Review Article

The Association between Post-Partum Depression and Nutrition and Dietary Patterns: Systematic Review

Abstract

Background: Postpartum Depression (PPD) is a common illness with long-term effects on mother and child. Nutrition is a crucial factor in mental health, but research findings on its connection to PPD are inconsistent. This review aims to explore the correlation between PPD and dietary patterns. **Materials and Methods:** We conducted a comprehensive search of several databases including PubMed/MEDLINE, Embase, ISI and ISI/Web of Science (WOS), Scopus, and Iranian databases such as Magiran, Scientific Information Database (SID), and IRANDOC from 2003 to 2020. Our search was based on the keywords "postpartum depression" and "nutrition, vitamin D, Folic acid, iron, zinc, and vitamins." We applied the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist to select articles based on inclusion/exclusion criteria. Of the 100 articles identified, only 24 articles met our criteria and were selected for further analysis. **Results:** Research suggests that low levels of vitamin D, iron, folate, and carbohydrates, and an unhealthy diet lacking in vegetables are potential causes of PPD. However, the impact of zinc, omega-3 essential fatty acids, and other nutrients such as antioxidants, vitamin E, and vitamin C on PPD is unclear due to conflicting information. Additionally, limited research has been conducted on the association between group B vitamins and PPD. **Conclusions:** In conclusion, we can lower the risk of PPD by providing dietary guidance and working with healthcare providers. It is important to pay attention to our diet and make sure we are consuming enough vitamins and nutrients to support our mental health.

Keywords: *Depression, diet healthy, diet, food, nutrition, postpartum*

Maryam Ghaedrahmati[1], Zahra Alipour[2]

[1]Ph.D of Reproductive Health, Narges Social Security Organization, Dorood, Lorestan, Iran, [2]Assistant Professor of Reproductive Health Department of Midwifery, School of Medicine Qom University of Medical Sciences, Qom, Iran

Address for correspondence:
Dr. Zahra Alipour, Assistant Professor of Reproductive Health Department of Midwifery, School of Medicine Qom University of Medical Sciences, Qom, Iran. E-mail: Kanom_Alipour@yahoo.com

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Introduction

Postpartum Depression (PPD) is a prevalent and severe mental health disorder that can have enduring effects on both the mother and the baby.[1] Depressed mothers experience feelings of sadness, fatigue, guilt, worthlessness, and anxiety as they take on the parental role, and may even have thoughts of harming themselves or the baby.[2] Sadly, many depressed mothers do not seek medical attention in time due to the stigma surrounding mental illness.[3] Therefore, early diagnosis and treatment can be challenging.

PPD prevalence ranges from 0.5% to 60.8% globally.[4] In Iran, about one-third of mothers experience PPD.[5] Risk factors include lack of support from a spouse, economic and social factors, previous psychiatric disorders, pregnancy complications, and domestic violence.[6-8] Inadequate nutrition may also contribute to major depression.[9] There is a hypothesis that nutritional deficiencies, which may occur during pregnancy and lactation, may increase the susceptibility to PPD due to hormonal changes.[1] Studies have been conducted on the relationship between the role of food and PPD,[8] but further research is needed to evaluate the role of nutrition in PPD.[10] Discovering nutritional risk factors could be a potential option for helping reduce the incidence of PPD. This systematic review aimed to investigate the association of PPD with nutrition and diet patterns.

Materials and Methods

This systematic review study is a part of the results of the doctoral dissertation on reproductive health (design and psychometrics predictive tool for PPD) that was supported by the Isfahan University of Medical Sciences and conducted in 2016. In this systematic review, we evaluated all

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studies in English and Persian according to the checklist. We used electronic search databases of PubMed/MEDLINE, Embase, ISI and ISI/Web of Science (WOS), Scopus, and Iranian databases such as Magiran, Scientific Information Database (SID), and IRANDOC from 2003 to 2020. Searching in the databases was made using keywords "Post-Partum depression" and "nutrition" or "vitamin D" or "Folic acid" or "iron" or "zinc" or "vitamins" or "carbohydrate" or "vitamin B." Keywords were selected by the MeSH system for assessing in the PubMed database.

We screened studies based on the inclusion criteria of investigating PPD within the first year after delivery, excluding studies on postpartum psychosis or bipolar affective disorders. Our systematic review was reported by the "Preferred Reporting Items for Systematic Reviews and Meta-Analyses" (PRISMA) guidelines.[11]

The quantitative studies were assessed for relevance, appropriateness, clarity, and methodology using the Mirza and Jenkins checklist[12] and the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement checklist.[13] The quality of the reviews was evaluated based on the assessment criteria in Smith *et al*.'s study.[14]

The initial search yielded 100 abstracts, which were evaluated by two researchers. We conducted content analysis and categorization of the results. Of the 100 articles identified, we included a total of 24 "good-quality studies" of various designs [Please refer to Figure 1].

We followed the standard procedure for data extraction and recorded the relevant information in Table 1. Two researchers independently examined full texts to determine which publications should proceed to the data extraction stage. The researchers compared their findings and resolved any discrepancies through discussion. Ultimately, we identified 24 papers that met our criteria.

To ensure the quality of the studies, we assessed the clarity of their objectives and information using the STROBE statement checklist, which includes items required for reporting observational studies. This assessment helped reduce the risk of bias due to insufficient information. Additionally, we evaluated the data summary forms and the qualifications of studies selected for the systematic review.

