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The Impact of a Balanced Vegetarian Diet on Healthy Pregnancy Development: A Literature Review

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Abstract

Introduction

According to data, 5% of people in Europe and 6% of people in Poland are vegetarians. Therefore, an increasing percentage of pregnant women will follow a plant-based diet. During pregnancy, the need for vitamins and minerals increases, and the proper balance and possible

supplementation of a vegetarian diet are crucial for proper fetal development and a pregnant woman's health.

Aim of study

This study aims to evaluate and compare information regarding the adequacy of a vegetarian diet for pregnant women and its impact on maternal outcomes, fetal development, newborn health and lactation.

Materials and methods

The search methodology incorporated the terms “vegetarian diet” or “plant-based diet” or “vegan” AND “pregnancy” or “pregnant” or “health benefits”, along with variations of these terms, found in many scientific databases. Publications issued before 2019 and case reports were excluded.

Conclusion

There is a consensus that a plant-based diet is safe during both pregnancy and lactation. Nevertheless, it may be associated with many nutrient deficiencies. A vegetarian diet promotes a lower incidence of excessive weight gain, which results in a less frequent occurrence of EWG-related complications. There was no higher prevalence of premature births or infant mortality. The occurrence of gestational diabetes, small gestational age/low birth weight and congenital anomalies require further study. Breastfeeding during a vegetarian diet is possible, but appropriate supplementation is recommended.

Keywords

vegetarian diet, vegan diet, pregnancy nutrition, plant-based diet during pregnancy, fetal development

Introduction

More and more people are adopting a plant-based diet [1,2,3,4]. Several types of plant-based diets exclude meat (white and red), fish and other animal products from the diet. (Table 1.) [1,5,6]. According to data, 5% of people in Europe [7] and 6% of people in Poland are vegetarians [8]. There are many reasons why people choose this diet, including compassion for animals, a desire to reduce the risk of type 2 diabetes, cardiovascular disease, cancer and other chronic diseases [1,6,10], environmental concerns and religious beliefs [7,9,11].

Throughout Western countries, women are approximately twice as likely as men to follow a vegetarian or vegan lifestyle [4,12]. A noticeable trend is also the increase in the number of vegetarians among the younger generations [12,13], among the surveyed population of people aged 15-29 in Poland, 44% declare reducing their meat intake, while 8% follow a fully plant-based diet [3]. This means an increasing percentage of pregnant women will follow a vegetarian diet. The role of maternal nutrition is significant not only for proper fetal development but also for a pregnant woman's health [14]. During pregnancy, the need for vitamins and minerals increases [15]. Therefore the appropriate balance and possible supplementation of a vegetarian diet is even more important than for women who are not pregnant [13].

Although the topic is relevant and up to date, there appears to be insufficient research available to determine the effects of such a diet during pregnancy [12,13]. There is a consensus in the literature that a well-planned plant-based diet is safe both for the fetus and for a pregnant woman [9,11,16]. However, there is some disagreement about the effects of this diet, particularly concerning the incidence of small gestational age (SGA) [17] and the incidence of gestational diabetes mellitus (GDM) [18].

Types of plant-based diets	**Excluded products**
pesco-vegetarian	meat
lacto-ovo-vegetarian	meat, fish
vegetarian	meat, fish, eggs and dairy products
vegan	meat, fish, eggs, dairy and other products of animal origin

Table 1. Types of plant-based diets.

Aim of the study

It is crucial to determine whether a vegetarian diet suits women during pregnancy and if it ensures the proper development of the fetus and newborn after birth. This work aims to gather and compare information on this subject from various sources to provide a publication for general practitioners, obstetricians, paediatricians and patients who follow such a diet and would like to know if it is safe during pregnancy and lactation.

Material and methods

Articles for this review were retrieved from multiple scientific databases, including PubMed, Google Scholar, and other scientific resources. The search methodology incorporated the terms “vegetarian diet” or “plant-based diet” or “vegan” AND “pregnancy” or “pregnant” or “health benefits”, along with variations of these terms. The selected articles were limited to those published in English and Polish. Moreover, the lists of references of the scientific papers were reviewed to find further relevant works. Publications issued before 2019 and case reports were excluded. The last search was conducted on the 30th of November 2024.

Main body

1. Differences between statistical vegetarian and non-vegetarian pregnant women

Scientific literature shows some differences between women following different diets.

