An Evidence Analysis Project: Evidence Analysis of Vitamin D Supplementation to Reduce Risk of Postpartum Depression

Brianne K Wakefield, BS

Submitted in partial fulfillment of the requirements

for the degree of Master of Science in Dietetics

Mount Mary University

Janine M. Bamberger, MS, RDN, CD

Assistant Professor, Department of Dietetics

Linda Gleason, MS, RD, CD

Instructor, Department of Dietetics

May 14, 2023

Abstract

Many nutrients are considered to impact mental health. The purpose of this evidence analysis project was to determine if vitamin D levels in postpartum women were related to prevalence of postpartum depression symptoms. Expecting mothers and women planning to become pregnant could benefit from having best practice guidelines in postpartum depression. This five-step process critically evaluates current literature on postpartum depression and vitamin D to formulate evidenced based conclusions. In total, seven studies were reviewed and evaluated in this evidence analysis project. Majority of the articles included found a correlation between vitamin D levels and postpartum depression. Increased vitamin D intake may lead to decreased prevalence of postpartum depression among expecting mothers.

Keywords: vitamin D, postpartum depression

ACKNOWLEDGMENTS

I would like to thank my husband and family for their unwavering support. They have given me the encouragement and strength throughout my entire academic career.

I would also like to express my immense gratitude for the many faculty members of Mount Mary University, specifically those who have guided me throughout the internship and graduate program.

To Janine Bamberger, thank you for your encouragement in navigating this final project. Your kindness, time spent and countless conversations to aid in the completion are greatly appreciated.

Table of Contents

Table of Figures

List of Tables

Chapter 1: Introduction to the Study

Medical research surrounding depression has become an increasingly popular topic due to the rising prevalence of depression in the United States. Major depressive disorder affects more than 8% of American adults per year (Mental Health America, 2022). It is likely that this number is increasing each year. Depression can cause individuals to withdraw, and it complicates other medical conditions. There is speculation on what causes depression. There may be many factors that contribute to this mood disorder including biological, cognitive, gender, co-occurrence, medications, genetics, and situational. One area that gets overlooked in connection to depression is nutrition. Diet plays a large role in the physical health of an individual and may play a large role in mental health.

Background

Depression has many kinds of symptoms and can affect individuals differently. Common symptoms of a depressive state are frequent feelings of sadness, emptiness, or hopelessness, loss of interests or pleasure in activities that were once enjoyed, sleep disturbances, lack of energy and tiredness, reduced appetite, weight loss, increased anxiety, and thoughts of suicide or harming oneself (CDC, 2022). For many people, depression affects the quality of life and is severe enough to cause a disturbance in day-to-day activities. A women's risk for depression increases after the birth of a child (CDC, 2022). This kind of depression is called postpartum depression. Postpartum depression according to the CDC (2022) is a common and serious illness that affects about 1 in every 8 women in the United States. Symptoms of postpartum depression also affect quality of life and include tearfulness, feelings of anger, withdrawing from loved ones, feelings of disconnect from the infant, and an increased guilt about being an unfit mother or doubting the ability to care for the baby.

Risk factors for depression or postpartum depression can include stressful life events, low social support, and previous or family history of depression. Nutrition may also play a role in the risk for depression and postpartum depression. Nutrients such as vitamin D, vitamin B12, omega-3 fatty acids, zinc, and iron are commonly considered in relation to depression. It is suggested that these nutrients could be linked to depression including postpartum depression, however, there is a lack of consensus of whether supplementation of such nutrients is effective in preventing depressive symptoms.

Problem Statement

With depression on the rise, especially in recent years, women who are pregnant and are in the postpartum period are at particular risk. These individuals are experiencing significant life changes. Body and hormonal changes occur, along with an increased responsibility, sleep deprivation, and financial burdens. These life changes can be stressful and put this population at risk for depressive symptoms. It is possible that nutrition can also play a role in the development of postpartum depression - in particular, vitamin D deficiency. It is important that an evidence-based practice is established on vitamin D intake to help these individuals at risk for developing depression. It is currently unclear if supplementation of vitamin D aids in decreasing the prevalence of postpartum depression.

Purpose of the Study

The purpose of this Evidence Analysis Library Project (EAL) is to assess the present literature on vitamin D supplementation and postpartum depression. This study will assist in developing evidence-based guidelines using critical appraisals of current peer-reviewed researched articles focused on the prevention of postpartum depression.

Research Question

Does vitamin D help to decrease risk of postpartum depression in expecting women?

Significance

Mental health is an increasing and ongoing health issue that impacts many citizens of the United States. It's important for dietitians to investigate possible causes and means to prevent nutrient deficiencies and their clinical effects. Dietitians play a large role in promoting optimal health and nutrition. It is the clinician's responsibility to find the best fit recommendation in treatment and prevention of mental health illnesses and as evidence becomes available, can aid in the prevention and treatment of mental health disorders.

The outcome of this Evidence Analysis Project is to aid expectant women in experiencing less debilitating postpartum depression symptoms. It has the potential to summarize the literature of evidence-based practice on postpartum depression. The findings of this project will help to review findings on vitamin D, the dosage, and timing of supplementation in expectant women.

Assumptions

In each EAL project it is important to address assumptions of the literature reviewed. For this project, it is assumed that all the studies in this evidence analysis are reliable and of high quality. The reliability and quality of each study and relevant articles will be assessed in this project.

