SURABAYA MEDICAL JOURNAL
(SMJ IDI SURABAYA)
Volume 2, Issue 2, November 2024, p.94-99
eISSN: 2986-7584
pISSN: 2986-2469

VIEWPOINTS

Unveiling the link: exploring the relationship between hypertensive disorders in pregnancy and maternal dietary patterns

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Article Info

Article history:
Received: 30-10-2024
Revised: 12-11-2024
Accepted: 23-11-2024
Published: 30-11-2024

Keywords:
Hypertensive disorders;
pregnancy;
dietary patterns

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ABSTRACT

Background: The increasing prevalence of pregnancy-related hypertension, a leading cause of maternal and neonatal mortality, emphasizes the need for safer management strategies. Due to potential risks associated with antihypertensive drugs, dietary interventions have gained interest as a promising alternative to help regulate blood pressure and improve pregnancy outcomes by targeting mechanisms such as inflammation and oxidative stress. **Objective:** To examine the relationship between the incidence of hypertensive disorders and maternal dietary patterns as a potential strategy for preventing maternal health problems. **Pros and Cons:** Diet is the main modifiable determinant of inflammation. Research has examined dietary patterns that may reduce the risk of hypertension in pregnancy. **Discussion:** Dietary choices during pregnancy significantly influenced the risk of hypertensive disorders, including preeclampsia. While plant-based and Mediterranean-diets are often associated with reduced risks, other studies present conflicting results due to individual physiological differences and unmeasured dietary factors. Further research into effective dietary patterns, such as the Dietary Approaches to Stop Hypertension (DASH), could provide clearer guidelines to help reduce hypertensive risks in pregnancy. **Conclusion:** The relationship between dietary patterns and the incidence of hypertensive disorders remains inconclusive. Despite the inconsistent findings, maintaining a well-balanced plant-based diet may be beneficial in all stages of life, especially in preventing HDP. Such a diet can help lower blood pressure, reduce the risk of heart disease, and improve cholesterol levels. Moreover, maintaining a well-balanced diet can provide adequate nutrients if combined with supplementation with folic acid, iron, zinc, calcium, iodine, vitamin D, vitamin B12, and omega-3 fatty acids.

Citation:
Putri K, R.S.T.W. and Pranata, G.J. (2024). 'Unveiling the link: exploring the relationship between hypertensive disorders in pregnancy and maternal dietary patterns'. Surabaya Medical Journal, *2*(2): 94-99. doi: 10.59747/smjidisurabaya.v2i2.84

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Surabaya Medical Journal (SMJ IDI Surabaya)
e-ISSN: 2986-7584; p-ISSN: 2986-2469

Highlights

1. High morbidity and mortality rates among pregnant women are caused by hypertension during pregnancy.
2. Maternal diet significantly influences pregnancy-related hypertension, highlighting the need for dietary interventions as a potentially safe approach to manage blood pressure during pregnancy and reduce the risks of severe maternal and neonatal outcomes.

BACKGROUND

Over the years, societal concern has centered on the impact of diet on the incidence of hypertension during pregnancy, which is an increasingly common medical complication during pregnancy. Hypertensive disorders of pregnancy (HDP) contribute significantly to maternal mortality rates worldwide, accounting for approximately 10-15% of all maternal deaths (Arvizu et al., 2020). These disorders include chronic hypertension, gestational hypertension, preeclampsia/eclampsia, and preeclampsia superimposed on chronic hypertension, characterized by blood pressure of ≥140/90 mmHg on at least two consecutive measurements during pregnancy (Garovic et al., 2022). The consequences of HDP are alarming, with an estimated 46,000 maternal deaths, 416,000 stillbirths, and 1.5-2 million neonatal deaths annually (Kinshella et al., 2021). Furthermore, pregnancies affected by hypertensive disorders are associated with short- and long-term complications, including seizures (eclampsia), preterm delivery, fetal growth restriction, and an increased risk of cardiovascular disease and renal failure. Therefore, HDP pose a serious threat to both maternal and infant health (Jiang et al., 2019). It is important to differentiate between chronic and gestational hypertension. Gestational hypertension develops after 20 weeks of pregnancy and mostly disappear within six weeks postpartum (Cífková, 2023). Early identification and medical management are critical for minimizing complications due to preexisting conditions, such as diabetes mellitus (Katsiki et al., 2010).