Studies show that people with plant-based dietary patterns have a lower body mass index (BMI) than omnivores [4,6,9,11,]. Pregnant vegetarian women have lower or the same BMI during pregnancy than women who eat meat [5,19,20]. Among non-meat eaters, vegans have the lowest BMI [11,17]. As in the general population, women on a plant-based diet have a lower risk of developing type II diabetes, cardiovascular disease and many others even after adjusting for BMI [11]. Furthermore, women adhering to a vegetarian diet often demonstrate higher educational and income levels than meat-eaters [7,15,17]. Moreover, the maternal age among vegetarians tends to be higher [12,19].

2. Intake of vitamins, minerals, DHA and protein

Pregnant women have increased nutritional demands to support fetal development, maternal tissue expansion, and overall metabolic adaptations, necessitating adequate intake of essential dietary components [15,21]. Vegetarians' nourishment needs during pregnancy and lactation are generally similar to non-vegetarians [9]. There is no doubt that a well-planned vegetarian diet is safe for the fetus and provides all the necessary nutrients [9,11,16]. Nevertheless, vegans are at an increased risk of nutrient deficiencies, and particular attention should be paid to levels of vitamin B12, iodine, iron, zinc, and docosahexaenoic acid (DHA) [2,7,11]. Deficiencies of these key substances are associated with several complications for the foetus [14,22], so careful consideration must be given to the need for each supplementation.

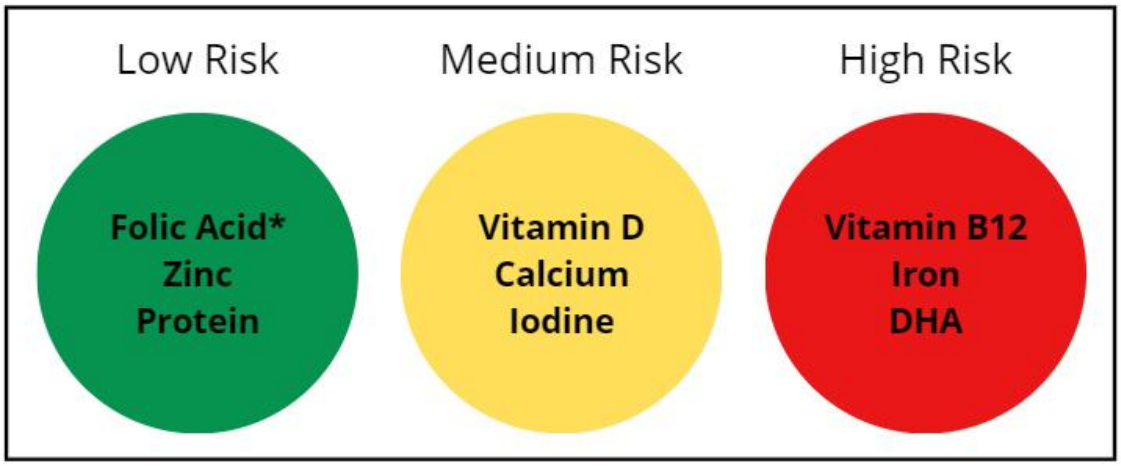

Figure 1. Deficiency Risk in Plant-Based Diets.

* Folic acid should be supplemented in every woman of childbearing age or pregnant.

2.1. Vitamin B12

Vitamin B12 is essential for many processes in the organism, such as DNA synthesis, red blood cell production, nervous system function and homocysteine metabolism [23,24]. Common deficiency symptoms are megaloblastic anaemia and neurological symptoms, including paresthesias and numbness [14,23]. Folic acid supplementation can compensate for anaemia, but it will not compensate for B12 deficiency, it will only prolong its diagnosis and delay its treatment [2,14,25].

Due to the increased demand, pregnant women are particularly vulnerable to B12 deficiency, which is associated with an increased chance of many adverse outcomes, including preeclampsia, low birth weight, and developmental disorders [23,26]. Vitamin B12 deficiency in people on a plant-based diet is a significant concern, as this substance is found almost only

in foods of animal origin [25,26]. Fermented foods and other non-fortified plant-based sources prove inadequate for reliable B12 intake [11,26]. Research consistently shows lower B12 levels among vegetarians and especially vegans [7,25,27]. Vegetarian and vegan pregnant women require consistent B12 supplementation or fortified food consumption to meet increased physiological demands [2,9,23]. Routine supplementation seems to be a good choice, as even a high vitamin B12 supply is considered safe in pregnancy [13,14]. Pregnant vegetarians and vegans who supplement with B12 no longer have lower B12 levels than omnivores [13,20].