Limitations

It is important to address a study's limitations, or shortcomings as these should be addressed when reviewing current literature to determine the quality of the study. Limitations could be the result of restricted resources, small sample size, or flawed methodology. In this evidence analysis project, some of the studies have small samples sizes which may make it

difficult to determine if an outcome is a true significant finding. Other limitations of this analysis include vitamin D supplementation of varying dosage, the differing depression assessment tools, and variations in the way blood vitamin D levels are assessed. These factors can also make it difficult to conclude a best-fit practice.

Delimitations

Delimitations are the boundaries put in place for the project that help to address the limitations. Delimitations for this study were used to address the limitations of current literature stated above.

The inclusion criteria:

i. Adult females 18-40 years of age
ii. Pregnancies with a single fetus
iii. Time frame of current literature published within the last 10 years (2013 or later)
iv. Sample sizes of at least 50 participants

The exclusion criteria:

i. Pediatric female subjects, <18 years of age
ii. Multiple pregnancy (more than one fetus)
iii. Time frame of research outside of 2013-2023
iv. Sample size of less than 50 participants
v. Articles published in other languages (non-English)

Definitions

The following terms will be frequently used throughout the evidence analysis project

Postpartum: the time after childbirth

Peripartum depression: major depressive episodes that occur during pregnancy

Postpartum depression: major depressive episodes that occur within the first 4 weeks after birth, or longer

Major depressive disorder: a common and serious medical issue that affects how an individual feels, thinks, and acts

Summary

Depression strongly affects the lives of individuals who suffer from the illness. The treatment of postpartum depression has additional challenges as new mothers navigate a major life change. In these vulnerable populations, nutritional deficiencies linked to depression are important to investigate and incorporate into clinical practice. Addressing nutrition in relation to mental health has the potential to make a difference in the treatment of those who suffer. An evidence analysis project is therefore needed and important to provide a practice guideline regarding vitamin D supplementation in pregnant women. It can also provide direction for further research concerning the topic. The EAL project will begin with a review of literature on postpartum depression and vitamin D supplementation in pregnant women. A step-by-step process of the literature analysis assessment followed by results and discussion of findings.

Chapter 2: Review of Literature

Depression is a serious mental health illness that can negatively affect personal wellbeing. The Center for Disease Control and Prevention (CDC, 2020) conducted a study showing that one in every 10 women in the United States experienced episodes of major depression in 2020. Along with that, CDC research (2020) also showed that, nationally one in every eight women experience postpartum depression (PPD) and symptoms. Peripartum, and postpartum, depression is defined by the American Psychiatric Association as depression that occurs in women during and after the birth of a child (symptoms must arise during or within a few weeks after childbirth) (American Psychiatric Association, 2022). The term peripartum is used more frequently now, in comparison to postpartum, due to the realization that for many women postpartum depression and symptoms can begin during the actual pregnancy.

Depression, no matter what the type, should be taken seriously by medical professionals. Common symptoms of the illness include hopelessness, anxiety, feeling "empty," lasting sadness, irritability, loss of energy, lack of concentration, loss of interest, difficulty sleeping, and intrusive thoughts of self-harm (CDC, 2020). These symptoms are a few of many other possible symptoms, which can be debilitating to those who experience them. Signs and symptoms unique to postpartum depression include crying more often than usual, feelings of disconnect from baby and loved ones, increased anger, increased worry of harming the baby, feelings of guilt related to thinking of not being a good mom, and severe doubt in being able to care for the child. Severity of symptoms can depend on the individual; however, peripartum depression is much more than experiencing the "baby blues" (which is typically is short lasting condition with less severe symptoms) according to the American Psychiatric Association (2022). Women can be extremely vulnerable during and after pregnancy; quality of life can be severely affected for both women

and infants. Healthy People 2030, a U.S. government health campaign, proposed a goal to increase screening of women during pregnancy for depression at clinic visits throughout the entire peripartum period (pregnancy and postpartum).

Nutritional deficiencies can have a negative impact on mental health. The purpose of this literature review is to analyze the evidence on the role of nutritional deficiencies in postpartum depression. Preliminary key search topics included: postpartum depression and diet quality, physical activity, food security and economic status, vitamin D, vitamin B12, and omega-3 fatty acids (FA). Pubmed and Medline databases were used to search for studies published on this topic withing the last five to seven years. Common search terms in the databases included: postpartum depression, perinatal depression, micronutrients, vitamin D, vitamin B12, and Omega-3 FA. These search topics were used in this literature review to gain a clear understanding of how nutrients play a role in postpartum depression.

Background

Medical research on depression has become a popular topic due to increased prevalence of depression. In the US alone, depression among adults tripled in the early months of 2020 (Mckoy, 2021); however, this may have been due to concerns surrounding the global pandemic. Common risk factors increase the likelihood of peripartum depression including low social support, poor economic status, a history of depression and drug use, a family history of depression, giving birth to low birthweight infants and experiencing a complicated pregnancy or birth (Moldenhauer, 2022). According to a study implemented by the CDC, younger first-time mothers are at increased risk and have shown a higher prevalence of peripartum depression (Ko et al., 2017). These factors are known to increase risk; however, not all women with risk factors develop peripartum depression. Additionally, dietary quality may be a modifiable risk factor in

depression since nutritional factors play a role in regulating biological pathways in the human body related to mental illness including inflammation, oxidated stress, gut microbiome, and brain plasticity (Yang et al., 2021). Current treatment for postpartum depression includes antidepressants and psychotherapy (Moldenhauer, 2022). Some women may need to be hospitalized if symptoms are severe.