Ethical considerations

This study received approval from the Isfahan University of Medical Sciences Research Committee and Ethics Committee (Grant Number: 394313). All stages of the study were conducted with adherence to research ethics, honesty, and transparency principles.

Results

Of the 100 articles that were retrieved, only 24 studies met the inclusion criteria for the systematic review [Table 2]. Among those, 17 studies revealed that perinatal depression is associated with lower levels of folate, vitamin D, vitamin B, iron, Se, and Zn.[1,2,9,15-28] However, only two studies

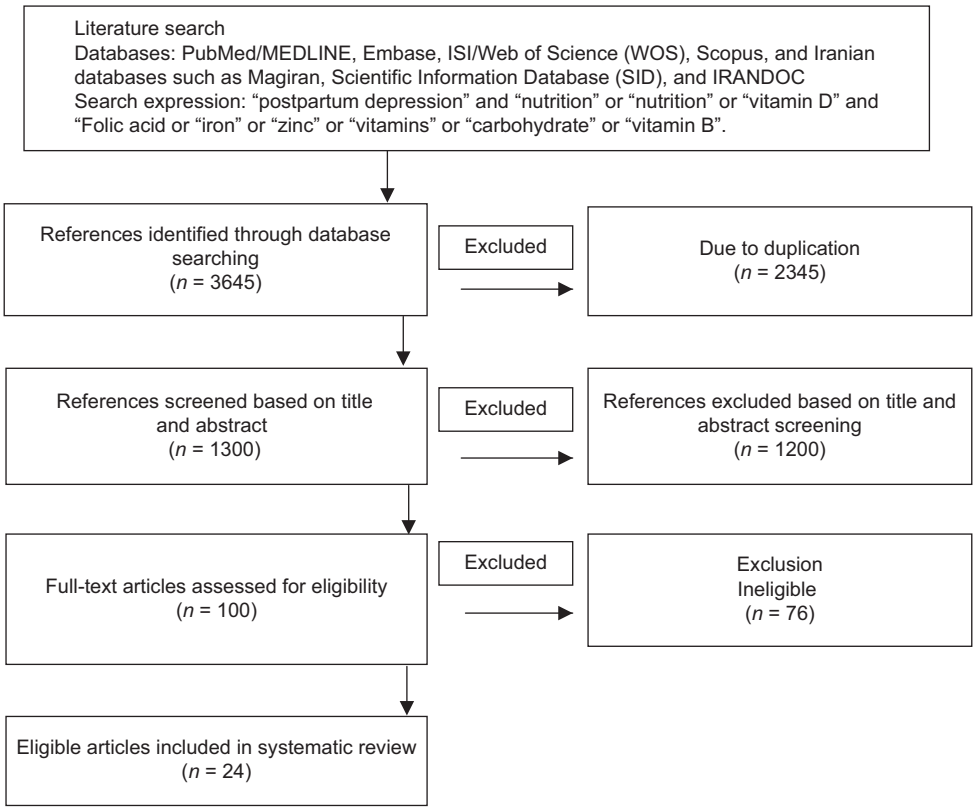

Figure 1: PRISMA flow diagram

Table 1: Literature search strategy for systematic review of the evidence on Post-partum depression and nutrition and dietary patterns

Database	Search terms	Yield
PubMed/MEDLINE	"postpartum depression" and "nutrition" or "healthy nutrition" or "vitamin D" and "Folic acid" or "iron" or	9281
ISI/Web of Science (WOS)	"Zinc" or "vitamins" or "carbohydrate" or "vitamin B." "postpartum depression" and "nutrition" or "healthy."	7665
Scopus	"nutrition" or "vitamin D" and "Folic acid" or "iron" or "zinc" or "vitamins" or "carbohydrate" or "vitamin B."	834
Scientific Information Database (SID)	"postpartum depression" and "nutrition" or "healthy nutrition" or "vitamin D" and "Folic acid" or "iron" or "zinc" or "vitamins" or "carbohydrate" or "vitamin B."	134
IranMedex databases	"postpartum depression" and "nutrition" or "healthy nutrition" or "vitamin D" and "Folic acid" or "iron" or "zinc" or "vitamins" or "carbohydrate" or "vitamin B."	173

found no link between group B vitamins and PPD,[2,29] and three studies failed to find a link between omega-3 and PPD.[9,30,31] Moreover, only two studies discovered a connection between healthy eating patterns, including fruits, vegetables, seafood, grains, and PPD.[10,24] One study found a link between PPD and lower levels of insulin,[32] while two studies found no link between zinc vitamins and PPD.[33,34]

Vitamins

Vitamin D

Vitamin D deficiency is a common issue in many countries due to insufficient sunlight. This vitamin is not naturally found in many foods, except for fish, egg yolk and milk are enriched with it.[35] Studies have shown that low levels of vitamin D are associated with PPD.[25,36,37] One study in Iran found that women with low vitamin D levels had a greater risk of depression 6–8 weeks after delivery.[15] Another study found that taking 2,000 units of vitamin D daily in the last 2 weeks of pregnancy and the first 8 weeks after delivery could reduce the risk of PPD.[38] A meta-analysis study showed that low levels of vitamin D (less than 50 nmol/l) were associated with a 3.67-fold risk of PPD.[22] A clinical study also found that taking a dose of 2000 IU/d of vitamin D can reduce depressive symptoms.[27]