2.2. Vitamin D

Vitamin D deficiency is widespread among pregnant women and the general population [14,28]. This deficiency is related to adverse pregnancy outcomes, among others preeclampsia and gestational diabetes [14,28]. Studies have shown that factors such as vitamin D supplementation and exposure to sunlight can significantly affect serum 25(OH)D levels compared to dietary intake [9,13]. Nevertheless, vegans and vegetarians have generally lower vitamin D levels than meat-eaters [13,27], whereas pesco-vegetarians usually have the highest levels among all groups [27]. In the USA and most European countries, every pregnant woman should supplement vitamin D, although research does not agree on the recommended dose [14,21,29]. The best way to select the dosage of vitamin D supplementation may be to measure the woman’s serum vitamin D level and adjust it individually [14,29].

2.3. Calcium

During pregnancy, calcium is required to mineralise the fetal bones and maintain the mother's bone density [14,21]. The main source of calcium in the diet is dairy, making a plant-based diet vulnerable to calcium deficiency [2,14]. The recommended daily intake during pregnancy is 1000 mg/d in both States and Europe [14,21]. Lacto-ovo-vegetarians, which means people who eat dairy (Table 1.), generally meet or surpass calcium intake recommendations [2,11]. Calcium consumption among vegans tends to be lower and occasionally falls short of the recommended levels, which may involve the need for supplementation during pregnancy [9,11,27].

2.4. Folic acid

Folic acid's most important role is preventing neural tube defects [29]. A vegetarian diet is characterised by an increased dietary folate intake [9,13,25]. Nevertheless, this does not mean that there is no need for supplementation. Every woman of childbearing age should supplement folic acid daily, until at least the twelfth week of pregnancy [13,22,25]. The Polish Society of Gynaecologists and Obstetricians recommends supplementation before and throughout the pregnancy [29].

2.5. Iodine

Iodine, necessary for synthesising thyroid hormones, is a key ingredient for fetal development [14,21]. Iodine deficiency or maternal hypothyroidism during pregnancy is associated with a greater chance of miscarriage, impaired neural development and reduced intelligence levels in children [29]. Foods with high iodine content are marine fish, seafood, dairy, and salt in countries where it is fortified [21,29]. The recommended daily dose of iodine increases during pregnancy to adequately supply both the mother and foetus, to 200µg/d in Europe and 220µg/d in the US [21,22]. The average iodine intake among vegans and vegetarians is generally lower than in meat-eaters, which makes them more likely to be deficient [2,27]. In many countries, including Poland, routine supplementation is recommended for pregnant women without thyroid disease, for whom the dose must be adjusted individually [14,29].

2.6. Iron

Iron is an essential mineral in pregnancy as too low levels are associated with SGA, preterm delivery (PD) and neurodevelopmental delay [14,25]. Its deficiency is widespread among pregnant women; up to 20% of them worldwide may be anaemic due to iron deficiency [14,21]. Vegetarians often have iron intakes comparable to, or slightly higher than meat-eaters, but their iron stores are generally lower [11,25,27]. This is due to the higher bioavailability of heme iron, present in meat, which is absorbed at a greater rate of 15–30%, compared to nonheme iron, predominantly found in plant-based foods, whose absorption rate usually does not exceed 10% [25,30]. Vegetarians also tend to have lower serum or plasma ferritin values, while haemoglobin values do not significantly differ from the omnivores [7,20]. Therefore, monitoring blood counts and ferritin levels in individuals following a plant-based diet may be beneficial. There is no consensus on iron supplementation for pregnant women. Some suggest

it in all pregnant women [9,22]. Others, including the Polish Society of Gynaecologists and Obstetricians, only in the case of a deficiency, as too high an iron level could also be harmful [21,29].

2.7. Zinc

Zinc is necessary for the activity of many enzymes and is crucial for the proper development of the foetus, as its deficiency can lead among others to growth restriction [17,25]. Plant-based diets have been linked to reduced zinc intake due to its lower bioavailability [25,27]. However, studies indicate that compared to non-vegetarian control groups, adult vegetarians typically have similar or slightly lower dietary zinc intake, with serum zinc levels also being lower but remaining within the normal range [9,11]. Available scientific data remain inconclusive regarding potential disparities in zinc status between vegetarian and non-vegetarian pregnant females [11].

2.8. Docosahexaenoic acid (DHA)

Omega-3 fatty acids, mainly DHA, are essential for the normal function of cell membranes, including in the brain and retina [14,21]. Supplementation with DHA or omega-3 fatty acids is associated with an increased birth weight and a lower chance of preterm birth. [9,21]. Sources of DHA in the diet are primarily fatty fish and algae [14,29]. Dietary intakes and blood levels of long-chain n-3 fatty acids are generally lower in vegetarians [11,27]. For women who do not eat fish, supplementation of algal DHA would be a good way to increase its levels [9,11]. Some sources, including the Polish Society of Gynaecologists and Obstetricians, indicate that daily DHA supplementation can be beneficial for every pregnant woman [2,29].