Postpartum and Nutrition

Discussion on mental health and nutrition is on the rise. Studies like Yang et al. (2021) explore diet quality in relation to mental health conditions. Yang et al. (2021) examined the diets of postpartum Chinese women. The study included 939 participants (age range of 20-45 years) from 10 different cities in China. To be included in the study, participants had to be healthy and within their first year post giving birth. Postpartum depression was assessed using the Edinburgh postnatal depression scale (EPDS) due to its favorable reliability and validity. Twenty-four-hour dietary food recalls were recorded. Yang et al. (2021) concluded that one third of participants experienced depressive symptoms; of these women, not only were shared socio-economic characteristics found, but poor diet variety and quality were also a shared factor. Specifically, these women were lacking intake of vegetables, fruits, dairy, and fish. Since these foods provide essential vitamins, minerals, amino acids, fiber, and phytochemicals, the lack of nutrient dense foods could play a role in the development of depressive episodes. Findings of Yang et al. (2021) were significant in revealing that depressed women have decreased vegetable intake and inadequate food variety. They concluded that there was an association between poor diet quality and increased risk of postpartum depression in Chinese women who recently gave birth.

In a similar study by Lin et al., 2019, also used the Edinburgh Postnatal Depression Scale (EPDS) as a measurement of perinatal depression and explored the relationship between

Taiwanese women, perinatal depression, and nutrition. A cross-sectional study of 244 Taiwanese women received assessments including postpartum depression symptoms (PPDS) screening and questionnaire, blood sample collection, biochemical analysis, and erythrocyte fatty acid profile analysis. Of the 244 women, only 120 gave complete data – an obvious limitation; of the 120, total of 23 participants experienced depressive symptoms. The study found that 8.4% of its participants were diagnosed with postpartum depression. Researchers concluded that there is a significant relationship between dietary vitamin B2, erythrocyte fatty acid composition, and dietary omega-3 fatty acids in perinatal depression (Lin et al.,2019) and determined that consumption of riboflavin and omega-3 fatty acids during pregnancy could offer protection against postpartum depression.

Specific micronutrients and diet quality may be linked to depression and peripartum depression in women. Micronutrients that have been investigated (among others) are omega-3, vitamin D, B vitamins, zinc, magnesium, and iron (Demelash, 2017). Certain micronutrients have been researched more frequently than others, such as vitamin D and omega-3 fatty acids. More research is needed due to the gap in the literature between micronutrients, dietary quality and their relationship to mental health.

Omega-3 Fatty Acids:

Omega-3 fatty acids have become a very important topic for research in many areas of nutrition and it is also prevalent in mental health research. Correlation found between postpartum depression and omega-3, the ratio of consumption of n-3 to n-6 in the American diet is 1:10 (Moldenhauer, 2022). This is significant considering our understanding of omega-3 fatty acids and their impact on overall health, such as cardiovascular health. We know that omega-3 consumption (or supplementation) is crucial for fetal development. It is suspected that omega-3

fatty acids may aid in decreasing the risks of perinatal depression, however; results are conflicting.

Researchers studying the correlation between postpartum depression and omega-3 fatty acids, Hamazaki et al. (2020) conducted research in Japan on the impact of n-3 poly unsaturated fatty acids (PUFAs) intake in pregnant women. The investigators explored the impact of fish and omega-3 consumption on postpartum depression. The amount of fish and n-3 PUFAs consumed was determined using a Food Frequency Questionnaire. The participants were asked how often they consumed each food type during pregnancy. Postnatal depression symptoms were assessed using the Kessler Psychological Distress Scale (K6) and given to the participants 6 months and 1 year after birth. According to the results at both six months and one year post-delivery women who consumed a higher amount of omega-3 PUFAS and fish had a decreased risk of postpartum depression. Authors also noted a stronger correlation with increased fish intake. Fish intake had more positive outcomes in decreasing PPD symptoms than omega 3.

In another study, researchers considered the imbalance in consumption of omega-6 and omega-3 fatty acids and found that a higher intake of n-6 fatty acids with a lower n-3 fatty acid intake increase the risk of depression was supported in the results (Hoge et al., 2019). In this study of 72 Belgian women, 17 had depressive symptoms within the first postpartum year. The authors concluded that the ratio of omega-6 to omegea-3, a higher consumption of omega-3 fatty acid is effective in preventing postpartum depression.

Vas et al. (2017) conducted a randomized placebo-controlled study on omega-3 supplementation from pregnancy to postpartum to assess postpartum depression likelihood and risk. The study took place in Brazil where 60 pregnant women at risk for perinatal depression were invited to participate. The first group was given a daily 1.8 g fish oil capsule (1.08 g of

EPA and 0.72 g of DHA) as a supplement and the control was given a daily placebo capsule. Supplementation was given for up to 16 weeks and did not begin until weeks 20-24 of pregnancy. A common scale used in many of the aforementioned studies was again used: The Edinburgh Postnatal Depression Scale for assessment of perinatal depression. The researchers concluded that the supplementation of fish oil capsules did not prevent the symptoms of postpartum depression in the group of women.

