THE PUBLISHING HOUSE
OF THE ROMANIAN ACADEMY

NATALITY-FERTILITY-FOOD TRIAD: REDUCING INFERTILITY THROUGH LIFESTYLE

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Accepted May 25, 2022

One of the known and widely researched causes of infertility is malnutrition, a major public health problem worldwide. In the case of males, infertility has been associated with high consumption of saturated fatty acids, trans fats, cholesterol, and sodium, along with poor consumption of vegetables and foods rich in antioxidants. Scientific studies performed on young males show that a diet rich in whole grains, fish, and vegetables leads to increased sperm quality. Sperm quality was negatively associated with body weight and body mass index (BMI), the principle being reversible. In the case of females, the influences of nutrition on fertility are determined by both the level of education and socioeconomic status. In underdeveloped countries, malnutrition tends to be the dietary cause of infertility, and in developed countries, obesity and eating disorders are more common influencing factors. BMI with values above 25 kg/m^2 or below 19 kg/m^2 increases the risk of infertility in females, but also that of miscarriage. Dietary counseling is an important action in treating infertility, thus representing a possible factor in increasing birth rates. To prevent infertility, multidisciplinary interventions are needed, including community dietary counseling, ongoing personalized nutrition intervention while increasing the level of nutrition education among the population.

Keywords: birth rate, infertility, nutrition, diet, malnutrition.

INTRODUCTION

The birth rate in Romania has undergone major changes. From 1955 to 2020 the TFR (*Total Fertility Rate*) changed from over 3.1 in 1955 to a minimum of 1.3 in 2000–2005, while nowadays the TFR is 1.6. According to the current data, a constant TFR of 2.1 is required to maintain native population in Romania.[1] In 2020, the number of births was still under the ideal value.[2] Due to these results, several national and international policies have been adopted to promote natality, of which: promoting sex education in schools, implementing compulsory health education for children and adolescents, promoting a healthy lifestyle, nutrition education for both children and adults, more careful assessment of nutritional status, screenings for early detection of lifestyle-related pathologies and more.

Based on the literature report, one of the main causes of reduced birth rate is infertility. Theoretically, infertility is the inability to conceive after one year (or more) of constant attempts and is a common problem affecting both genders.[3] There are many risk factors for infertility, in addition to diet and nutritional status: age (especially maternal), high-intensity physical activity and high volume, sedentary lifestyle, various sexually transmitted diseases, stress, and exposure to various chemical pollutants.

Proc. Rom. Acad., Series B, 2021, *24(1)*, p. 79–83

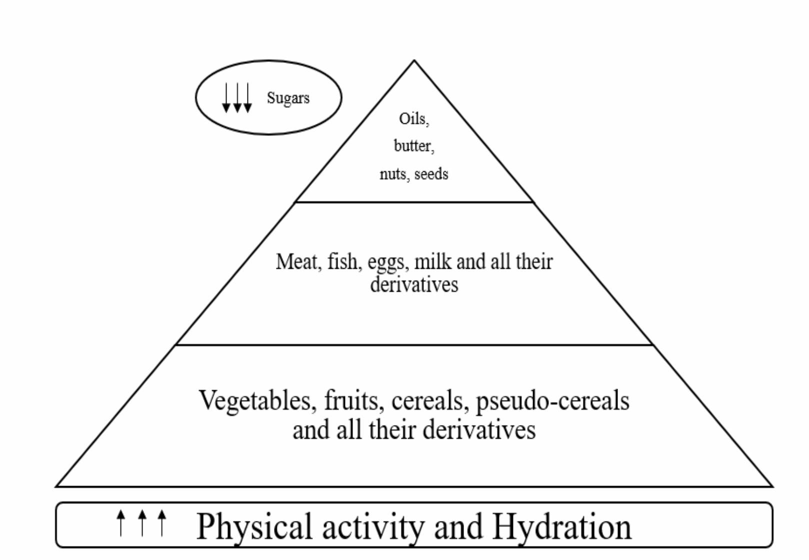

Figure 1. Food pyramid.

