Proceedings of the 4th International Conference on Biological Engineering and Medical Science
DOI: 10.54254/2753-8818/70/2024.18845

Effects of a vegetarian diet on pregnant women

Yumeng Zhou

Henan University of Technology

zhouym0319@outlook.com

Abstract. The aim of this paper is to explore the effects of vegetarianism on pregnant women, including the nutritional requirements during pregnancy, the nutrient composition of vegetarian diets and their potential effects on maternal and fetal health. Through a review and analysis of the existing literature, it was found that vegetarianism may have positive effects on pregnant women during pregnancy, such as reducing pregnancy sickness and avoiding excessive weight gain, but it may also lead to nutritional deficiencies, such as anemia and fetal growth retardation. This paper emphasizes that when choosing a vegetarian diet, pregnant women should self-assess, consult their doctors, and seek alternatives to compensate for nutrients lacking in the vegetarian diet to ensure their own health and that of their fetus.

Keywords: vegetarian diet, pregnant women, nutrition, fetus, health.

1. Introduction

Vegetarian diet in nutrition or medicine is a diet based on plant-based proteins such as grains, fruits and vegetables, legumes and nuts. Vegetarian diets can generally be separated as can be categorized as full vegetarian and semi-vegetarian. A full vegetarian diet is one that does not use any meat, while a semi-vegetarian diet includes a lacto-vegetarian diet, an egg-vegetarian diet, a lacto-egg-vegetarian diet, and a fish-vegetarian diet[1]. Vegetarianism is becoming a popular diet as people are increasingly concerned about healthy eating. For pregnant women, the appropriateness of choosing a vegetarian diet has been a controversial topic. In this paper, we will discuss the effects of vegetarianism on pregnant women from three aspects: the nutritional requirements during pregnancy, the nutritional composition of vegetarian diets, and their potential effects on the health of pregnant women and fetuses.

2. Nutritional requirements during pregnancy

Pregnancy is a special stage in a woman's life, and balanced maternal nutrition during pregnancy is vital for both the mother and the fetus. Pregnant women in the early stages of pregnancy should be light and palatable, eat small meals to ensure that the intake of adequate amount of food containing carbohydrates, while in the late stages of pregnancy should be appropriate to increase the intake of fish, poultry, eggs, lean meat, seafood, dairy, and often eat iron-rich foods[2]. Pregnant women need to consume enough protein, fat, carbohydrates, vitamins, minerals and other nutrients that are vital to the health of the pregnant woman and the fetus, such as iron to help prevent anemia, and protein is important to the development of the fetus. According to the Guidelines for the American and Mediterranean Diets, adherence to food safety recommendations before and during pregnancy should

DOI: 10.54254/2753-8818/70/2024.18845

avoid inadequate levels of key nutrients and micronutrients (protein, iron, folic acid, vitamin D, calcium, iodine, omega-3, and vitamin B12), which may predispose the offspring to chronic diseases later in life, such as obesity, diabetes, cardiovascular disease, and Neurodevelopmental delays[3]. According to academics such as Deborah et al, a vegetarian or vegan diet for pregnant women can essentially fulfill the nutritional needs of pregnant women[4].

2.1. Role of the nutrient calcium

2.1.1. Maintaining bone health. Calcium is a major component of bones and teeth and helps maintain healthy bones in pregnant women. During pregnancy, a large amount of calcium is stored in the mother's body for the growth and development of fetal bones and teeth. Dietary calcium deficiency not only affects the calcification of fetal bones, but also causes lowering of blood calcium in pregnant women, calf muscle spasms (leg cramps), osteoporosis, etc.[5].

2.1.2. Fetal skeletal and dental development. From the 18th week of pregnancy onwards, the fetus needs a lot of calcium for calcification of its bones and teeth, so the mother needs to provide enough calcium to meet the needs of the fetus. Calcification of fetal bones and teeth starts at 2 months and suddenly accelerates after 8 months, so a large amount of calcium is absorbed from the mother's blood to meet the need[6]. If a pregnant woman is deficient in calcium, the fetus will suffer from poor development, which will affect the normal growth of its bones and teeth.