Vitamin B Complex

Demelash (2017) discussed the roles of micronutrients for depressed patients and how the B vitamins can affect mental health due to their important roles in in brain function. One of these important roles is the synthesis of neurotransmitters. Vitamin B12 in specifically was explored by conducting a cross-sectional study using archived plasma samples from a previous study. For the study, 217 women ages 18-50 years of age donated plasma for biochemical analysis. The researchers used the Edinburg Postnatal Depression Scale (EPDS) to screen for depression symptoms in participants 6-weeks postpartum. The authors concluded that the women with suspected postpartum depression were the participants who had lower vitamin B12 plasma levels compared to the non-postpartum depression women. A limitation of this study was that both data collection of the previous study and e screening measure were self-reported.

Khodadad et al. (2021) sought to explore the relationship between vitamin B6 and the prevention of postpartum depression. A single-blind, placebo controlled clinical trial was conducted on a total of 81 pregnant participants. The women were split into two groups those who supplemented with vitamin B6 (n= 40) and those who took the placebo (n=41). The vitamin B6 dosage for the experimental group was 80 mg. For each participant, supplementation began during week 28 and continued to the end of pregnancy. The researchers used the Hospital

Anxiety-Depressive Scale (HADS), Social Support Appraisal Scale (SS-A) as well as the Holmes and Rahe Life Change and Stress Evaluation Questionnaire (HRLCSEQ) to assess the risk of postpartum depression. The EPDS (as seen in previously reviewed studies) was used to assess depression symptoms after the pregnancy (post vitamin B6 intervention). The authors found that vitamin B6 is positively correlated in the prevention of PPD of the studied women. The authors noted that the limitations of this study were dietary vitamin B6 was not accounted for as well as physical activity. The authors claim that this was the first study on vitamin B6 and postpartum depression and that further studies on vitamin B6 and PPD are recommended.

Singh et al. (2017) specifically accounted for adolescent pregnant Latina women and the effect dietary micronutrient intake had on perinatal and postpartum depression. The authors chose to study this group of subjects because adolescents may be more at risk of depression due to lack of social support as well as poor micronutrient intake. A group of 108 adolescent pregnant Latinas participated in this study. The participants completed an Automated Self-Administered 24-hour dietary recall (ASA24) during the 2nd trimester of their pregnancy to gather data on dietary nutritional status. The level of stress was determined using the Perceived Stress Scale and the Prenatal Distress Questionnaire. Depressive symptoms were measured with the Reynolds Adolescent Depression Scale. Lastly, social support was measured with the Social Support Questionnaire. Researchers found that 50% of the adolescents had inadequate intake of folate among other micronutrients (vitamin A and E, iron, zinc, calcium, magnesium, and phosphorus). Researchers also found that more than 20% of the pregnant teenagers were deficient in thamin, riboflavin, niacin, vitamin B6 and B12, among others including vitamin C, copper, and selenium. Individuals with affected mood outcomes and social support those associated with the increased dietary intake of many of the B vitamins (thiamin, riboflavin,

niacin, folate, B6 and B12), vitamin C, vitamin E, iron, and zinc. The authors concluded that dietary intake and micronutrient levels play a role in the health interventions for perinatal and postpartum depression, specifically in adolescent pregnancies.

Iron & Zinc

Iron and zinc are other micronutrients commonly considered when it comes to mental health and depression. Sheikh et al. (2015) studied the effects of early iron supplementation on postpartum depression through a randomized double-blind placebo-controlled study. Seventy mothers with postpartum depression were evaluated after supplementation with iron dosed at 50mg of elemental iron per day. The Edinburgh Postnatal Depression Scale was used to assess depression, and the scores were significantly decreased in those receiving supplemental iron. The authors found that early supplementation increased the outcome of iron stores as measured by ferritin in the participants, and they saw a drop in EPDS scores in these individuals. Lower PPD symptoms were observed in the iron supplemented group as well.

Goshtasebi et al. (2013) researched the relationship between postpartum depression and amenia in pregnant women by conducting a longitudinal study. The participants (n = 254) were followed from the first prenatal appointment through 4-6 weeks post-delivery. A serum blood sample was collected at the time of delivery to assess anemia status in the participating women. The authors noted that the participants were similar in age, job, education, BMI, and gestational age at delivery. The Postpartum Depression Scale was again used in this study to assess postpartum depression symptoms. The researchers concluded that diagnosis and treatment of anemia in pregnancy leads to a decrease in postpartum depression. They suggested that all expectant mothers should supplement with iron during pregnancy regardless of anemia and

ferritin status. A limitation of the study, according to the authors, was the social support was not addressed in these women.

While the previously mentioned research had a positive impact on iron status and postpartum depression, Armony-sivan et al. (2012) did not have similar findings. The authors looked at pre- and postnatal maternal iron status and depression symptoms in Chinese women. Participants (n=137) were healthy individuals (age 18 years or older) who had no complications during pregnancy. The EPDS was used to assess the depression symptom severity and was given to each participant 24-48 hours after delivery and again 6-weeks postpartum. EPDS scores were not significantly different in those deficient in iron as compared to those who were not anemic. Authors concluded that there was no relationship between postpartum depression diagnosis and iron status.