FOOD INTAKE AND THE CHARACTERISTICS OF A BALANCED DIET

One of the known and widely researched causes of infertility is malnutrition. Malnutrition refers to inadequate nutrient intake compared to individual needs, being seen in both excessive and deficient food intake. However, malnutrition is a worldwide public health condition which affects human mortality rate.

A large number of scientific projects have been carried out on an ongoing basis to assess the daily need for food and nutrients, to maintain health condition and proper development rate. However, there are no important results regarding food intake. However, studies aproaching nutrigenetics proved to be important in implementing a correct and personalized diet plan.

Although individual ideal portions are constantly changing according to research results, some dietary principles have been implemented in the community in order to improve nutritional education among the population. Thus, the food pyramid (Figure 1) includes various dietary principles which should be applied in daily food intake. From them we mention: the use of plant-based products (vegetables, fruits, cereals, and pseudocereals, along with all their derivatives), in combination with a medium consumption of low-fat animal products (lean meat, fish, eggs, dairy products), and low ingestion of fats and sweeteners. Similar interventions reduce anthropometric imbalance in malnutrition, with or without the association of some medical conditions. Yet, the main outcome is further related to a personalized intervention, monitored by a multidisciplinary medical team.

FOOD INTAKE AND MALE FERTILITY

In male patients, infertility has been associated with high consumption of saturated fatty acids, trans fats, cholesterol, and sodium, along with lack of vegetables (vegetables and fruits). High saturated fat foods such as meat (sausages, smoked products, etc.), red meat (pork, sheep, beef, etc.), high-fat dairy products (butter, cream, Greek yogurt, etc.), and refined/highly processed products (fast food products) are associated with the risk of male infertility. Trans fats are mostly found in processed foods such as margarine, fast food, chips, etc.

Low consumption of foods high in antioxidants was early correlated with male infertility[4]. More specific, antioxidants are chemical compounds involved in preventing the oxidation of other products. Over time, several reaserch papers proved their importance in preventing cancer, Alzheimer, next to cardiovascular and autoimmune diseases.

In man aged between 18 and 55 years, the consumption of skimmed milk products and especially skimmed milk was related to an increased sperm concentration and motility[5], while the consumption of red meat was negatively associated with these parameters.[6,7] Scientific studies performed on young males (18–22 years) show that a high intake of whole grains, fish and vegetables (fruits and vegetables) can increase sperm quality. Yet, the sperm quality was negatively and statistically significantly associated with the body weight and BMI (Body Mass Index).[8-10] However, some papers show that the outcome is reversible and by improving the body weight one can increase the chances of conception.[11]

Studies show that oral supplementation with Q10 coenzyme (300 mg/day) during 26 to 48 weeks may influence sperm quality.[12-14] Also, supplementation with vitamin E during 24 weeks had positive effects, as well as using EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid) during 32 weeks period.[16] Although more attempts have been made to increase male fertility by using several mineral or vitamin supplements, no significant improvements were seen after ingestion of selenium[17], beta-carotene[18,] or carnitine[19].

FOOD INTAKE AND FEMALE FERTILITY

In female patients, nutrition can affect fertility, based on the level of education and socioeconomic status. Thus, in underdeveloped countries, malnutrition tends to be the main cause of infertility, while in developed countries obesity and eating disorders (anorexia nervosa, bulimia) are more commonly seen.[20]. The quality of the diet can also influence female fertility through changes in body composition, a very small percentage of adipose tissue being associated with amenorrhea. Therefore, a drop in body weight regardless of the percentage of active mass, can influence ovulation, implantation, and fetus development.

