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Healthy Nutrition Can Impact Women's Fertility – Myth or Reality?

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ABSTRACT

Nowadays, women live in a stressful environment with numerous responsibilities and challenges, and fertility-related difficulties are one of them. Many factors influence female fertility, such as genetics, age, environment, sexually transmitted infections (STIs), lifestyle, etc. Researchers seek to find out which factors positively impact female fertility. The broad discussion around the interdependent correlation between healthy nutrition and fertility has recently unfolded. Studies give credible information on how vital nutrient density and food quality are for women's health. Consuming unsaturated fats, vegetables, fruits, fish, whole grains, legumes, and nuts positively affects female fertility. In contrast, trans fats, refined carbohydrates, animal protein, and others can negatively influence the reproductive system.

Keywords: Female fertility; fertility age; healthy diet; infertility nutrition; reproductive health.

INTRODUCTION

In the 21st century, people, especially women, live in a stressful environment with many challenges and responsibilities. Society demands too much from a woman – to look good, study well, find a good job, be an obedient daughter, be a good friend, wife, mother, etc. Living up to these expectations is stressful, overwhelming, and energy-consuming, creating extra health demands and risks. When women mentally, physically, and financially are ready to have a child, which is essential to achieve, they face different reproductive health issues. Time goes by, and a woman's fertility clock is ticking.

Statistics indicate that first-time mothers' age has increased. For instance, in Europe, the mean age of women at birth of their first child was 28.8 years in 2013. The mean age was increasing every year and reached 29.7 in 2021. The share of births to mothers aged 40 and over has doubled between 2001 and 2021, from 2.4% to 5.7%.[1]

It is known that increased age increases fertility problems. Women under 30 have an 85% chance of getting pregnant. This chance declines with age, with 40-year-old women having a 44% chance to conceive.[2] Increased fertility problems caused by aging mothers negatively influence the birth rate. In Europe, the number of live births per 1000 persons in 2001 was 10.2 and has decreased to 9.1 in 2021.[1] Age, genetic, sexually transmitted infections (STIs), environment, lifestyle, and other factors influence female fertility.[3] Worldwide, people face infertility problems. Almost one in six people have experienced infertility at some stage. According to the World Health Organization (WHO) report, which globally estimates the prevalence of infertility, indicates that lifetime prevalence is 17.5% and period prevalence is 12.6%.[4]

Infertility is a disease when a woman cannot get pregnant after 12 months or more of regular unprotected sexual intercourse.[5] Infertility can be primary - when a woman has never been pregnant, secondary - which appears after one successful pregnancy and unexplained when the infertility reason is unclear. Fertility-related issues are topical and crucially important to find factors that can positively impact female fertility.

This paper aims to identify whether healthy nutrition can positively influence female fertility.

The role of nutrition in health

Nutrition is essential for growth, development, reproduction, physical and mental well-being. It is indispensable to health.[6] An unhealthy diet can be a risk and trigger disease complications.[7] The role of nutrition in health was emphasized even in ancient Greece. Philosophers observed food's effect on people's health.[8] Pythagoras believed that lifestyle and healthy food (no meat) are essential for physical and spiritual health.[9]

During the day, the body needs certain nutrients for regular operation. Nutrients, such as carbohydrates, proteins, and fats, have a specific role in the body - they provide energy and are essential for body structure and functioning. Carbohydrates are the primary source of energy in the metabolic processes. There are two types of carbohydrates: simple and complex. Simple carbohydrates are quickly digestible substances and are the fastest energy source. Complex carbohydrates are a group of simple

carbohydrates with slower absorption, as they need to be converted into simple ones to absorb, which takes time. If a person intakes more straightforward carbohydrates than necessary, the body stores the excess carbohydrates between cells and turns them into fat.[10] Proteins are structural nutrients for building or renewing body bones, muscles, organs, and tissues. Protein consists of amino acids. It has a complex composition; therefore, the body needs more time to digest and absorb it, so proteins are a long-lasting energy source.[10] Fats are stored in the body's fat tissue. They protect vital organs and also prevent the body from heat loss. Fatty acids are essential for producing hormones, cell membranes, and other substances. Fats have a complex structure, and the body needs time to absorb them, but at the same time, they are the most efficient source of energy. The body stores excess energy as fat under the skin and uses it when needed, for instance, during growth, illness, injury, or in case of reduced intake of nutrients. Fats are monounsaturated, polyunsaturated, saturated, and trans fats. It is preferable to use unsaturated fats as trans fats and saturated fats (fats, mainly from animal sources) increase the risk of health-related problems. If the body gets excessive unhealthy fat, it begins to accumulate in blood vessels and organs, which is a cause of many diseases.[11] Vitamins and minerals are essential for the body's structure and function. Usually, the body absorbs them from food products. Most people do not observe a balanced eating routine, and some have absorption problems, so mineral and vitamin supplementation is necessary daily. The essential role of water for a body is also noteworthy. Water makes body systems function properly. It is in every cell; it hydrates, carries blood cells and nutrients, and has a cleansing function.[11]