Like Armony-sivan (2012), Kavitha et al. (2021) focused their work on postpartum depression but examined zinc status in a case-controlled study in Karnataka, India. The goal of the research was to compare postpartum blood zinc levels in those who were experiencing postpartum depression to blood zinc levels in healthy controls. The study took place over 3 months with a total of 80 participants – 40 diagnosed with PPD and 40 in the control. The Edinburgh Postnatal Depression Scale was used in this study to decide which individuals were taken as cases or put into the control group. A score of greater than 10 on the EPDS resulted in placement in the PPD case group, whereas a score of less than 10 on the EPDS resulted in the participant placement in the control group. The authors found that there were decreased levels of zinc in those participants who were diagnosed with PPD than in those who were in the control group. The study excluded any mothers who were taking any kind of mineral supplement or a multivitamin as well as those already being treated for depression. A limitation of this study was

that the sample size was small, and the authors mentioned that social economic status was not taken into consideration in this study.

In another study, zinc and magnesium levels were the focus (Edalati-Fard et al., 2016). This cross-sectional study completed on 122 postpartum women in Tabriz-Iran found that there was a significant inverse relationship between magnesium serum level and the Edinburgh depression score. Authors included participants 18 years or older who were able to read and write. Women who were hospitalized after giving birth due to a complicated pregnancy were excluded from this study. The EPDS was used for analysis of postpartum depression and a blood draw was used to gather magnesium and zinc levels. Researchers found that the higher magnesium levels correlated with a decreased risk of postpartum depression; however, they found no correlation between blood zinc levels and risk of PPD. A limitation of this study is that the study design is cross-section; the authors suggest that a case-control study would make for stronger findings.

Vitamin D

Vitamin D is a popularly debated nutrient in research on whether there is a connection between vitamin D and depression. Jani et al., (2020) focused on Australian women through their use of data from the Birthing Outcomes System (BOS). Since 2013, the BOS has recorded maternal vitamin D status and blood samples measured at 14 weeks gestation and throughout the pregnancy. Jan et al., (2020) split the participants into two groups: vitamin D deficient and not vitamin D deficient based on vitamin D serum levels. Findings revealed vitamin D deficiencies are related to increased risk for perinatal depression. Therefore, the study supports previous research evidence that showed a correlation of low levels of vitamin D to perinatal depression.

Vitamin D and metabolic ratios were also studied. Women with darker skin (e.g., Hispanics, African American, Latinos) do not absorb vitamin D3 from the environment as efficiently as those with lighter skin (Webb et al., 2018). The body absorbs vitamin D3 from specific food sources such as fatty fish as well as from prenatal vitamins; however, vitamin D3 needs to be altered to become biologically active once in the body. With vitamin D as the independent variable and depressive symptoms as the dependent variable, Accortt et al. (2021), used a variety of assessment tools to assess depression symptoms during pregnancy and the postpartum period. Tools included the Beck Depression Inventory (BDI) scores and the 21-item Center for Epidemiologic Studies Depression Scale (CES-D). The BDI includes a 21-item scale that assesses depressive symptoms with scores ranging from 0-63. Likewise, the CES-D includes a 21-item screening tool that assesses depression symptoms with a possible score range of 0-60. Higher the scores for each of these tools indicate higher levels of depressive symptoms in an individual. In conclusion, Accortt et al. (2021) confirmed that routine prenatal screenings for vitamin D metabolites should be performed to aid in prevention of PPD – especially in those women with darker skin tones. Perinatal depression can affect fewer women if vitamin D levels are increased. This is significant for clinics when screening patients that may be at higher risk.

In addition to perinatal depression, vitamin D deficiency has also been associated with fatigue. Both depression and fatigue have been common post-birth occurrences. Rouhi et al., (2018) specifically examined vitamin D levels and symptoms, including fatigue and depression, in postpartum Iranian women. In this study, a group of 80 women were put into two groups – one group was supplemented with 1000IU vitamin D3 and the second group was given a placebo. The groups of women were instructed to complete two separate questionnaires. The Edinburgh Postnatal Depression Scale (EPDS) and the Fatigue Identification Form (FIF) individually. The

study took place over six months, after which the women took the questionnaires for a second time. A limitation of this study was that vitamin D levels were not assessed by blood samples (which would have given a more accurate depiction). Vitamin D levels were assessed only by supplemented or not supplemented. The use of the EPDS and FIF screening tools can cause for an increase of reporting error. Vitamin D decreased depression scores and fatigue scores in the intervention group significantly. Researchers concluded that due to both lack of blood measurement and small sample size more research is needed. Overall, though, results suggest that vitamin D supplementation in pregnancy may be a useful strategy for preventing perinatal depression.

In their study on vitamin D and perinatal depression, Rouhi et al. (2018) concluded that vitamin D deficiency during pregnancy and after birth increases the risk of symptoms and diagnosis of perinatal depression. However, some studies found that Vitamin D blood levels are not helpful in decreasing the risk of postpartum depression. Lin et al. (2021) found that Vitamin D level has a negative correlation with postpartum depression. The authors found that the participants who were deficient in vitamin D during pregnancy, and during the months post birth, included individuals with and without depressive symptoms. Therefore, the effect of vitamin D was not evident in the study's results due to vitamin D deficiency being high in each group. However, researchers did note that it is typical for Chinese women to be in confinement after they give birth. This group of women are not likely to be exposed to sunlight during such time and therefore would be at a greater risk for vitamin D deficiency. In this case, researchers suggested that this group of women should supplement with Vitamin D due to the large-scale deficiency among them.