2.9. Protein intake

During pregnancy and lactation, women's protein requirements are significantly higher [13,15]. An adequate amount of protein in the diet is crucial for developing the foetus throughout pregnancy [15,31]. A low daily intake of protein (<60 g/day) may lead to a low birth weight [31]. Studies show that vegetarians, and especially vegans, typically consume less protein on average compared to omnivores [13]. However, vegetarians generally consume more than adequate amounts of protein, particularly in Western countries [9,11]. Pregnant women on a plant-based diet should consume approximately 1.1g/kg of protein per day [2].

3. Maternal complications of pregnancy

Adhering to plant-based diets during pregnancy could cause some adverse maternal outcomes or, on the contrary, reduce the risk of their occurrence. Most of the research focuses on the prevalence of gestational diabetes mellitus (GDM), hypertension and excessive weight gain (EWG) (Table 2.). Since non-meat eaters have a lower chance of being affected by cardiovascular diseases, type 2 diabetes, cancer and other diseases [10], the pregnancy will be less complicated by the numerous implications of these diseases in pregnancy.

Maternal complication	**Impact of a plant-based diet**
gestational diabetes mellitus	requires further study
hypertensive disorders	beneficial effects
excessive weight gain during pregnancy	beneficial effects

Table 2. Impact of a plant-based diet on maternal complications.

3.1. Gestational diabetes mellitus

Gestational diabetes mellitus (GDM) complicates around 7-14% of pregnancies [32,33]. It can be briefly described as glucose intolerance and may lead to many adverse maternal and fetal outcomes such as macrosomia, polyhydramnios, congenital defects, preeclampsia and many others [18,32]. Many pieces of research are consistent with the statement that the consumption of plenty of vegetables has a protective effect against the development of type 2 diabetes [6,33], however, when it comes to GDM, there is no clear consensus [34,35]. Some studies report that vegans had fewer cases of GDM in pregnancy [11,12], while others claim that the incidence was the same as among pregnant women eating meat regularly [17]. Two papers found a relationship between a plant-based diet before pregnancy and a lower risk of GDM [33,36]. Further research is needed in this area [2,34].

3.2. Hypertensive disorders

One of the most serious maternal complications during pregnancy is pregnancy-induced hypertension (PIH), which can be described as hypertension which manifests after the 20th week of pregnancy. It complicates around 4.6% to 13.1% of pregnancies [37]. Even more

dangerous complication is pre-eclampsia (PE), which not only presents as a hypertension de novo after 20th weeks of pregnancy but is also connected with proteinuria or other maternal organ failure, its prevalence is about 3-5% of all pregnancies [38]. Both these diseases may result in placenta dysfunction [38], preterm birth, small gestational age, HELLP syndrome or even maternal or fetal death [37]. Plant-based dietary patterns were related to the reduced risk of preeclampsia and pregnancy-induced hypertension (PIH) [34]. According to Raghavan et al. [34] diets with a higher intake of fruits, vegetables, nuts, and legumes lower the incidence of preeclampsia by 14-29% and 30-42% concerning PIH. None of the studies showed a higher incidence of PIH in vegetarian women, some indicated no difference between plant and meat diets [17,19,25]. Studies agree that excessive weight gain during pregnancy and higher pre-pregnancy BMI are connected with a higher prevalence of PIH and PE [12,38,39], both of which are less frequent in non-meat eaters than in meat eaters.

3.3. Excessive weight gain during pregnancy

Excessive body weight (EWG) is a risk factor for many diseases in all age groups and genders. The same applies to pregnant women, in whom both a high pre-pregnancy BMI and excessive weight gain during pregnancy have a strong influence on the occurrence of pregnancy complications [12,39].

Being overweight or obese greatly increases the risk for maternal adverse outcomes such as gestational diabetes, pregnancy-induced hypertension, and pre-eclampsia as well as for fetal complications, among others preterm birth, and large size for gestational age at birth [39]. Many studies revealed that an EWG could also lead to the same pregnancy complications as a high pre-pregnancy BMI, so proper control of weight gain during pregnancy is important [11,12,13]. Women following a plant-based diet during pregnancy gained less weight and had a lower risk of EWG than omnivores [9,19,25].

4. Fetal development and neonatal outcomes

When considering the use of a plant-based diet during pregnancy, the safety of the mother and the developing foetus is important. Many studies discuss topics such as the incidence of congenital defects, preterm birth, birth weight, and neonatal morbidities (Table.