However, findings from cohort studies suggest that vitamin D deficiency is related to the incidence of PPD, and vitamin D may play a significant role in the recovery of women with PPD. The mechanism of this action is unclear.[29]

Group B vitamins

Limited evidence suggests that group B vitamins have no direct influence on PPD, as it does not affect the immune system or the hypothalamic–pituitary–adrenal axis.[2] While some studies have explored their relationship, none provide convincing evidence of a link.[2]

Vitamin B1 or thiamine

Thiamine is a water-soluble vitamin that is not stored in the body[19] and must be consumed daily from sources such as beef, chicken, cereals, nuts, and beans.[39] Its daily requirement is 1.1–1.2 mg for adults and 1.4 mg for pregnant and breastfeeding women.[40] It is essential for neurotransmitter synthesis and energy production, and its deficiency can cause brainstem changes and depressive symptoms.[41] Supplementation with thiamine can improve these symptoms.[42]

Vitamin B2 or riboflavin

Riboflavin is commonly found in dairy products, lean meats, liver, green leafy vegetables, and yeasts,[18] while few studies have analyzed the link between low vitamin B2 and PPD.[18,43] However, a cohort study suggests that moderate intake of vitamin B2 can help reduce the risk of PPD.[43]

Vitamin B6 or pyridoxine

Vitamin B6 or pyridoxine can be sourced from meat, poultry, fish, eggs, white potatoes, and starchy vegetables.[44] This vitamin is vital for the biosynthesis of essential neurotransmitters such as serotonin and dopamine, which are known to improve mood and cognitive function.[45] Patients with depression usually have high homocysteine levels and low levels of folate and vitamin B6.[46] Homocysteine is a non-essential sulfur amino acid that can be toxic to blood vessels and cause oxidative stress and cell death.[47] A study has shown that taking vitamin B6 can independently reduce the incidence of PPD.[43]

Vitamin B12

Normal levels of vitamin B in the blood range from 147.6 to 664.2 pmol/L. Anything above this range is considered toxic.[16] Vitamin B12 deficiency leads to an increase in homocysteine levels and a decrease in the efficiency of folate and B12 due to its trapping in the 5-methyltetrahydrofolate cycle instead of the active form of tetrahydrofolate.[16] Folate and vitamin B12 play a vital role in several metabolic pathways in the central nervous system. Elevated serum homocysteine levels indicate a deficiency of vitamin B12 and folate, and are seen in depressed patients.[48] However, a systematic review found

Table 2: Included studies for literature review

Authors and year conducted	Design type	Number of papers included (date range)	Participants	Outcome	Country	Sample	Tools	Quality level
Sparling (2017)[1]	Systematic review	24 (1996-2016)	14262	In all, 14 studies found associations of perinatal depression with lower levels of folate, vitamin D, Fe, Se, Zn, fats, and fatty acids, while two studies found associations between perinatal depression and higher nutrient levels. Eight studies found no evidence of an association.	Germany	-	-	High
Ellsworth-Bowers (2012)[2]	Critical review	13 (unknown)	4443	Findings suggest that while n-3 PUFA levels have been shown to vary inversely with PPD and link with psychoneuroimmunology, there is mixed evidence regarding the ability of n-3 PUFA to prevent or treat PPD. B vitamin status is not linked to PPD, even though it seems to vary inversely with depression in non-perinatal populations and may have an impact on immunity. Vitamin D and the trace minerals Zn and Se are linked to PPD and psychoneuroimmunology.	USA	-	-	Medium
Opie (2020)[10]	Systematic review	6 (1835-2020)	Unknown	A balanced maternal diet with an emphasis on fruits, vegetables, fish, grains, legumes, and herbs could be a potential option for helping reduce the incidence of PPD.	Australia	-	-	High
Zhao (2020)[24]	Review of systematic reviews and meta-analyses	48 (since inception until 2019)	Unknown	Greater seafood consumption, healthy dietary patterns, multivitamin supplementation, fish and PUFA intake, calcium, vitamin D, zinc, and possibly selenium are protective factors.	China	-	-	High
Abedi (2018)[15]	Case–control study	-	120	There is a significant relationship between a low level of vitamin D and PPD.	Iran	60 women with and 60 without PPD	Beck Depression Scale	High
Wang (2018)[22]	Systematic review and meta-analysis	9 (2012-2016)	8470	Serum 25 (OH) D levels <50 nmol/l were associated with 2.67 times (OR 3.67; 95% CI 1.72–7.85) increased risk of postpartum depression.	China	-	-	High
Lin (2019)[18]	Cross-sectional study	-	-	Plasma vitamin B2 levels and erythrocyte FA composition might have a major effect on PPD development. Our results suggest that the moderate consumption of riboflavin and n-3 FA could have protective effects on PPDS.	Taiwan	344 women	EPDS*	High
Swardfager (2013)[50]	Systematic reviews and meta-analyses	17 (1984-2010)	2447	Depression is associated with a lower concentration of zinc in peripheral blood.	Canada	-	-	High
Goshtasebi (2013)[51]	Longitudinal study	-	-	Treatment of physiologic factors, especially anemia, would reduce the risk of PPD.	Iran	254 participants	EPDS	High

Contd...

Table 2: Contd...