To summarize, it is clear that healthy nutrients are essential for everyday life. Unfortunately, in many countries, daily diet is based on food with low nutritional density.[12] People must consume a varied diet to obtain a wide range of nutrients. Healthy dietary patterns should consider nutrient density (ND: amount of nutrients per reference amount of food) and nutrient profiling (NP: assessment of nutrient quality).[13] Studies suggest moderate eating can decrease the risk of cardiovascular diseases, type II diabetes, and other chronic diseases.[14] Nutritionists focus on providing diverse dietary choices for individuals to reduce the risk of diseases.

Nutrition and Female fertility

Nutrition, as one of the leading aspects of women's health, is a significant issue for medical and public health fields. The role of nutrition, once again, was emphasized during the 2012 World Health Assembly. The WHO established Global Nutrition Targets 2025, addressing overweight, malnutrition, and reproductive-age women's nutrition needs.[15]

Women's reproductive health system is full of changes during the life cycle. Menarche, premenstrual syndrome (PMS), pregnancy, and menopause are associated with psycho-emotional and (in some cases) physical stress. External factors can sever these processes, such as environment, socio-economic, living and working conditions, etc. One major external factor was the COVID-19 pandemic, which wholly isolated countries, disrupted health systems, paralyzed the world, and changed everyone's life. People lost jobs and income and could not feed themselves with proper nutritious food.[16] The factors mentioned above can trigger the development of eating disorders, mental health issues, and reproductive system dysfunction.

Women and girls around the world, because of nutrition-related issues, are losing the potential to achieve reproductive health and not only. Three of 17 Sustainable Development Goals (SDGs) - No hunger, good health and well-being, and Gender equality – are most pertinent to women's health needs, which is already a step forward.[17] However, more has to be done to increase awareness in the society.

As mentioned above, one of the main challenges to women's health is fertility-related issues. Fertility is the capacity of a woman to get pregnant and give birth to a child naturally.[18] Although not everything is clarified, and many unanswered questions exist, studies emphasize the positive link between healthy nutrition and women's reproductive health. In contrast, unhealthy eating behaviors can cause fertility-related problems.

Some examples below clearly illustrate unhealthy nutrition's role in infertility-related problems. Uncontrolled daily intake of carbohydrates can cause obesity or type II diabetes, which is associated with fertility problems.[19] Obesity can be one of the primary triggers of menstrual cycle disruption, anovulatory cycle, and infertility in reproductive-age women. The adipose tissue is not only a depot of calories; it is a sizeable endocrine organ in which a whole set of hormones and cellular active substances are produced and transformed. For instance, some amount of estradiol is produced in fat tissue, the most crucial hormone for the functioning of the reproductive system. In the case of obesity, the level of this sex hormone increases and causes ovulatory dysfunction and anovulation in women.[20]

Also, there is a connection between obesity and insulin resistance hyperinsulinemia. Insulin is one of the potent stimulators of androgen synthesis in the ovaries. Hyperinsulinemia leads to the overproduction of androgens. Hyperandrogenism itself leads to menstrual abnormalities and changes in ovarian steroidogenesis. Studies have unequivocally confirmed that insulin resistance, hyperinsulinemia, and obesity are some of the main factors causing polycystic ovary syndrome (PCOS), which can become a cause of infertility.[20,21] At the same time, insulin

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resistance can adversely affect developing eggs and cut in signaling pathways in the brain that regulate oogenesis.[19]

A prospective cohort study evaluated the association between dietary energy density (ED) and the probability of conceiving. The study found that high dietary ED can reduce fertility.[22] Individuals who are overweight or obese and have fertility problems are advised to restrict caloric intake, avoid high glycemic index food, and increase exercise.