Body mass index, with values above 25 kg/m^2 or below 19 kg/m^2 increases the risk of infertility in females but also the risk of miscarriage regardless of body composition.[21,22] Obesity, represented by excessive total weight, in the absence or presence of associated pathologies, can negatively affect female fertility by inducing hormonal imbalances, changes in the menstrual cycle, abortion, premature birth, fetal development problems, increased risk of gestational diabetes.[23-26]

Eating disorders associated with malnutrition influence both fertility and the response to specific treatments, the process being reversible in the absence of other pathologies.[27]

Other lifestyle factors that can affect fertility in both sexes are tobacco, coffee, and alcohol consumption. In female patiens, the use of tobacco increases the risk of miscarriage, reduces the chances of conception and response to treatment, while in males, sperm quality and motility can be affected.[28]

Micronutrients such as iodine can affect fertility. During pregnancy, due to the increased iodine needs, the daily food intake becomes of particular importance. Supplementation can maintain maternal health but also fetal development and reduce the risk of abortion.[29] Iodine deficiency has been associated with intrauterine growth restriction, neonatal mortality, abortion, preeclampsia, placenta previa, and conception problems. Vitamin D is involved in increasing the birth rate by supporting the immune system, reducing the risk of preeclampsia, gestational diabetes, miscarriage, premature birth, and/or restriction of intrauterine growth, Therefore, it is widely recommended to constantly monitor the level of vitamin D and iodine before conception.[30] Other micronutrients associated with (but not limited to) female fertility that requires careful dietary monitoring to prevent deficiency or excess (usually by supplementation and not by direct food consumption) are zinc, iron, selenium, vitamin B6, folic acid, vitamin B12, vitamin A, vitamin C and vitamin E.[31] In addition to vitamin D status, vitamin D-binding protein (VDBP) status may affect fertility. Early studies proved that low circulating values are associated with endometriosis, infertility, miscarriage, preeclampsia, preterm birth, also affecting the weight of the baby at birth and the development of the fetus. Elevated VDBP values are positively associated with miscarriage, and/or premature rupture of membranes.[32] VDBP monitoring is also recommended for males of childbearing age, especially for infertility.[33]

DIETARY INTERVENTION FOR INFERTILITY PREVENTION

Nutrition education and health education represent measures that can increase fertility at reproductive age.[34, 35]

Adequate carbohydrate intake tends to be essential in order to maintain general health and reproductive function. More specific, the intake of complex carbohydrates (from whole grains, vegetables, legumes) is generaly recommended while limiting the consumption of simple carbohydrates / or those with a high glycemic index (sugar, honey, refined / processed cereals, and other synthetic inducers). In the absence of special characteristics (very high level of physical activity, the presence of metabolic problems), the diet of a healthy adult (regardless of sex, but with small variations depending on age) will include 45–65% carbohydrates, the equivalent of 130 grams/day and 25–28 grams of fiber. Consumption of sugars and sweeteners is limited to less than 10% of total caloric intake for both sexes.[36] Although the benefits of low-carb diets for maintaining reproductive health and fertility have been analyzed over time, the results are insufficient to recommend such measures.[37]

Protein intake requires special attention and will include an average of 46 grams/day for females and 56 grams for males, representing 10–35% of the total energy intake during a day. Protein requirements are influenced by several factors such as physical activity level, stress level, sleep quality, active body mass, or health, and individual monitoring should be considered.[36]

Fat intake will vary between 25 and 35% of total calories, while saturated fats should be limited to less than 10% of the daily energy intake.[36]

In the case of women with confirmed pregnancy, the ideal protein intake is 71 grams/day throughout pregnancy, with an increased carbohydrate requirement, of 175 grams/day. In terms of fiber intake, the main recommendation is to consume 14 grams of fiber for every 1000 calories ingested and to ensure a fat intake between 20 and 35% of total caloric intake. Saturated fats and sugars will each be limited to less than 10% of total caloric intake, a nutritional measure recommended even before conception.[36]

The Mediterranean diet is a current standard regarding daily food intake due to its appliance and positive effect over fertility in both sexes.[38] Furthermore, fertility is improved following high amounts of fruits and vegetables consumed on a daily basis[39]. However, in the absence of nutritional education adherence to a healthy lifestyle is a common problem.[40]

CONCLUSIONS

Unbalanced diet and sedentary lifestyle are one of the causes of increased infertility rate in both sexes. Dietary counseling is an important action in treating infertility, thus representing a possible factor in increasing natality. To prevent infertility, multidisciplinary interventions are needed, including community dietary counseling, along with ongoing personalized nutrition intervention, while increasing the level of nutrition education of the population.

Conflict of interest: The authors have nothing to declare.

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