2.1.3. Prevention of pregnancy complications. Proper calcium supplementation can reduce the risk of complications such as gestational hypertension and preeclampsia. Gestational hypertension is a disease specific to pregnancy, the incidence rate is about 5%~10%, the pathogenic factors are more complex, the disease will reflect a series of manifestations such as high blood pressure, proteinuria, edema and so on[7]. Hypertension in pregnancy is extremely harmful to the health of mothers and infants, and can cause postpartum hemorrhage, placenta previa, intrauterine distress and other adverse pregnancy outcomes while causing abnormal elevation of maternal blood pressure, and is a key factor in maternal and perinatal deaths during pregnancy[8]. Studies have shown that daily calcium supplementation of $\geqslant$1000 mg significantly reduces the risk of preeclampsia and preterm labor in women on a low-calcium diet.

According to research, pregnant women calcium supplementation to balance supply and demand, in early, middle and late pregnancy, the average daily accumulation of fetal calcium were 7 mg, 110 mg and 350 mg, plus the balance of maternal calcium metabolism on calcium demand for 300 mg / day, as well as the maternal absorption rate of calcium in the food for 30%, according to the Chinese Nutrition Society, "Dietary Nutrient Reference Intake for Chinese Residents (2013 version)" recommended that pregnant women daily calcium recommended intake: 800 mg in early pregnancy (up to 14 weeks), middle and late pregnancy (after 14 weeks) and breastfeeding 1000 mg to meet the calcium needs of pregnancy. Accordingly, the Recommended Dietary Allowance for Calcium (2013 Edition) of the Chinese Academy of Nutrition recommends that the daily intake of calcium for pregnant women should be 800 mg in early pregnancy (before the 14th week of gestation), and 1,000 mg in mid- and late-pregnancy (after the 14th week of gestation) and lactation in order to meet the calcium needs during pregnancy. Calcium-rich foods should be the mainstay of intake. When dietary calcium intake is insufficient, calcium supplements can be taken at[9].

2.2. Role of the nutrient protein

2.2.1. Promoting Fetal Development. Protein is an important component that makes up the tissues and organs of the fetus. Adequate protein supplementation for pregnant women can provide the necessary nutritional support for the brain, bones and muscles of the fetus, thus promoting its normal growth and development. Pregnant women should choose to consume high-quality proteins, such as eggs. With

DOI: 10.54254/2753-8818/70/2024.18845

the growth of the fetus, pregnant women need more proteins, and animal proteins should account for half of the total protein intake in a day. Eggs are a kind of high-quality proteins, which is a kind of animal proteins, and eggs are also rich in all kinds of amino acids required by the human body as well as many kinds of microelements, such as calcium, iron, phosphorus and so on, and they are an important substance for the composition of various enzymes of the human body[10].

2.2.2. Maintenance of maternal health. During pregnancy, pregnant women have an increased need for protein due to pregnancy reactions and physical changes. Adequate protein can help pregnant women maintain the health of the uterus, placenta and mammary glands, and prevent the occurrence of adverse conditions such as hypoproteinemia, edema and anemia. If the placenta is underdeveloped it can not only bring about a variety of pregnancy disorders during pregnancy, jeopardizing maternal safety and health, but also poses a threat to their long-term health after delivery[11]. Epidemiological studies have shown that the risk of hypertension, ischemic heart disease, and stroke in preeclamptic patients is 3.7, 2.6, and 1.8 times higher than that of normal pregnant women in the first 10 to 20 years of pregnancy, respectively, and the risk of diabetes mellitus is two times higher than that of normal pregnant women. This suggests that placental dysplasia is one of the most important risk factors for maternal chronic diseases such as cardiovascular disease and diabetes mellitus in the long term[12].

According to the recommendations of the American College of Nutrition (ACOG), pregnant women should consume about 70 grams of additional protein per day, which is equivalent to twice the amount needed by an average adult woman. Specifically for different stages of pregnancy, for example, an additional 15 grams of high-quality protein per day is needed in mid-pregnancy, while about 25 grams are needed in late pregnancy.