Fetal/Neonatal complication	Impact of a plant-based diet
congenital malformations	requires further study
preterm birth	no association
small gestational age and low birth weight	requires further study
neonatal morbidities	no association

Table 3. Impact of a plant-based diet on fetal/neonatal complications.

4.1. Congenital malformations

In many studies the incidence of hypospadias was investigated, however, there was no correlation between its prevalence compared to meat eaters [13,35]. Since vegetarians and vegans have a higher risk of B12 deficiency, the frequency of neural tube defects was studied. No association with a plant-based diet was found, probably because of well-recommended vitamin supplementation [13]. In this research, no significant difference was found in the occurrence of newborn malformations between vegetarian and omnivorous mothers [5]. Few studies have investigated this topic, and further research is needed in this area.

4.2. Preterm birth

The preterm birth is a delivery after the 22nd week and before the 37th week of pregnancy, which can give newborns complications of prematurity [19]. None of the reviewed studies demonstrated an association between a maternal plant-based diet and an increased risk of preterm birth [12,13,25]. In one study, on the contrary, the incidence of preterm birth in meat eaters was reported to be higher than in those following a plant-based diet [40].

4.3. Small gestational age and low birth weight

Abnormal fetal weight gain during pregnancy and inadequate birth weight are associated with higher infant mortality and morbidity [5,41]. Small gestational age (SGA) is a situation when the estimated foetus or newborn’s masses are below the 10th percentile for the relevant gestational age [41]. Low birth weight (LBW) is when a newborn's weight is ≤ 2500 grams

[19]. Although a plant-based diet is often associated with a greater chance of low birth weight, the findings in the literature are inconsistent. Some studies reported a higher likelihood of SGA and LBW among vegans and vegetarians [12,17,19]. However, in some of them, this association lost statistical significance after adjusting for BMI [12] which could be explained by the fact that non-meat eaters have statistically lower BMI and chances for EWG during pregnancy, which predisposes to lower birth weight of the baby [13,17,19]. Many papers indicate only a higher frequency of LBW, but not of SGA [17,19]. Other papers have shown no difference in the birth weight of babies of Caucasian women using different types of diet [25,35,40]. The majority of the vegan and vegetarian people are of Asian origin, among which SGA and LBW are more present, which in two studies has been taken into account as one of the reasons why the prevalence of SGA and LBW was higher in non-meat eaters [12,17].

4.4. Neonatal morbidities

None of the papers indicated higher neonatal morbidity in women on a plant-based diet [13,17]. Furthermore, SGA in children of vegetarian or vegan women was not associated with increased mortality, which suggests proper development during pregnancy [13,17,40].

5. Lactation

According to the WHO, a baby up to the age of 6 months should be exclusively breastfed, as breastfeeding has many benefits for both baby and mother. Lactation, like pregnancy, is a state of increased nutrient demand [2,21]. To ensure adequate levels of nutrients in breast milk, some recommend routine supplementation of vitamin D [29,42], folic acid [29,42], and iodine [9] independently of the diet. Research shows that the milk of vegans and vegetarians is not qualitatively different from that of meat eaters [13]. However, maternal deficiencies on a plant-based diet will be associated with reduced amounts of certain substances in the milk [2]. This is especially true for vitamin B12 and DHA, which should be routinely supplemented in all lactating non-meat eaters [2,9,43]. According to research, as long as the mother supplements vitamin B12, the milk of vegans and vegetarians does not contain less of it than that of omnivores [13]. As for DHA, its levels in human milk increase with supplementation [2], but there is a lack of studies comparing its levels in women on a plant-based diet supplementing DHA. Studies do not agree on the routine supplementation of other nutrients in vegans and vegetarians:

- Lactating vegetarians could benefit from vitamin D supplementation [25], as their children are particularly vulnerable to vitamin D deficiency [2].
- Folic acid levels in breastfeeding women on a meat-free diet are comparable to omnivores [25].
- As in pregnancy, breastfeeding vegetarians are at risk of iodine deficiency and should control their iodine intake [43].
- During lactation, iron requirements decrease significantly and return to pre-pregnancy levels with the return of menstruation [44].

Conclusion

A plant-based diet is considered safe during both pregnancy and lactation. However, due to its limitations, it may be associated with nutrient deficiencies. Medical staff should pay particular attention to vitamin B12, iodine, iron, zinc and DHA levels. It seems appropriate for every pregnant woman on a plant-based diet to supplement vitamin B12, vitamin D, folic acid and probably iodine, iron and DHA. If dairy is also excluded from the diet, it may be beneficial to increase calcium intake. The amount of protein pregnant vegetarians consume should be around 1.1 g/kg per day; in developed countries, this is probably met without a change in diet. Studies agree that a vegetarian diet promotes a lower incidence of excessive weight gain, which results in a less frequent occurrence of EWG-related complications. No association has been shown between this diet and an increased number of premature births or infant mortality. The incidence of gestational diabetes, SGA/low birth weight, and congenital anomalies among plant-based pregnant women requires further study. The milk of vegan and vegetarian women is not significantly different from that of omnivorous women. Nevertheless, to ensure adequate nutrient levels in the milk, any lactating woman on a plant-based diet should supplement with vitamin B12 and DHA. Vitamin D and iodine supplementation may also be beneficial.