Authors and year conducted	Design type	Number of papers included (date range)	Participants	Outcome	Country	Sample	Tools	Quality level
Wassef (2019)[28]	Review	17 (up to 2017)		Anemia and/or iron deficiency may contribute to PPD in at-risk women.	Canada	-	-	High
Yan (2017)[52]	Cohort study	-	-	Prolonged folic acid (FA) supplementation during pregnancy was associated with a decreased risk of PPD.	China	1592 participants	CSS**	High
Armony (2012)[53]	Observational study			There was no relationship between maternal iron status and PPD.	China	Pilot sample 137 and confirmatory 567	EPDS	High
Xu (2018)[23]	Cohort study	2001-2010	-	Depression was associated with anemia in women before and after birth.	New South Wales (NSW)	Population-based 649210	The APDC*** is a routinely collected census	High
Levant (2016)[56]	Review	14 (2002-2010)	Unknown	Particularly, decreased DHA is associated with both non-puerperal and PPD.	USA	-	-	High
Llorente (2003)[31]	Clinical trial	-	-	No correlation between docosahexaenoic (omega-3 fatty acid) acid and depression.	USA	200 participants	Current depression symptoms	High
Browne (2006)[30]	Case–control	-	-	There was no association between postnatal depression and either fish consumption in early pregnancy or omega-3 status after birth.	New Zealand	80 participants and 39 in the control group	Diagnostic interview	High
Mougharbel (2015)[56]	Systematic review	17 (2002-2014)	56601	The significant positive association between n-3 PUFA intake and PPD.	USA	-	-	High
Baines (2007)[26]	Cross-sectional			Vegetarian's 21–22% reporting depression compared with 15% of non-vegetarians (P<0.001). Low iron levels and menstrual symptoms were also more common in both vegetarian groups.	Australia	9113 women	SF-36 ****	High
Mirghafourvand (2017)[59]	Double-blind randomized controlled			Orange peel essential oil did not reduce PPD and anxiety.	Iran	96 women	EPDS and STAI	High
Amini (2019)[25]	Systematic review	7 (1975-2017)	4771	Vitamin D deficiency is related to the incidence of PPD and vitamin D may play a significant role in the recovery of women with PPD.	Iran	-	-	High
Murphy (2010)[36]	Exploratory descriptive study	-	-	Vitamin D may play a significant role in PPD.	USA	97 women	EPDS	High
Tiderencel (2019)[27]	A review of current literature	3 (2002-2018)	Unknown	Vitamin D may play a role in reducing PPD.	USA	-	-	Medium

Contd...

Table 2: Contd...

Authors and year conducted	Design type	Number of papers included (date range)	Participants	Outcome	Country	Sample	Tools	Quality level
Kurniati (2020)[34]	Cross-sectional	-	-	No correlation between serum zinc level and postpartum blues syndrome.	Indonesia	70 women	EPDS	High
Fard (2017)[33]	Clinical trial	-	-	Magnesium and zinc did not reduce postpartum anxiety and depressive symptoms.	Iran	A randomized clinical trial	EPDS and STAI *****	High

*Edinburgh Postpartum Depression Scale (EPDS). **The Chinese version of the Self-Rating Depression Scale (CSS). ***Admitted Patient Data Collection (APDC). ****Short FormHealth Survey (SF-36). ***** Spielberger State-Trait Anxiety Inventory (STAI)

no association between serum levels of vitamin B12, folate, ferritin, and the risk of PPD.[37]

Zinc

Zinc is a rare metal ion and the second most abundant element in the human body, after calcium. It plays a crucial role in both the immune and endocrine systems.[49] Zinc is responsible for stimulating and inhibiting chemical mediators in the central nervous system.[49] According to a comprehensive meta-analysis, depressed women had lower blood zinc levels (1.85 µmoll/L) than non-depressed women.[50] Additionally, a systematic review found that low zinc levels are linked to a higher risk of PPD.[1] However, several studies have shown no correlation between serum zinc levels and postpartum blues syndrome.[34] Moreover, a clinical trial found that zinc did not have a significant effect on reducing postpartum anxiety and depressive symptoms.[33]

Iron

Various studies have indicated that women with anemia tend to experience more significant PPD as compared to other mothers.[9] The diagnosis and treatment of anemia during pregnancy can help reduce the risk of PPD.[51] Additionally, low ferritin levels during the postpartum period can also contribute to PPD.[28] A cohort study in China involving 1,592 women showed that consuming iron for over 6 months, which began during pregnancy, helped reduce the risk of depression 6 and 12 months after delivery.[52] However, another study found no association between maternal serum iron and postpartum depressive symptoms.[53] A quality cohort study conducted on 649121 samples over 10 years showed that there is a significant association between anemia and depression during the first year after delivery.[23] Foods such as red meat, liver, seeds, beans, and oysters are rich sources of iron.[54]

Folate

Folate is an essential component in the synthesis of chemical mediators such as serotonin, dopamine, and norepinephrine. Studies have shown a link between folate levels and cognitive function.[42,43] Folate is required in the synthesis of S-Adenosyl Methionine (SAM) from Homocysteine (HCY), which is essential for neurotransmitter production. Furthermore, a deficiency in folate can halt the production of HCY to cysteine. However, several studies have revealed that elevated HCY levels are associated with PPD.[21,52] A cohort study of 1,592 Chinese pregnant women followed up for up to 6 months postpartum found that taking folic acid for more than 6 months reduced the risk of PPD.[55]