The medical treatment for HDP focuses on maintaining blood pressure levels within a safe range. When blood pressure exceeds 170/110 mmHg, emergency hospitalization is necessary (Cífková, 2023). However, the use of antihypertensive drugs during pregnancy poses challenges due to concerns about their potential effects on the developing fetus, as many of these medications cross the placenta and fall under category C medications (Khedun et al., 2000). As a result, there is a growing interest in exploring dietary interventions as a viable and safe approach to prevent HDP. Notably, dietary modifications can be easily implemented in real-life situations, providing multiple health benefits during pregnancy (Jiang et al., 2019). Extensive research has revealed a direct relationship between dietary patterns and the mechanisms underlying pregnancy-related hypertension, including inflammatory responses, oxidative stress, vascular endothelial damage, and abnormal lipid metabolism (Jiang et al., 2019).

OBJECTIVE

This study aims to examine the relationship between the incidence of hypertensive disorders and maternal dietary patterns as a potential strategy for preventing maternal health problems.

PROS AND CONS

Hypertensive disorders of pregnancy (HDP) encompass several conditions characterized by elevated blood pressure during pregnancy, such as gestational hypertension, preeclampsia, chronic hypertension, and superimposed preeclampsia (Ikem et al., 2019; Kibret et al., 2019). Preeclampsia, in particular, is clinically diagnosed by the onset of maternal hypertension after 20 weeks of gestation, accompanied by proteinuria. In the absence of proteinuria, the condition may also be diagnosed based on evidence of kidney and liver dysfunction, neurological symptoms, hematological abnormalities, or uteroplacental dysfunction (Achamrah and Ditisheim, 2018). The underlying pathogenesis of preeclampsia is thought to involve abnormal placental development that activates the maternal

inflammatory system and leads to oxidative stress (Pashapour et al., 2019). Understanding this cascade of events is critical for developing effective preventive strategies for preeclampsia.

Modifying habits and lifestyle such as quitting smoking, managing weight gain, and adopting a healthy diet, can help prevent the incidence of HDP (Abdollahi et al., 2021). Increasing awareness of the importance of dietary habits during pregnancy has led more people to recognize their benefits for both maternal and child health (Ikem et al., 2019). Despite this, there is a growing trend toward adopting specific dietary patterns, such as vegetarianism, among pregnant women. However, pregnancy requires greater macronutrient and micronutrients consumption and a well-balanced diet (Miedziaszczyk et al., 2021). Pregnancy leads to physiological changes in the gastrointestinal system, causing pregnant women to experience reduced peristalsis that results in nausea and vomitting. Additionally, pregnancy significantly increases nutritional demands, particularly for essential micronutrients. Therefore, this period is critical for implementing nutritional interventions (Zaragoza-Martí et al., 2022). Pregnant women can adopt various dietary patterns to reduce the risk of HDP, for instance, a vegetarian diet that is rich in vegetables, fruits, whole grains, and plant-based proteins, while excluding animal protein sources such as meat, fish, and seafood, and including dairy products such as cheese and eggs. Vegetarian diets are rich in antioxidants and anti-inflammatory substances (Tan et al., 2019). There are several models of vegetarian diets, such as the lacto-ovo vegetarian diet which excludes meat and fish, the ovo vegetarian diet, and the lacto vegetarian diet (Miedziaszczyk et al., 2021). A vegan diet is differentiated from lacto-ovo vegetarianism in that it relies on plant-based foods and eliminates dairy products and eggs (Avnon et al., 2020). This diet is free of all animal protein sources such as meat, fish, and even honey (Tan et al., 2019).

Another dietary pattern that pregnant women can adopt is the Mediterranean diet which is known for being rich in nutrients. This diet emphasizes fats from extra virgin olive oil (EVOO), with a high intake of plant-based foods such as fruits, vegetables, nuts, and seeds, as well as a moderate intake of animal protein products including fish, eggs, and dairy products such as yogurt and cheese. This diet eliminates the intake of buttercream and limits the consumption of dessert, red meat, and processed meats (Zaragoza-Martí et al., 2022). Another emerging dietary option is the Dietary Approaches to Stop Hypertension (DASH), which focuses on fruits, vegetables, whole grains, low-fat dairy products, and plant-based proteins while minimizing red meat, processed meat, sweets, and sugar-sweetened beverages (Perry et al., 2022). Evaluating whole dietary patterns, rather than individual nutrients, is considered more relevant for understanding dietary influence due to the small effect sizes and biological interactions.