Disclosure

Author's contribution

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Conflict Of Interest

The authors declare no conflict of interest.

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References

1. Orzeł A, Sieniawska J, Sieniawska D, Proszowska P, Kotowicz Z, Pich-Czekierda A, & Madoń M. (2024). Vegetarian Diet in Children: Benefits, Drawbacks and Risks. Journal of Education, Health and Sport, 64, 221–246. DOI: https://doi.org/10.12775/JEHS.2024.64.015
2. Sebastiani G, Herranz Barbero A, Borrás-Novell C, et al. The Effects of Vegetarian and Vegan Diet during Pregnancy on the Health of Mothers and Offspring. Nutrients. 2019;11(3):557. DOI: https://doi.org/10.3390/nu11030557
3. Meat Atlas 2021, Heinrich Böll Stiftung, Friends of the Earth Europe & BUND September 2021, https://eu.boell.org/sites/default/files/2021-09/MeatAtlas2021_final_web.pdf?dimension1=ecology. Polish.
4. Modlinska K, Adamczyk D, Maison D, Pisula W. Gender Differences in Attitudes to Vegans/Vegetarians and Their Food Preferences, and Their Implications for Promoting Sustainable Dietary Patterns–A Systematic Review. Sustainability. 2020; 12(16):6292. DOI: https://doi.org/10.3390/su12166292
5. Ferrara P, Sandullo F, Di Ruscio F, Franceschini G, Peronti B, Blasi V, Bietolini S, Ruggiero A. The impact of lacto-ovo-/lacto-vegetarian and vegan diets during pregnancy on the birth anthropometric parameters of the newborn. J Matern Fetal Neonatal Med. 2020 Dec;33(23):3900-3906. DOI: https://doi.org/10.1080/14767058.2019.1590330
6. Oussalah A, Levy J, Berthezène C, Alpers DH, Guéant JL. Health outcomes associated with vegetarian diets: An umbrella review of systematic reviews and meta-analyses. Clin Nutr. 2020;39(11):3283-3307. DOI: https://doi.org/10.1016/j.clnu.2020.02.037
7. Hargreaves SM, Raposo A, Saraiva A, Zandonadi RP. Vegetarian Diet: An Overview through the Perspective of Quality of Life Domains. Int J Environ Res Public Health. 2021 Apr 12;18(8):4067. DOI: https://doi.org/10.3390/ijerph18084067
8. ProVeg (2022): Plant-based food in Poland. Market and consumer insights. Based on research from the Smart Protein project, a European Union's Horizon 2020 research and innovation programme (No 862957).
9. Craig WJ, Mangels AR, Fresán U, et al. The Safe and Effective Use of Plant-Based Diets with Guidelines for Health Professionals. Nutrients. 2021;13(11):4144. DOI: https://doi.org/10.3390/nu13114144