Essential fatty acids

Essential unsaturated fatty acids, also known as Polyunsaturated Fatty Acids (PUFAs), are divided into two

main categories: linoleic acid (n-6) and á-linolenic acid (n-3). Omega-3, which is derived from three fat groups, namely Alpha-Linolenic Acid (ALA), Eicosapentaenoic Acid (EPA), and Docosahexaenoic Acid (DHA), is a type of linolenic acid.[17] The significant positive association between n-3 PUFAs intake and PPD.[56]

Studies have shown that there is a link between low levels of omega-3 fatty acids and higher levels of PPD.[17] Among these, the role of the DHA is more pronounced. Pregnancy and lactation naturally decrease DHA levels.[28,57] However, the connection between DHA and PPD is inconsistent. In an interventional study, even with a daily intake of 200 mg of DHA in women with lowered serum levels, there was no change in the prevalence of PPD in the first 4 months after delivery.[31] Nonetheless, some studies have found no correlation between fish intake or omega-3 supplementation and PPD.[30,58] In general, systematic reviews have been unable to establish an effective relationship between omega-3 fatty acids and PPD.[59] However, the prevalence of PPD is higher in vegetarian diets than in omnivorous diets.[26]

Carbohydrates

Carbohydrates play a crucial role in energy production and can impact mood. Although a few studies have been conducted on the relationship between carbohydrates and the risk of PPD,[29,60,61] research has shown that pregnancy leads to insulin resistance,[60] which can make women more susceptible to depression and impaired glucose tolerance.[61] A cohort study has found that women with gestational diabetes are at a significantly higher risk of developing PPD during pregnancy and the postpartum period.[62] Additionally, it has been hypothesized that decreased insulin levels after delivery can lower serotonin levels and cause depression.[32] Fluctuations in blood sugar levels can also lead to the secretion of inflammatory and adipokine markers such as interleukin 6, which have been linked to PPD.[63,64] However, one cohort study found no association between glycemic index and PPD.[30] Finally, low-carbohydrate diets tend to increase the risk of depression because they reduce the production of serotonin in the brain. Carbohydrate-rich foods, however, promote the feeling of well-being by triggering the production of tryptophan.[65]

Antioxidants

Vitamin C plays a crucial role in preventing oxidative stress. It also acts as a cofactor for a group of enzymes that are responsible for regulating and synthesizing important functions throughout the body.[55] A study has indicated that a high dose of vitamin C (3 g/day) can reduce the severity of PPD.[9] However, another study has found that compressed drops of orange peel do not have any effect on PPD or anxiety.[59] There was no significant association found between vitamin E or carotenoids and PPD.[9]

Healthy diet pattern

Eating a well-balanced diet includes fruits, vegetables, fish, and seafood.[8] This diet reduces postpartum anxiety and depression.[31,57] Several studies have shown that consuming whole grains, fruits, vegetables, and fish can effectively lower the prevalence and protect against PPD.[10,24]

Additionally, a study has found that not consuming enough vegetables is more likely to increase the likelihood of PPD than not eating enough meat.[66]

Discussion

This study is a systematic review that aims to explore the relationship between PPD and nutrition, particularly a healthy diet pattern. Nutrients play a vital role in the brain by providing structural substrates and acting as cofactors in many biological reactions. Many nutrients have been shown to have a role in normal function.

Research shows that healthy eating patterns can significantly reduce the risk of PPD by preventing mental health disorders and regulating neurotransmitter synthesis and brain functions associated with depression.[67] The study also reveals that some nutritional deficiencies, such as a lack of vitamins D, iron, and folate, are linked to a higher risk of PPD. Additionally, vitamin D at a dosage of 2000 IU/d can reduce the incidence of depressive symptoms, as found in this review.[68]

It is important to note that the majority of pregnant women have below-optimal levels of vitamin D, highlighting the need for prenatal education on the importance of this nutrient. Additionally, the relationship between low iron levels and PPD has been well-established.[69]

Anemia, which can be caused by a reduction of inflammatory cytokines, such as interleukin 2, can be a contributing factor in depression.[70] Correction of pregnancy anemia, therefore, is crucial. Poor dietary quality has also been associated with PPD in some studies,[71] emphasizing the importance of healthy eating patterns. In line with these findings, iron, along with other nutrients, plays an essential role in maintaining mental health and improving brain function. Foods rich in iron include meat, poultry, fish, eggs, dried beans, and fortified cereals. The form of iron found in meat products, called heme, is more easily absorbed.

Maintaining healthy eating patterns that include vegetables is crucial for good health. The results of a recent study suggest that iron, among other essential nutrients, plays a critical role in maintaining mental health and improving brain function.[71]

There is conflicting information about the role of omega-3 essential fatty acids and other nutritional factors such as vitamin E or vitamin C in mental health. A large cohort

study showed no substantial evidence of an association between omega-3 and PPD in an adjusted model.[72] Some studies have reported a strong relationship between PPD and vitamin B,[43] but this was not found in this study or some others.[2] Despite the varying results, it is clear that nutrition has a significant impact on mental health, and some nutritional deficiencies contribute to the development of PPD.[73] One limitation of the study was the lack of clinical trial articles, and the wide variety of working methods used in different studies may affect the results.

