory factors that interfere with ovarian function and lead to ovulatory disorders (abnormalities in oocyte differentiation and maturation, reduced oocyte viability and altered ovulation rates). By reducing weight in obese

or overweight women, it is possible to restore normal cycles and thus increase the likelihood of conception.

Women who would like to become pregnant should pay attention to the above factors described in this article and modify them if possible. It is important that doctors inform patients that they themselves can control their fertility potential and that they are able to improve it by taking care of a healthy lifestyle.

In order to increase the chances of conceiving, it is worthwhile to take care of a healthy body weight (through a well-balanced diet with a Mediterranean pattern and moderate exercise), give up stimulants, reduce stress and sleep no less than 6h a day. Clearly, it is impossible to eliminate each of the adverse factors, but it is worth at least reducing them. Minimising even one negative factor can improve female fertility.

More research is needed on the effects of stress, sleep and stimulants on women's reproductive capacity. This will help to determine their exact significance.

Author's contribution

Conceptualization, Maria Janina Śmigielska-Mikołajczyk, Agata Szostak, Anna Szeliga; methodology, Kinga Szopińska, Karolina Oluszczak; software, Liliana Dyląg, Magdalena Graca; check, Weronika Łowicka, Karolina Korta; formal analysis, Konrad Wawszkowicz, Karolina Oluszczak; investigation, Kinga Szopińska, Liliana Dyląg; resources, Agata Szostak, Maria Janina Śmigielska-Mikołajczyk, Weronika Łowicka; data curation, Anna Szeliga, Magdalena Graca; writing-rough preparation, Konrad Wawszkowicz, Karolina Korta, Kinga Szopińska; writing-review and editing, Magdalena Graca, Weronika Łowicka, Liliana Dyląg; visualization, Konrad Wawszkowicz, Anna Szeliga; supervision, Karolina Korta, Karolina Oluszczak; project administration, Maria Janina Śmigielska-Mikołajczyk, Agata Szostak;
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