3. Nutritional Composition of Vegetarian Food

Vegetarians rely heavily on plant-based foods such as vegetables, fruits, whole grains, and legumes in their diet. These foods are rich in dietary fiber, vitamins, minerals and other nutrients that are beneficial to the health of pregnant women. However, vegetarian diets are relatively low in important nutrients such as iron, protein and fat, and certain nutrients, such as vitamin B12, are found mainly in animal foods. Therefore, it is difficult for a vegetarian diet to meet the comprehensive nutritional requirements during pregnancy.

Vegan pregnant women need to pay special attention to DHA supplementation during pregnancy, as DHA is essential for fetal brain and retina development. Studies have shown that vegan women have 20-40% lower DHA levels compared to omnivorous women, and that breast milk levels of DHA are lower in vegan women[13-14]. However, the effect of vegetarian or vegan diets on ARA (a polyunsaturated fatty acid, a nutrient required for infant physical development) status is unknown. Erythrocyte ARA concentrations were similar in 4-week-old infants of vegan or omnivorous mothers, but DHA concentrations in the erythrocytes of vegan mothers were 70% lower than in those of omnivorous mothers. Lakin et al. reported that the proportion of ARA in the erythrocytes of recently bred vegan women was reduced by 16%, and that of DHA was reduced by 5%, compared with that of omnivorous animals. In addition, the proportion of DHA in umbilical cord tissue was 36% lower in vegetarian pregnancies compared to omnivorous women, but there was no difference in ARA[15]. DHA is an important substance needed for human brain growth and development. DHA is one of the essential n-3 fatty acids, which plays a positive role in human health, can effectively promote brain development, improve vision, prevent cardiovascular system diseases, etc., and is an important part of the brain and retina of infants. DHA is an important component of nerve cells and retina, and is an important nutrient for maintaining the health and growth of the nervous system[16].

In China, the risk of vitamin B12 deficiency is higher during pregnancy, and the risk of vitamin B12 deficiency increases as the pregnancy extends, so vegan pregnant women are at high risk for vitamin B12 deficiency[17]. According to the German Lacto-Egg Vegetarian Pregnant Women Study, vegan mothers whose breast milk has insufficient concentrations of vitamin B12 are at high risk of

DOI: 10.54254/2753-8818/70/2024.18845

obtaining nutrient deficiencies in their offspring, and these vitamin B12 deficient infants, the deficiencies manifested themselves in severe developmental and neurological symptoms[18].

4. Potential effects of a vegetarian diet on maternal and fetal health

4.1. Adverse effects

Pregnant women are prone to anemia during pregnancy when they consume only vegetarian food, due to the low iron content in vegetarian food and the low absorption rate of plant-based iron. Pregnant women have an increased need for iron during pregnancy, which can easily lead to anemia if the intake of iron in the vegetarian diet is insufficient. Anemia is the most common nutritional disease in pregnancy, and clinical studies have found iron deficiency to be the leading cause of anemia in pregnancy[19]. Anemia not only affects the health of the pregnant woman, but may also adversely affect the growth and development of the fetus. IDA (Iron Deficiency Anemia) during pregnancy is a common nutritional deficiency disease among pregnant women in China, with an incidence rate of about 30%, which has many adverse effects on the health of the mother and the fetus. IDA in pregnant women can induce preterm delivery, low birth mass children, fetal growth retardation, stillbirth and anemia heart disease in pregnant women, and it is also very easy to induce IDA in infants and young children, which is a serious threat to the health of mothers and infants for two generations.[20-21].