Conclusion

Nutrition plays a crucial role in mental health, particularly with regard to depression. A lack of vitamin D, iron, folate, carbohydrates, and a healthy diet pattern (with an emphasis on vegetables) increases the risk of PPD. Depletion of nutrient reserves during pregnancy can also increase the risk of maternal depression. Eating vegetables and adopting a healthy eating pattern can help reduce the risk of PPD. Further evidence is needed to guide clinical practice on nutritional biomarkers.

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Conflicts of interest

Nothing to declare.

References

1. Sparling TM, Nesbitt RC, Henschke N, Gabrysch S. Nutrients and perinatal depression: A systematic review. J Nutr Sci 2017;6:e61.
2. Ellsworth-Bowers ER, Corwin EJ. Nutrition and the psychoneuroimmunology of postpartum depression. Nutr Res Rev 2012;25:180-92.
3. Dennis CL, Chung-Lee L. Postpartum depression help-seeking barriers and maternal treatment preferences: A qualitative systematic review. Birth 2006;33:323-31.
4. Klainin P, Arthur DG. Postpartum depression in Asian cultures: A literature review. Int J Nurs Stud 2009;46:1355-73.
5. Veisani Y, Delpisheh A, Sayehmiri K, Rezaeian S. Trends of postpartum depression in Iran: A systematic review and meta-analysis. Depress Res Treat 2013;2013:291029. doi: 10.1155/2013/291029.
6. Alipour Z, Kheirabadi GR, Kazemi A, Fooladi M. The most important risk factors affecting mental health during pregnancy: A systematic review. East Mediterr Health J 2018;24:549-59.
7. Ghaedrahmati M, Kazemi A, Kheirabadi G, Ebrahimi A, Bahrami M. Postpartum depression risk factors: A narrative review. JEHP 2017;6:60.
8. Silva DFO, Cobucci RN, Gonçalves AK, Lima SCVC. A systematic review of the association between dietary patterns and perinatal anxiety and depression. BMC Pregnancy Childbirth 2019;19:212.
9. Bodnar LM, Wisner KL. Nutrition and depression: Implications for improving mental health among childbearing-aged women. Biol Psychiatry 2005;58:679-85.
10. Opie RS, Uldrich AC, Ball K. Maternal postpartum diet and postpartum depression: A systematic review. Matern Child Health J 2020;24:966-78.
11. Moher D, Liberati A, Tetzlaff J, Altman DG, PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. PLoS Med 2009;6:e1000097. doi: 10.1371/journal.pmed.1000097.
12. Mirza I, Jenkins R. Risk factors, prevalence, and treatment of anxiety and depressive disorders in Pakistan: Systematic review. BMJ 2004;328:794. doi: 10.1136/bmj.328.7443.794.
13. Cuschieri S. The STROBE guidelines. Saudi J Anaesth 2019;13(Suppl 1):S31-4.
14. Mokkink LB, Terwee CB, Stratford PW, Alonso J, Patrick DL, Riphagen I, *et al*. Evaluation of the methodological quality of systematic reviews of health status measurement instruments. Quality of life research : an international journal of quality of life aspects of treatment, care and rehabilitation. 2009;18:313-33.
15. Abedi P, Bovayri M, Fakhri A, Jahanfar S. The relationship between vitamin D and postpartum depression in reproductive-aged Iranian women. J Med Life 2018;11:286-92.
16. Huang X, Fan Y, Han X, Huang Z, Yu M, Zhang Y, *et al*. Association between serum vitamin levels and depression in US adults 20 years or older based on national health and nutrition examination survey 2005–2006. Int J Environ Res Public Health 2018;15:1215. doi: 10.3390/ijerph15061215.
17. Leung BM, Kaplan BJ. Perinatal depression: Prevalence, risks, and the nutrition link—a review of the literature. J Am Diet Assoc 2009;109:1566-75.
18. Lin Y-H, Chen C-M, Su H-M, Mu S-C, Chang M-L, Chu P-Y, *et al*. Association between postpartum nutritional status and postpartum depression symptoms. Nutrients 2019;11:1204. doi: 10.3390/nu11061204.
19. Martel JL, Kerndt CC, Doshi H, Franklin DS. Vitamin B1 (Thiamine). StatPearls. Treasure Island (FL): StatPearls Publishing Copyright © 2021, StatPearls Publishing LLC.; 2021.
20. Mattson MP, Shea TB. Folate and homocysteine metabolism in neural plasticity and neurodegenerative disorders. Trends Neurosci 2003;26:137-46.
21. Pan W-H, Chang Y-P, Yeh W-T, Guei Y-S, Lin B-F, Wei I-L, *et al*. Co-occurrence of anaemia, marginal vitamin B6, and folate status and depressive symptoms in older adults. J Geriatr Psychiatry Neurol 2012;25:170-8.
22. Wang J, Liu N, Sun W, Chen D, Zhao J, Zhang W. Association between vitamin D deficiency and antepartum and postpartum depression: A systematic review and meta-analysis of longitudinal studies. Arch Gynecol Obstet 2018;298:1045-59.
23. Xu F, Roberts L, Binns C, Sullivan E, Homer CS. Anaemia and depression before and after birth: A cohort study based on linked population data. BMC Psychiatry 2018;18:224.
24. Zhao X-H, Zhang Z-H. Risk factors for postpartum depression: An evidence-based systematic review of systematic reviews and meta-analyses. Asian J Psychiatr 2020;53:102353. doi: 10.1016/j.ajp.2020.102353.