10. Kim, H., Caulfield, L. E., Garcia-Larsen, V., Steffen, L. M., Coresh, J., & Rebholz, C. M. (2019). Plant-Based Diets Are Associated With a Lower Risk of Incident Cardiovascular Disease, Cardiovascular Disease Mortality, and All-Cause Mortality in a General Population of Middle-Aged Adults. Journal of the American Heart Association, 8(16), e012865. DOI: https://doi.org/10.1161/JAHA.119.012865
11. Melina V, Craig W, Levin S. Position of the Academy of Nutrition and Dietetics: Vegetarian Diets. J Acad Nutr Diet. 2016 Dec;116(12):1970-1980. DOI: https://doi.org/10.1016/j.jand.2016.09.025
12. Kesary Y, Avital K, Hiersch L. Maternal plant-based diet during gestation and pregnancy outcomes. Arch Gynecol Obstet. 2020 Oct;302(4):887-898. DOI: https://doi.org/10.1007/s00404-020-05689-x
13. Axelsson P, Beermann T, Hansen H, Jeppesen MM, Kristensen A, Marxen S, Renault. DSOG Guideline Bulletin: Vegetarian and vegan diets during pregnancy. Danish Journal of Obstetrics and Gynaecology. 2024;2(1), 51-61. DOI: https://doi.org/10.56182/ccd2xa40
14. Brown B, Wright C. Safety and efficacy of supplements in pregnancy. Nutr Rev. 2020 Oct 1;78(10):813-826. Erratum in: Nutr Rev. 2020 Sep 1;78(9):782. DOI: https://doi.org/10.1093/nutrit/nuz101
15. Manta-Vogli PD, Schulpis KH, Dotsikas Y, Loukas YL. The significant role of amino acids during pregnancy: nutritional support. J Matern Fetal Neonatal Med. 2020;33(2):334-340. DOI: https://doi.org/10.1080/14767058.2018.1489795
16. Hess JM, Comeau ME, Smith JL, Swanson K, Anderson CM. Vegetarian Diets During Pregnancy: With Supplementation, Ovo-Vegetarian, Lacto-Vegetarian, Vegan, and Pescatarian Adaptations of US Department of Agriculture Food Patterns Can Be Nutritionally Adequate. J Acad Nutr Diet. 2024 Aug 10:S2212-2672(24)00751-2. DOI: https://doi.org/10.1016/j.jand.2024.08.001
17. Yisahak SF, Hinkle SN, Mumford SL, et al. Vegetarian diets during pregnancy, and maternal and neonatal outcomes. Int J Epidemiol. 2021;50(1):165-178. DOI: https://doi.org/10.1093/ije/dyaa200
18. Schiattarella A, Lombardo M, Morlando M, Rizzo G. The Impact of a Plant-Based Diet on Gestational Diabetes: A Review. Antioxidants (Basel). 2021 Apr 2;10(4):557. DOI: https://doi.org/10.3390/antiox10040557

19. Avnon T, Paz Dubinsky E, Lavie I, Ben-Mayor Bashi T, Anbar R, Yogev Y. The impact of a vegan diet on pregnancy outcomes. J Perinatol. 2021;41(5):1129-1133. DOI: https://doi.org/10.1038/s41372-020-00804-x
20. Avnon T, Anbar R, Lavie I, et al. Does vegan diet influence umbilical cord vitamin B12, folate, and ferritin levels?. Arch Gynecol Obstet. 2020;301(6):1417-1422. DOI: https://doi.org/10.1007/s00404-020-05561-y
21. Jouanne M, Oddoux S, Noël A, Voisin-Chiret AS. Nutrient Requirements during Pregnancy and Lactation. Nutrients. 2021;13(2):692. DOI: https://doi.org/10.3390/nu13020692
22. Procter SB, Campbell CG. Position of the Academy of Nutrition and Dietetics: nutrition and lifestyle for a healthy pregnancy outcome. J Acad Nutr Diet. 2014;114(7):1099-1103. DOI: https://doi.org/10.1016/j.jand.2014.05.005
23. Rashid S, Meier V, Patrick H. Review of Vitamin B12 deficiency in pregnancy: a diagnosis not to miss as veganism and vegetarianism become more prevalent. Eur J Haematol. 2021;106(4):450-455. DOI: https://doi.org/10.1111/ejh.13571
24. National Institutes of Health, Office of Dietary Supplements. (n.d.). Vitamin B12: Fact sheet for health professionals. Retrieved 28.11.2024r, from https://ods.od.nih.gov/factsheets/VitaminB12-HealthProfessional/
25. Baroni L , Rizzo G , Goggi S , Giampieri F , Battino M . Vegetarian diets during pregnancy: effects on the mother's health. A systematic review. Food Funct. 2021;12(2):466-493. DOI: https://doi.org/10.1039/d0fo01991g
26. Niklewicz A, Smith AD, Smith A, et al. The importance of vitamin B12 for individuals choosing plant-based diets. Eur J Nutr. 2023;62(3):1551-1559. DOI: https://doi.org/10.1007/s00394-022-03025-4
27. Neufingerl N, Eilander A. Nutrient Intake and Status in Adults Consuming Plant-Based Diets Compared to Meat-Eaters: A Systematic Review. Nutrients. 2021;14(1):29. Published 2021 Dec 23. DOI: https://doi.org/10.3390/nu14010029
28. Amrein K, Scherkl M, Hoffmann M, Neuwersch-Sommeregger S, Köstenberger M, Tmava Berisha A, Martucci G, Pilz S, Malle O. Vitamin D deficiency 2.0: an update on the current status worldwide. Eur J Clin Nutr. 2020 Nov;74(11):1498-1513. DOI: https://doi.org/10.1038/s41430-020-0558-y
29. Zimmer M, Sieroszewski P, Oszukowski P, Huras H, Fuchs T, Pawlosek A. Polish Society of Gynecologists and Obstetricians recommendations on supplementation

during pregnancy. Ginekol Pol. 2020;91(10):644-653.
DOI: https://doi.org/10.5603/GP.2020.0159