Secondly, excessive consumption of vegetarian food may lead to retarded development of the fetus, which requires a large amount of energy substances such as proteins, fats and carbohydrates for its growth and development. Vegetarian diet may not be able to provide sufficient energy and nutrients, leading to fetal developmental delay. In addition, some essential nutrients, such as vitamin B12, are crucial for the development of the nervous system, and a deficiency may lead to impaired mental development. Vitamin B12 is an important coenzyme in the process of cellular DNA synthesis, as well as a major nutrient in the metabolism of FA (folic acid), which can participate in the metabolic process of sugar, protein and fat in human tissue cells, and its level is closely related to the development of the fetal nervous system. During pregnancy, pregnant women's demand for vitamin B12 increases, due to the fact that the neural tube of the fetus has already begun to develop in the early stages of pregnancy, while the human body cannot synthesize its own vitamin B12, can only be exogenously ingested, if pregnant women do not have enough intake of vitamin B12, not only increase the risk of pregnant women to develop high Hcy (homocysteine) anemia, but also may lead to birth defects in the fetus and undesirable outcomes of the offspring [22].

4.2. Favorable impacts

A vegetarian diet reduces the intake of saturated fat and cholesterol by pregnant women, which reduces the risk of chronic diseases such as high blood pressure and diabetes. In addition, vegetarians typically have lower body weight and less abdominal obesity, which can help prevent gestational diabetes and high blood pressure. Although a strict vegetarian diet may require additional supplements of certain nutrients (e.g., vitamin B12, iron, calcium, etc.), the nutritional needs of pregnant women and their fetuses can be effectively met through a sensible diet of nuts, legumes, whole grains, vegetables and fruits. For example, flaxseed oil, nuts and algae are good sources of DHA, which helps fetal brain development.

5. Conclusion

The impact of a vegetarian diet on pregnant women is twofold. On the one hand, certain nutrients in a vegetarian diet are beneficial to the health of pregnant women, such as reducing pregnancy sickness and avoiding excessive weight gain; on the other hand, a vegetarian diet is difficult to meet the comprehensive nutritional needs during pregnancy, which may lead to problems such as anemia and delayed fetal development. Therefore, when choosing a vegetarian diet, pregnant women should self-assess, consult their doctors and look for alternatives to make up for the nutrients lacking in a

vegetarian diet. In addition, pregnant women should consume meat as appropriate during pregnancy to ensure a balanced intake of various nutrients.

Vegetarian diet is one of the popular dietary methods in recent years, and whether its nutrient types can meet the human body's needs is one of the criteria for judging the advantages and disadvantages of this dietary method. In this paper, the relationship between a vegetarian diet and the health level of pregnant women is reviewed in light of previous studies, and the development of a vegetarian diet and the nutritional needs of special populations are considered. This study is only a preliminary exploration of the effects of a vegetarian diet on pregnant women, and more in-depth studies are yet to be conducted. It is hoped that in the future, more studies will focus on the relationship between diet during pregnancy and maternal and child health, and provide more scientific and rational dietary advice for pregnant women.

References

[1] Mai Bo, Li Na. An all-vegetarian diet is bad for health [N]. Guangdong Science and Technology News, 2023-11-24(009). DOI:10.28252/n.cnki.ngdkj.2023.000337.

[2] Gao Weixin. "Six threes to help you understand the importance of nutrition during pregnancy [J]. Food and Health, 2022, 34(01): 6-7.

[3] Zhang, X., et al., A hybrid approach for scalable sub-tree anonymization over big data using MapReduce on cloud. journal of Computer and System Sciences, 2014. 80(5): p. 1008-1020.

[4] Sui, Hongwei & He, X., A review of vegetarian nutrition research. Journal of Nanning Institute of Vocational Technology, 2019. 24(01): pp. 1-4

[5] Li Ran. Calcium supplementation during pregnancy [J]. Health Guide, 2022, 28(02):36-37.

[6] Su herself. 10 key questions about calcium supplementation during pregnancy [J]. Health for all, 2021, (05):48-49.

[7] He Caiying. Translation, revision and application of the nursing student internship satisfaction scale [D]. Changsha: Central South University, 2013.

[8] Lai YH. Effect of supervised calcium supplementation during pregnancy on preventing hypertensive disorders of pregnancy and improving the incidence of adverse pregnancy outcomes [J]. Smart Health, 2022, 8(20): 119-122+144.DOI:10.19335/j.cnki.2096-1219. 2022.20.030.