25. Amini S, Jafarirad S, Amani R. Postpartum depression and vitamin D: A systematic review. Critical Reviews in Food Science and Nutrition. 2019;59:1514-20.
26. Baines S, Powers J, Brown WJ. How does the health and well-being of young Australian vegetarian and semi-vegetarian women compare with non-vegetarians? Public health nutrition. 2007;10:436-42.
27. Tiderencel KA, Zelig R, Parker A. The Relationship Between Vitamin D and Postpartum Depression: A Review of Current Literature. Topics in Clinical Nutrition. 2019;34:301-14.
28. Wassef A, Nguyen QD, St-André M. Anaemia and depletion of iron stores as risk factors for postpartum depression: a literature review. Journal of Psychosomatic Obstetrics & Gynecology. 2019;40:19-28.
29. Kaplan BJ, Crawford SG, Field CJ, Simpson JSA. Vitamins, minerals, and mood. Psychological bulletin. 2007;133:747.
30. Browne JC, Scott KM, Silvers KM. Fish consumption in pregnancy and omega-3 status after birth are not associated with postnatal depression. Journal of affective disorders. 2006;90:131-9.
31. Llorente AM, Jensen CL, Voigt RG, Fraley JK, Berretta MC, Heird WC. Effect of maternal docosahexaenoic acid supplementation on postpartum depression and information processing. American journal of obstetrics and gynecology. 2003;188:1348-53.
32. Chen T-H, Lan T-H, Yang C-Y, Juang K-D. Postpartum mood disorders may be related to a decreased insulin level after delivery. Medical hypotheses. 2006;66:820-3.
33. Fard FE, Mirghafourvand M, Mohammad-Alizadeh Charandabi S, Farshbaf-Khalili A, Javadzadeh Y, Asgharian H. Effects of zinc and magnesium supplements on postpartum depression and anxiety: A randomized controlled clinical trial. Women Health. 2017;57:1115-28.
34. Kurniati Y, Sinrang W. Postpartum blues syndrome: Serum zinc and psychosocial factors. Enfermeria clinica. 2020;30:18-21.
35. Lamberg-Allardt C. Vitamin D in foods and as supplements. Progress in Biophysics and Molecular Biology. 2006;92:33-8.
36. Murphy PK, Mueller M, Hulsey TC, Ebeling MD, Wagner CL. An exploratory study of postpartum depression and vitamin d. J Am Psychiatr Nurses Assoc 2010;16:170-7.
37. Trujillo J, Vieira MC, Lepsch J, Rebelo F, Poston L, Pasupathy D, *et al*. A systematic review of the associations between maternal nutritional biomarkers and depression and/or anxiety during pregnancy and postpartum. Journal of affective disorders. 2018;232:185-203.
38. Vaziri F, Nasiri S, Tavana Z, Dabbaghmanesh MH, Sharif F, Jafari P. A randomized controlled trial of vitamin D supplementation on perinatal depression: in Iranian pregnant mothers. BMC Pregnancy Childbirth. 2016;16:239.
39. Gibson GE, Hirsch JA, Fonzetti P, Jordan BD, Cirio RT, Elder J. Vitamin B1 (thiamine) and dementia. Annals of the New York Academy of Sciences. 2016;1367:21-30.
40. Martin PR, Singleton CK, Hiller-Sturmhöfel S. The role of thiamine deficiency in alcoholic brain disease. Alcohol research & health. 2003;27:134.
41. Nakagawasai O, Yamadera F, Iwasaki K, Asao T, Tan-No K, Niijima F, *et al*. Preventive effect of kami-untan-to on performance in the forced swimming test in thiamine-deficient mice: relationship to functions of catecholaminergic neurons. Behavioural brain research. 2007;177:315-21.
42. Mikkelsen K, Stojanovska L, Apostolopoulos V. The effects of vitamin B in depression. Current medicinal chemistry. 2016;23:4317-37.
43. Miyake Y, Tanaka K, Okubo H, Sasaki S, Furukawa S, Arakawa M. Soy isoflavone intake and prevalence of depressive symptoms during pregnancy in Japan: baseline data from the Kyushu Okinawa Maternal and Child Health Study. European journal of nutrition. 2018;57:441-50.
44. Stover PJ, Field MS. Vitamin B-6. Advances in nutrition (Bethesda, Md). 2015;6:132-3.
45. Sakowski SA, Geddes TJ, Thomas DM, Levi E, Hatfield JS, Kuhn DM. Differential tissue distribution of tryptophan hydroxylase isoforms 1 and 2 as revealed with monospecific antibodies. Brain Res. 2006;1085:11-8.
46. Dabrowska J, Hazra R, Guo J, DeWitt S, Rainnie D. Central CRF neurons are not created equal: phenotypic differences in CRF-containing neurons of the rat paraventricular hypothalamus and the bed nucleus of the stria terminalis. Frontiers in neuroscience. 2013;7:156.
47. Malinow M. Homocyst (e) ine and arterial occlusive diseases. Journal of internal medicine. 1994;236:603-17.
48. Stanger O, Fowler B, Piertzik K, Huemer M, Haschke-Becher E, Semmler A, *et al*. Homocysteine, folate and vitamin B12 in neuropsychiatric diseases: review and treatment recommendations. Expert review of neurotherapeutics. 2009;9:1393-412.
49. Smart TG, Hosie AM, Miller PS. Zn2+ ions: modulators of excitatory and inhibitory synaptic activity. Neuroscientist. 2004;10:432-42.
50. Swardfager W, Herrmann N, Mazereeuw G, Goldberger K, Harimoto T, Lanctôt KL. Zinc in depression: a meta-analysis. Biological psychiatry. 2013;74:872-8.
51. Goshtasebi A, Alizadeh M, Gandevani SB. Association between maternal anaemia and postpartum depression in an urban sample of pregnant women in Iran. Journal of health, population, and nutrition. 2013;31:398.
52. Yan J, Liu Y, Cao L, Zheng Y, Li W, Huang G. Association between duration of folic acid supplementation during pregnancy and risk of postpartum depression. Nutrients. 2017;9:1206.
53. Armony-Sivan R, Shao J, Li M, Zhao G, Zhao Z, Xu G, *et al*. No relationship between maternal iron status and postpartum depression in two samples in China. Journal of pregnancy. 2012;2012.
54. Lim KH, Riddell LJ, Nowson CA, Booth AO, Szymlek-Gay EA. Iron and zinc nutrition in the economically-developed world: A review. Nutrients. 2013;5:3184-211.
55. Pullar JM, Carr AC. High Vitamin C Status Is Associated with Elevated Mood in Male Tertiary Students. 2018;7.
56. Mougharbel F. The Role Of Omega-3 Unsaturated Fatty Acids In Postpartum Depression: A Systematic Review And Narrative Synthesis. 2015.
57. Levant B. N-3 (omega-3) Fatty acids in postpartum depression: implications for prevention and treatment. Depression research and treatment. 2011;2011.
58. Kobayashi M, Ogawa K, Morisaki N, Tani Y, Horikawa R, Fujiwara T. Dietary n-3 polyunsaturated fatty acids in late pregnancy and postpartum depressive symptom among Japanese women. Front Psychiatry 2017;8:241.
59. Mirghafourvand M, Mohammad Alizadeh S, Hakimi S, Khodaie L, Galeshi M. The effect of orange peel essential oil on postpartum depression and anxiety: a randomized controlled clinical trial. 2017.
60. Murakami K, Miyake Y, Sasaki S, Tanaka K, Yokoyama T, Ohya Y, *et al*. Dietary glycemic index and load and the risk of postpartum depression in Japan: The Osaka Maternal and Child Health Study. J Affect Disord 2008;110:174-9.
61. Rahimlou M, Morshedzadeh N, Karimi S, Jafarirad S.