Williams et al. (2016) performed a study that took place in prenatal clinics in Ann Arbor, Michigan on Vitamin D levels and postpartum depression. Vitamin D levels were measured via maternal blood draws that were taken at specific times throughout the pregnancy as well as a few weeks post-pregnancy. Participants also completed the Beck Depression Inventory (BDI) which included 21 questions to assess signs and feelings of depression. The study presented evidence showing more severe depression symptoms in women with low vitamin D levels during early pregnancy stages (12-20 weeks) than in the postpartum period; however, the study did not find the same results due to vitamin D levels were not found to cause higher depressive symptoms in postpartum, but only in early pregnancy. The study concluded that more research needs to be done and that it is believed that vitamin D is valuable in reducing risk of perinatal depression.

Further investigation on vitamin D and the relationship it has between depression and fatigue has been studied. Abedi et al. (2018) conducted a study on Iranian women to investigate the relationship between vitamin D, postpartum depression, and fatigue. The aim of the study was to see if vitamin D supplementation was able to treat depression and fatigue in Iranian women. Abedi et al. (2018) conducted a case-control study consisting of 60 women with postpartum depression and 60 women without postpartum depression. The two groups were then divided into the treatment group and the control groups over four-ten months following birth. The women then received supplemental vitamin D3 (1000IU) or a placebo pill taken daily over the course of 6 months. Abedi et al. (2018) concluded that vitamin D supplementation decreased the fatigue scores in the treated group of women. One limitation of this study was that vitamin D deficiency was not assessed by blood samples. The researchers concluded that vitamin D supplementation post-birth could be a preventable aid in postpartum depression but that more research is needed.

Nielsen et al. (2013) hypothesized that vitamin D status during pregnancy can affect postpartum depression outcomes. More than 91,000 Danish women were recruited for this study. Measures were acquired by interview and blood draws of the participants at weeks 10-12 and week 25 of each pregnancy. Overall, Nielsen et al. (2013) found no relationship between vitamin D status and postpartum depression in Danish women. The authors found the opposite of their hypothesis. Women with the highest vitamin D levels were found to have more postpartum depressive symptoms than compared to those with lower vitamin D levels. This study is significant because it contradicts findings that support the relationship between vitamin D and postpartum depression.

There may be a potential link between vitamin D deficiency and postpartum depression. It could be beneficial to investigate the relationship of vitamin D supplementation and risk of postpartum depression. Reviewing current literature on vitamin D and postpartum depression through an Evidence Analysis Project would help to conclude whether vitamin D supplementation could decrease the risk of postpartum depression in expecting women.

Research Methodology

In reviewing of the literature, it's clear that more research is needed due to the conflicting evidence found between vitamin D levels and postpartum depression, concluding the relevance and importance on nutrition and the role it may play in peripartum depression. The current literature in this review discussed how supplementation of various micronutrients may be a benefit to women who are expecting or planning to become expectant in preventing PPD. An EAL project is an appropriate approach due to the conflicting evidence found in the literature. There is lack of guidelines for dietitians in the use of these micronutrients in perinatal patient care concerning postpartum depression. Having guidelines set in place is important when

providing care of best practices to these individuals. In the next chapters, evidence-based findings will be evaluated to find the most appropriate recommendations regarding nutrition and pre- and postnatal population of women.

Conclusion

Research on mental health and nutrition have become more prevalent today as the cases of mental health issues are rising, especially after Covid-19. Due to the prevalence of mental health issues, it is important for dietitians to investigate possible causes and prevention of these illnesses through diet and nutrition. Dietitians are advocates to consuming a balanced diet to prevent and treat disease and for taking therapeutic does of nutrients when that is shown beneficial. It's important for clinicians to keep up on current literature and be involved in research in mental health. Postpartum depression is a serious illness with multiple ramifications. Mothers alone are not the only ones affected by this illness, as the infant and other family members are likely to be as well. Researchers have investigated micronutrients and postpartum depression and, in this review, have provided insight to vitamin D, omega-3 fatty acids, the B vitamins, Iron and Zinc and peripartum depression. It is the clinician's responsibility to find the best practice recommendation in treatment and prevention; therefore, the aim of this evidence analysis project is to review the literature to establish if vitamin D intake during pregnancy affects risk of developing postpartum depression.

Chapter 3: Methodology

The methodology of this evidence analysis project is defined by the Academy of Nutrition and Dietetics through the Evidence Analysis Process which takes place in five parts (Academy of Nutrition and Dietetics, 2022). A review of current literature on the chosen topic is critically analyzed through this process with the goal of finding the best recommendation in current dietetic practice. This topic that will be evaluated, based on previously conducted research, is the relationship between postpartum depression and vitamin D blood levels. This chapter focuses on the five-step process and is outlined below.

Evidence Analysis Process

Step One: Formulate the Evidence Analysis Question

The Academy of Nutrition and Dietetics (2022) stresses the importance of a strong evidence analysis question that refers the gap in the research that is found in the literature review. To aid in formulating the analysis question, the Academy suggests the use of the PICO method (Academy of Nutrition and Dietetics, 2022). PICO stands for population, intervention, comparison, and outcome of interest. Through the use of PICO, the evidence analysis question is developed and defined. Table 1 exhibits the PICO method.

Table 1.