30. Piskin E, Cianciosi D, Gulec S, Tomas M, Capanoglu E. Iron Absorption: Factors, Limitations, and Improvement Methods. ACS Omega. 2022;7(24):20441-20456. Published 2022 Jun 10. DOI: https://doi.org/10.1021/acsomega.2c01833
31. Halldorsson TI, Birgisdottir BE, Brantsæter AL, et al. Old Question Revisited: Are High-Protein Diets Safe in Pregnancy?. Nutrients. 2021;13(2):440. Published 2021 Jan 29. DOI: https://doi.org/10.3390/nu13020440
32. Modzelewski R, Stefanowicz-Rutkowska MM, Matuszewski W, Bandurska-Stankiewicz EM. Gestational Diabetes Mellitus-Recent Literature Review. J Clin Med. 2022;11(19):5736. DOI: https://doi.org/10.3390/jcm11195736
33. Tobias DK, Zhang C, Chavarro J, et al. Prepregnancy adherence to dietary patterns and lower risk of gestational diabetes mellitus. Am J Clin Nutr. 2012;96(2):289-295. DOI: https://doi.org/10.3945/ajcn.111.028266
34. Raghavan R, Dreibelbis C, Kingshipp BL, et al. Dietary patterns before and during pregnancy and maternal outcomes: a systematic review. Am J Clin Nutr. 2019;109(Suppl_7):705S-728S. DOI: https://doi.org/10.1093/ajcn/nqy216
35. Tan C, Zhao Y, Wang S. Is a vegetarian diet safe to follow during pregnancy? A systematic review and meta-analysis of observational studies. Crit Rev Food Sci Nutr. 2019;59(16):2586-2596. DOI: https://doi.org/10.1080/10408398.2018.1461062
36. Chen Z, Qian F, Liu G, et al. Prepregnancy plant-based diets and the risk of gestational diabetes mellitus: a prospective cohort study of 14,926 women. Am J Clin Nutr. 2021;114(6):1997-2005. DOI: https://doi.org/10.1093/ajcn/nqab275
37. Zhuang C, Gao J, Liu J, et al. Risk factors and potential protective factors of pregnancy-induced hypertension in China: A cross-sectional study. J Clin Hypertens (Greenwich). 2019;21(5):618-623. DOI: https://doi.org/10.1111/jch.13541
38. Perry A, Stephanou A, Rayman MP. Dietary factors that affect the risk of pre-eclampsia. BMJ Nutr Prev Health. 2022;5(1):118-133. Published 2022 Jun 6. DOI: https://doi.org/10.1136/bmjnph-2021-000399
39. Santos S, Voerman E, Amiano P, et al. Impact of maternal body mass index and gestational weight gain on pregnancy complications: an individual participant data meta-analysis of European, North American and Australian cohorts. BJOG. 2019;126(8):984-995. DOI: https://doi.org/10.1111/1471-0528.15661

40. Reijonen JK, Tihtonen KMH, Luukkaala TH, Uotila JT. Vegetarian diet and pregnancy outcome. Eur J Obstet Gynecol Reprod Biol X. 2024;24:100345.
DOI: https://doi.org/10.1016/j.eurox.2024.100345
41. Englund-Ögge L, Brantsæter AL, Juodakis J, et al. Associations between maternal dietary patterns and infant birth weight, small and large for gestational age in the Norwegian Mother and Child Cohort Study. Eur J Clin Nutr. 2019;73(9):1270-1282.
DOI: https://doi.org/10.1038/s41430-018-0356-y
42. Mikulska A, Szajewska H, Horvath A, Rachtan-Janicka J. Poradnik karmienia piersią :według zaleceń Polskiego Towarzystwa Gastroenterologii, Hepatologii i Żywienia Dzieci. Wydawnictwo Lekarskie PZWL; 2016. Polish.
43. Karcz K, Królak-Olejnik B. Vegan or vegetarian diet and breast milk composition - a systematic review. Crit Rev Food Sci Nutr. 2021;61(7):1081-1098.
DOI: https://doi.org/10.1080/10408398.2020.1753650
44. Snetselaar LG, de Jesus JM, DeSilva DM, Stoody EE. Dietary Guidelines for Americans, 2020-2025: Understanding the Scientific Process, Guidelines, and Key Recommendations. Nutr Today. 2021 Nov-Dec;56(6):287-295.
DOI: https://doi.org/10.1097/NT.0000000000000512