Association between dietary glycemic index and glycemic load with depression: A systematic review. Eur J Nutr 2018;57:2333-40.

62. Hinkle SN, Louis GMB, Rawal S, Zhu Y, Albert PS, Zhang C. A longitudinal study of depression and gestational diabetes in pregnancy and the postpartum period. Diabetologia 2016;59:2594-602.
63. Fasshauer M, Blüher M, Stumvoll M. Adipokines in gestational diabetes. Lancet Diabetes Endocrinol 2014;2:488-99.
64. Osborne LM, Monk C. Perinatal depression--the fourth inflammatory morbidity of pregnancy? Theory and literature review. Psychoneuroendocrinology 2013;38:1929-52.
65. Rao TSS, Asha MR, Ramesh BN, Rao KSJ. Understanding nutrition, depression and mental illnesses. Indian J Psychiatry 2008;50:77-82.
66. Zhao J. Low consumption of vegetables is associated with postpartum depression: A cross section study. Curr Dev Nutr 2020;4(Suppl 2):1112.
67. Rechenberg K, Humphries D. Nutritional interventions in depression and perinatal depression. Yale J Biology Med 2013;86:127-37.
68. Xie F, Huang T, Lou D, Fu R, Ni C, Hong J, *et al*. Effect of vitamin D supplementation on the incidence and prognosis of depression: An updated meta-analysis based on randomized controlled trials. Front Public Health 2022;10:903547. doi: 10.3389/fpubh.2022.903547
69. Hameed S, Naser IA, Al Ghussein MA, Ellulu MS. Is iron deficiency a risk factor for postpartum depression? A case–control study in the Gaza Strip, Palestine. Public Health Nutr 2022;25:1631-8.
70. Azami M, Badfar G, Khalighi Z, Qasemi P, Shohani M, Soleymani A, *et al*. The association between anemia and postpartum depression: A systematic review and meta-analysis. Caspian J Intern Med 2019;10:115-24.
71. Yang C, Zhao A, Lan H, Ren Z, Zhang J, Szeto IM-Y, *et al*. Association between dietary quality and postpartum depression in lactating women: A cross-sectional survey in urban China. Front Nutr 2021;8:705353. doi: 10.3389/fnut.2021.705353.
72. Sallis H, Steer C, Paternoster L, Smith GD, Evans J. Perinatal depression and omega-3 fatty acids: A Mendelian randomisation study. J Affect Disord 2014;166:124-31.
73. Grajek M, Krupa-Kotara K, Białek-Dratwa A, Sobczyk K, Grot M, Kowalski O, *et al*. Nutrition and mental health: A review of current knowledge about the impact of diet on mental health. Front Nutr 2022;9:1805. doi: 10.3389/fnut.2022.943998.