PICO Format

Component	Definition
Population	Expectant women between the age of 18-40 years
Intervention	Current vitamin D blood levels observe or additional Vitamin D supplementation [> the RDA for pregnancy (>15 mcg (600 IU) per day]

Comparison	Normal vitamin D blood levels or vitamin D blood levels without additional supplementation
Outcome of Interest	Prevention of postpartum depression; decreased prevalence and severity of depressive symptoms

Adapted from the Academy of Nutrition and Dietetics (2022).

With use of the PICO method, the evidence analysis question formulated is: Does vitamin D help to decrease risk of postpartum depression in expecting women? The following steps of the evidence analysis process will be applied to this question.

Step Two: Gather and Classify the Evidence

The second step of the Evidence Analysis Process includes a plan on how the evidence was gathered and classified on the chosen research topic. In this step, logs of searches and databases were kept as well as logs of search terms used during the review of literature. From there, a list of inclusion and exclusion criteria were applied to research articles. The criteria and searched article documentation were compiled into the Search Plan and Results as displayed in

Table 2.

Search Plan and Results

Question
Does vitamin D help to decrease risk of postpartum depression in expecting women?

Date of Literature Review for the Evidence Analysis

2022

Inclusion Criteria

- Adult female subjects (18-40 years)
- Single fetus pregnancies
- If supplemented, supplementation solely with vitamin D (prenatal vitamins are permitted)
- Research published within the last 10 years (2013 or later)
- Sample size: > than 50 participants in each group

Exclusion Criteria

- Pediatric female subjects (< 18 years of age)
- Multiple fetus pregnancies
- Supplementation with nutrients other than vitamin D
- Research outside of the following timeframe: 2013-2022
- Sample size: < 50 participants in each group
- Language: limited to articles published in English

Search Terms

- “postpartum depression and vitamin D”
- “peripartum depression and vitamin D”
- “vitamin D supplementation and pregnancy”
- “postpartum depression and vitamin D supplementation”

Electronic Database Used

- PubMed (filtered to only include articles within the last 10 years)

Articles to Review:

- Postpartum depression and vitamin D → 1225
- Peripartum depression and vitamin D → 152
- Vitamin D supplementation and pregnancy depression→ 2709
- Postpartum depression and vitamin D supplementation → 804

Articles Included:

Abedi, Bovayri, M., Fakhri, A., & Jahanfar, S. (2018). The Relationship Between Vitamin D and Postpartum Depression in Reproductive-Aged Iranian Women. *Journal of Medicine and Life*, *11*(4), 286–292. https://doi.org/10.25122/jml-2018-0038

Accortt, Arora, C., Mirocha, J., Jackman, S., Liang, R., Karumanchi, S. A., Berg, A. H., & Hobel, C. J. (2021). Low Prenatal Vitamin D Metabolite Ratio and Subsequent Postpartum Depression Risk. *Journal of Women's Health (Larchmont, N.Y. 2002)*, *30*(1), 113–120. https://doi.org/10.1089/jwh.2019.8209

Accortt, E. E., Schetter, C. D., Peters, R. M., & Cassidy-Bushrow, A. E. (2016). Lower prenatal vitamin D status and postpartum depressive symptomatology in African American women: Preliminary evidence for moderation by inflammatory cytokines. *Archives of women's mental health*, *19*(2), 373–383. https://doi.org/10.1007/s00737-015-0585-1

Nielsen, Strøm, M., Boyd, H. A., Andersen, E. W., Wohlfahrt, J., Lundqvist, M., Cohen, A., Hougaard, D. M., & Melbye, M. (2013). Vitamin D status during pregnancy and the risk of subsequent postpartum depression: a case-control study. *PloS One*, *8*(11), e80686–e80686. https://doi.org/10.1371/journal.pone.0080686

Rouhi, Rouhi, N., Mohamadpour, S., & Tajrishi, H. P.-R. (2018). Vitamin D reduces postpartum depression and fatigue among Iranian women. *British Journal of Midwifery*, *26*(12), 787–793. https://doi.org/10.12968/bjom.2018.26.12.787

Vaziri, F., Nasiri, S., Tavana, Z., Dabbaghmanesh, M. H., Sharif, F., & Jafari, P. (2016). A randomized controlled trial of vitamin D supplementation on perinatal depression: in Iranian pregnant mothers. *BMC pregnancy and childbirth*, *16*, 239. https://doi.org/10.1186/s12884-016-1024-7

Williams, J. A., Romero, V. C., Clinton, C. M., Vazquez, D. M., Marcus, S. M., Chilimigras, J. L., Hamilton, S. E., Allbaugh, L. J., Vahratian, A. M., Schrader, R. M., & Mozurkewich, E. L. (2016). Vitamin D levels and perinatal depressive symptoms in women at risk: a secondary analysis of the mothers, omega-3, and mental health study. *BMC pregnancy and childbirth*, *16*(1), 203. https://doi.org/10.1186/s12884-016-0988-7