[9] Luo Wenqiong. Calcium supplementation during pregnancy is important[J]. Family medicine. Happy Health, 2021, (08):64.

[10] Wei Fuying. A few precautions pregnant moms must know[N]. Medicine and health care newspaper, 2024-03-12(013).

[11] Steegers EA, von Dadelszen P, Duvekot JJ, et al. Preeclampsia. Lancet, 2010, 376: 631-44.

[12] Wang Yanling. Placental development and maternal-fetal health [J]. Life Science, 2017, 29 (01) : 21-30. DOI:10.13376/j.cbls/2017004.

[13] Sanders T.A., Reddy S. The influence of a vegetarian diet on the fatty acid composition of human milk and the essential fatty acid status of the infant. J. Pediatr. 1992;120:S71-S77. doi: 10.1016/S0022-3476(05)81239-9.

[14] Kornsteiner M., Singer I., Elmadfa I. Very low n-3 long-chain polyunsaturated fatty acid status in Austrian vegetarians and vegans. ann. nutr. Metab. 2008;52:37-47. doi: 10.1159/ 000118629.

[15] Crozier SR, Godfrey KM, Calder PC, Robinson SM, Inskip HM, Baird J, Gale CR, Cooper C, Sibbons CM, Fisk HL, Burdge GC. Vegetarian Diet during Pregnancy Is Not Associated with Poorer Cognitive Performance in Children at Age 6-7 Years. Nutrients. 2019 Dec 11;11(12):3029. doi: 10.3390/nu11123029. PMID. 31835868; PMCID: PMC6949927.

[16] WANG Wei-Wei, ZHOU Zhaobin, ZHANG Yun-Qiang et al. Effects of DHA on maternal pregnancy outcome and infant growth and development[J/OL]. China Fats and Oils:1-10[2024-01-29].https://doi.org/10.19902/j.cnki.zgyz.1003-7969.230142.

[17] WANG Shuxia, JIANG Shan, YANG Zhenyu et al. Correlation between vegetarian diet and vitamin B12 status in Chinese pregnant women[C]//Chinese Society of Nutrition, Institute of Nutrition and Health, Chinese Center for Disease Control and Prevention, Institute of Food and Nutritional Development, Ministry of Agriculture and Rural Development, Shanghai Institute of Nutrition and Health, Chinese Academy of Sciences, and School of Public Health, Huazhong University of Science and Technology. Proceedings of the 15th National Conference on Nutritional Sciences of the Chinese Society of Nutrition. [publisher unknown], 2022:1. DOI:10.26914/c.cnkihy.2022.034027.

[18] Dror DK, Allen LH.Effect of vitamin B12 deficiency on neurodevelopment in infants: current knowledge and possible mechanisms.Nutr Rev, 66 (2010), . Nutr Rev, 66 (2010), pp. 250-255

[19] Mou Zuixiang, Guo Xilin, Wu Ping, et al. Survey on the prevalence of iron deficiency and iron-deficiency anemia among pregnant women in Wanzhou urban area, Chongqing [J]. China Maternal and Child Health, 2023, 38(07): 1273-1276. DOI:10.19829/j.zgfybj.issn.1001-4411.2023.07.030.

[20] Expert Working Group on Revision of Dietary Guidelines for Maternal and Child Populations, Expert Committee on Revision of Dietary Guidelines, Chinese Nutrition Society. Dietary guidelines for women during pregnancy [J]. Chinese Journal of Perinatal Medicine, 2016, 19(6): 641-647

[21] Song Q, Ye XJ. A case-control study of community-based nutritional intervention for iron deficiency anemia in pregnant women [J]. Chinese Journal of Social Medicine, 2014, 31(3): 179-180.

[22] SUN J, WELL HANG. Changes in serum homocysteine, folic acid and vitamin B_(12) levels in pregnant women of different trimesters in Guiyang area and their effects on offspring outcomes [J]. Modern Medicine and Health, 2024, 40(14): 2357-2361+2366.