Not only obesity but also being underweight can be a reason for fertility-related problems. Eating disorders, such as anorexia or bulimia, cause an inadequate supply of nutrients and majorly impact a woman's endocrine system. Any influence on the endocrine system can disrupt the ovulation process and lead to irregular menstrual cycles, ovarian dysfunction, premature menopause, and infertility.[23]

In most women's everyday lives, coffee is a must-drink. Many years have been of discussions about whether caffeine can hinder fertility. The typical attitude in the 90s was that women who drank coffee every day were half as likely to conceive. However, there are no other studies that showed similar results. On the other hand, one of the most significant prospective cohort studies, with 3628 female participants planning a pregnancy, evaluated the association between caffeine and fertility. The study found that women who drank 300 mg of caffeine per day, compared to those who drank less than 100 mg or none per day, had no difference in fertility rates.[24] The other study, with one cohort and three case-control studies with 12,912 participants, showed that low, medium, and high caffeine intake does not increase the risk of infertility.[25] However, the relationship between caffeine and fertility has yet to be clearly defined. Therefore, specific counseling is recommended with the doctor about caffeine consumption for women trying to conceive.

Until recently, society believed that healthy nutrition was only adequate for obesity. Nowadays, there is knowledge that healthy macronutrients and micronutrients are necessary for general well-being, which includes the proper functioning of the reproductive health system. The role of macronutrients in the body was explained in the previous subsection.

The importance of micronutrients for women's reproductive health, such as calcium, iron, selenium, zinc, vitamins especially B12, and folic acid (vitamin B9) with recommended doses, was emphasized last period. For instance, daily intake of folic acid is essential to prevent neural tube defects during pregnancy, increase a woman's chance of fertility, and carry a pregnancy to term. The daily recommended dose of folic acid is at least 400 micrograms for women trying to conceive. The micronutrients can be found in food products - Folic acid in vegetables, fruits, nuts, seafood, eggs, dairy, and meat; Calcium in dairy products, cabbage, kale, broccoli, almonds, tofu, sardines with bones; Iron in beans, vegetables, cereals, bread, selenium in nuts, seafood, fish, shrimp, muscle meats, cereals, dairy products; Vitamin B12 in fish, meat, poultry, eggs, milk, etc. Even though soy products were known as avoidable products for fertility, there are some arguments about dairy and soy products' positive effects on reproductive function. However, it requires additional research.[19]

The SUN (Seguimiento Universidad de Navarra) cohort study, which was conducted from 1999 until 2018, with 22,786 participants, an average of 35 years old, found that the Mediterranean diet (MedDiet) may enhance fertility and hence shows a positive association with fertility.[26,27] MedDiet is a plant-based diet that includes daily whole grains, olive oil, fruits, vegetables, beans, other legumes, nuts, herbs, and spices. The preferred animal protein is fish and seafood.[14] A similar impact was shown in another study between the Mediterranean diet and female fertility, emphasizing genetic and ethnic factors.[28]

Another cohort study, where 18,555 participants consumed food that contained plant-origin proteins, low-glycemic carbohydrates, monounsaturated fatty acids, and supplements with iron, folate, and multivitamins, found a positive association between healthy diet and fertility.[29]

A prospective study assessed adherence to the Med diet, the alternate Healthy Eating Index 2010, the Fertility Diet developed based on risk factors for anovulatory infertility, and a pro-fertility diet developed by the researchers based on factors previously related to assisted reproductive technologies outcomes (higher intake of supplemental folic acid, vitamin B12, vitamin D, low- rather than high-pesticide residue produce, whole grains, dairy, soy foods, and seafood rather than other meats). The results showed that higher adherence to the Med Diet was associated with increased clinical pregnancy and live birth probability.[30,31]

CONCLUSION

The body system works as a whole, and what is beneficial for overall health is suitable for the reproductive health system. Developing healthy eating behavior is vital for fertility. Studies show that healthy nutrition, be it a Med diet, low glycemic index food consumption, plant-origin proteins, unsaturated fats, etc., positively impact female fertility. This certainly is NOT a myth.

However, further studies are necessary to define the exact daily dose of nutrients to reach the best results for female fertility. No specific diet has been proposed so far. Many ongoing research studies investigate the association between healthy nutrition and fertility, which will explore and explain much more in this field.

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