Several studies have compared the prevalence of HDP between vegetarian and omnivorous pregnant women. These studies reported a lower likelihood of preeclampsia among those following a diet rich in plant-derived foods, attributed to the high levels of antioxidants and vitamin C, which eliminates free radicals (Kibret et al., 2019). In addition, observational research conducted in Norway analyzed the diet of 23,000 mothers, comparing the prevalence of HDP among pregnant women with a vegetarian diet and those without. The findings revealed a reduced risk of preeclampsia in women with a vegetarian diet as the diet is rich in vegetables, plant-based foods, and vegetable oils (Perry et al., 2022). Moreover, studies have shown that healthy dietary patterns characterized by high consumption of vegetables were associated with a 51-82% reduction in the risk of preeclampsia. Meanwhile, mothers with low vegetable consumption had a 2.6 times higher risk of developing preeclampsia compared to those with high vegetable consumption (Kinshella et al., 2021).

Recent research has yielded contradictory findings regarding the relationship between high vegetable consumption and the incidence of preeclampsia, with a study suggesting no correlation between them (Kibret et al., 2019). Similarly, a prospective cohort study found no association between a vegetarian diet during pregnancy and the incidence of HDP (Yisahak et al., 2021). Furthermore, several studies also found no significant correlation in the incidence of HDP among various dietary groups, which contrasts with earlier research suggesting a lower risk among those following a vegan diet (Avnon et al., 2021).

The American Dietetic Association (ADA) and the Academy of Nutrition and Dietetics recommended a balanced diet to support a safe pregnancy, including well-planned vegetarian and vegan diets. These diets are considered nutritionally sufficient and provide positive health outcomes for mothers

Surabaya Medical Journal (SMJ IDI Surabaya)
e-ISSN: 2986-7584; p-ISSN: 2986-2469

(Yisahak et al., 2021). However, the German Nutrition Society advises against vegan diets during pregnancy due to the high potential for low micro- and macronutrient deficiencies. While vegan diets have protective effects against heart disease, due to their lower levels of saturated fatty acids, animal proteins, and cholesterol, and higher levels of folic acids, fibers, antioxidants, phytochemicals, and carotenoids, they often lack micronutrients such as iron, zinc, vitamin B12, vitamin D, omega-3 fatty acids, calcium, and iodine. Calcium deficiency increases the risk of HDP, including preeclampsia (Miedziaszczyk et al., 2021). Similarly, deficiencies in iodine, calcium, vitamin C, and vitamin D have been associated with an increased risk of preeclampsia (Baroni et al., 2021). Recent epidemiological research has emphasized the role of vitamin D insufficiency, which is more common among vegetarians, in the development of preeclampsia. Vitamin D plays a critical role in the etiology of preeclampsia through its ability to modulate immune function and inflammatory response, which are important for proper placental implantation and angiogenesis (Pashapour et al., 2019).

Diet is the main modifiable determinant of inflammation. Research has examined the effects of the Western diet which commonly contains trans fatty acids. These fats can directly contribute to systemic inflammation and endothelial dysfunction. The Western diet is characterized by a high intake of margarine, potatoes, mixed meats, salt, and white bread, which increases the risk of HDP (Ikem et al., 2019). Consistent with these findings, research has shown that women who adhered more closely to a Western diet had an almost six-fold increased risk of preeclampsia. A prospective cohort study involving more than 55,000 Danish women found a 1.40 times higher risk of HDP (Perry et al., 2022). Additionally, certain dietary components such as processed meat, potatoes, sugary drinks, and salty snacks have been shown to heighten the risk of developing preeclampsia (Kibret et al., 2019).

In contrast to the Western diet, the Seafood diet, characterized by a high intake of fish and vegetable, has been shown to lower the risk of preeclampsia due to the anti-inflammatory properties of docosahexaenoic acid found in fish oil (Ikem et al., 2019). Similarly, a cohort study highlighted a significant reduction in preeclampsia risk associated with the Seafood diet (Perry et al., 2022). When compared to the Mediterranean diet, both diets appear to share similarities in their emphasis on vegetable-rich foods and high fish consumption, which may offer protective benefits against HDP (Ikem et al., 2019). However, an observational study of Australian reproductive women found that mothers who had low adherence to a Mediterranean-style diet were associated with an increased risk of HDP compared with those with high adherence (Perry et al., 2022). In contrast, a cohort study revealed that the Mediterranean diet, comprising vegetables, vegetable oils, pasta, fish, legumes, and rice, was not significantly associated with gestational hypertension (Kibret et al., 2019). These conflicting results regarding the association between the Mediterranean diet and HDP can be attributed to the fact that the precise biological mechanisms underlying its potential protective effects remain unclear (Perry et al., 2022).

An updated case-control study suggested that adherence to the DASH diet reduces the risk of preeclampsia (Perry et al., 2022). Evidence supports the benefits of the DASH diet on blood pressure in pregnant populations. Compared to an omnivorous diet, the DASH diet was reported to result in a lower incidence of preeclampsia in pregnant women (Jiang et al., 2019). Similarly, a prospective study of 11,535 women encompassing a total of 16,892 pregnancies over 18 years of follow-up found that the DASH diet before pregnancy was significantly associated with a lower risk of preeclampsia. This reduction is attributed to its ability to mitigate systemic oxidative stress, endothelial dysfunction and inflammation, potentially preventing the onset of preeclampsia. These effects are prominent as the remodeling of spiral arteries in the decidua begins early in pregnancy (Arvizu et al., 2020). However, a review of 290 studies concluded that greater adherence to the DASH diet did not significantly reduce the incidence of preeclampsia (Perry et al., 2022).

A recent meta-analysis presented interesting findings regarding the relationship between diet and HDP. The study revealed that higher adherence to a healthy diet was associated with a significant 14% reduction in the odds of experiencing HDP (Abdollahi et al., 2021). However, findings from different studies have shown inconsistencies, with some reporting conflicting results regarding the relationship between a healthy diet and HDP (Kibret et al., 2019). For instance, a prospective cohort study conducted in the Netherlands found as no significant association between dietary patterns during pregnancy and the incidence of preeclampsia (Abdollahi et al., 2021). These discrepancies

between studies could be attributed to the influence of other physiological processes during pregnancy that regulate blood pressure, which may occur regardless of dietary patterns. Additionally, the inability to account for the confounding intake of foods that were not captured by specific dietary patterns may also contribute to the observed variations (Jiang et al., 2019).

A deeper understanding of the relationship between maternal diet and HDP emphasizes the role of diet as a modifiable risk factor. Following the recommendations of the WHO, a daily intake of more than 400 g of fruits and vegetables, along with nuts, whole grains, legumes, olive oil, fish, and mixed seafood of 230 g per week can contribute to overall maternal well-being. Additionally, limiting the intake of high-fat, high-salt, and high-sugar foods, including sugary beverages, as well as reducing the consumption of red and processed meats, can further mitigate the risk of preeclampsia. It is also important to note that raw fish and fish known to contain high levels of mercury such as shark, king mackerel, and bigeye tuna should be avoided during pregnancy (Perry et al., 2022).

Limitations

This study did not address recommendations for the consumption of foods such as olive oil in the DASH diet, the portions of animal-based foods, or the quantity of fruits that should be consumed by pregnant women.

CONCLUSION

The relationship between dietary patterns and the incidence of hypertensive disorders remains inconclusive. Despite the inconsistent findings, maintaining a well-balanced plant-based diet may be beneficial in all stages of life, especially in preventing HDP. Such a diet can help lower blood pressure, reduce the risk of heart disease, and improve cholesterol levels. Moreover, maintaining a well-balanced diet can provide adequate nutrients if combined with supplementation with folic acid, iron, zinc, calcium, iodine, vitamin D, vitamin B12, and omega-3 fatty acids.

Conflict of Interest

None

Funding

None

Author Contribution

RSTWPK (writing the draft, editing, data curation, conceptualization, funding, translating, data analysis); DJP (writing the draft, editing).

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Surabaya Medical Journal (SMJ IDI Surabaya)
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