Excluded Articles

Article	**Reason for Exclusion**
Agarwal, S., Kovilam, O., & Agrawal, D. K. (2018). Vitamin D and its impact on maternal-fetal outcomes in pregnancy: A critical review. *Critical reviews in food science and nutrition*, *58*(5), 755–769. https://doi.org/10.1080/10408398.2016.1220915	Postpartum depression not assessed
Jani, R., Knight-Agarwal, C. R., Bloom, M., & Takito, M. Y. (2020). The Association Between Pre-Pregnancy Body Mass Index, Perinatal Depression and Maternal Vitamin D Status: Findings from an Australian Cohort Study. *International journal of women's health*, *12*, 213–219. https://doi.org/10.2147/IJWH.S239267	Age of participants are not specified
Shi, D., Wang, G. H., & Feng, W. (2020). Nutritional assessments in pregnancy and the risk of postpartum depression in Chinese women: A case-control study. *Medicine*, *99*(33), e21647. https://doi.org/10.1097/MD.0000000000021647	Vitamin D not assessed
Arshad, R., Sameen, A., Murtaza, M. A., Sharif, H. R., Iahtisham-Ul-Haq, Dawood, S., Ahmed, Z., Nemat, A., & Manzoor, M. F. (2022). Impact of vitamin D on	Postpartum depression not assessed

maternal and fetal health: A review. *Food science & nutrition*, *10*(10), 3230–3240. https://doi.org/10.1002/fsn3.2948	
Palacios, C., Kostiuk, L. K., & Peña-Rosas, J. P. (2019). Vitamin D supplementation for women during pregnancy. *The Cochrane database of systematic reviews*, *7*(7), CD008873. https://doi.org/10.1002/14651858.CD008873.pub4	Postpartum depression not assessed
Amini, Amani, R., Jafarirad, S., Cheraghian, B., Sayyah, M., & Hemmati, A. A. (2022). The effect of vitamin D and calcium supplementation on inflammatory biomarkers, estradiol levels and severity of symptoms in women with postpartum depression: a randomized double-blind clinical trial. *Nutritional Neuroscience*, *25*(1), 22–32. https://doi.org/10.1080/1028415X.2019.1707396	Supplementation of calcium and vitamin D; wanting additional supplementation of vitamin D alone
Abedian Z, Soltani N, Mokhber N, Esmaily H. Depression and Anxiety in Pregnancy and Postpartum in Women with Mild and 23. Severe Preeclampsia. *Iran J Nurs Midwifery Res.* 2015 Jul-Aug; 20(4): 454–459. Doi: 10.4103/1735-9066.161013	Preeclampsia cases

Step Three: Critically Appraise Each Article

This step of the Evidence Analysis Process includes a review of each included research article while using an evidence analysis worksheet or by use of the Data Extraction Tool provided by the Academy of Nutrition and Dietetics (2016). For this evidence analysis, the use of an evidence analysis worksheet will be used to review each article in depth while comparing one to another. This step allows for organized compilation of the studies and their findings. The following is to be included in the worksheet: article citation, study design, quality rating, research purpose, inclusion criteria, exclusion criteria, description of study protocol, data

collection summary, description of data sample, summary of results, author conclusion, reviewer comments, and the funding source to critically appraise the articles. The Quality Criteria Checklist which the Academy uses to evaluate bias and gives an overall rating of the study, indicating positive (+), neutral (∅) or negative (-). The goal of this step is to abstract key information from each article under investigation. All information from the critical appraisal of articles will be combined into a summary table checklist (Appendix 1), for quick comparison review.

Step Four: Summarize the Evidence

To summarize the evidence found in step three of the Evidence Analysis Process, the Overview Table is used. The table is shown below (Figure 1). Articles found to have a higher rating and proven more valid will have more of an impact on the analysis question. According to the Evidence Analysis (EAL) manual, the importance of the Overview Table is to determine trends found in the research studies assessed including: an overall summary statement, comparison factors statement, methodological statement, an outcome impact statement, and definitions of key terms (The Academy of Nutrition and Dietetics, 2016).

Table 3.

Evidence Overview Table

Author, Year, Study Design, Class Rating	Study Type / Purpose	Study Populations	Intervention	Outcomes	Limitations

Adapted from the Academy of Nutrition and Dietetics (2022).

Step Five: Write and Grade the Conclusion Statement

Lastly, the fifth step of the process gathers all the evidence that points to a certain conclusion. A "bottom line" conclusion statement is developed, and the use of a Conclusion Grading Table (Figure 2) is used to compile the strength of the evidence found based on the quality, consistency, quality, clinical impact, and generalizability of the studies. A recommendation of best practice can then be considered.

Figure 1. Conclusion Grading Table

Conclusion Grading Table					
Strength of Evidence Elements	**Grades**				
	I Good/Strong	**II Fair**	**III Limited/Weak**	**IV Expert Opinion Only**	**V Grade Not Assignable**
Quality • Scientific rigor/validity • Considers design and execution	Studies of strong design for question Free from design flaws, bias and execution problems	Studies of strong design for question with minor methodological concerns, OR Only studies of weaker study design for question	Studies of weak design for answering the question OR Inconclusive findings due to design flaws, bias or execution problems	No studies available Conclusion based on usual practice, expert consensus, clinical experience, opinion, or extrapolation from basic research	No evidence that pertains to question being addressed
Consistency Of findings across studies	Findings generally consistent in direction and size of effect or degree of association, and statistical significance with minor exceptions at most	Inconsistency among results of studies with strong design, OR Consistency with minor exceptions across studies of weaker design	Unexplained inconsistency among results from different studies OR single study unconfirmed by other studies	Conclusion supported solely by statements of informed nutrition or medical commentators	NA
Quantity • Number of studies • Number of subjects in studies	One to several good quality studies Large number of subjects studied Studies with negative results have sufficiently large sample size for adequate statistical power	Several studies by independent investigators Doubts about adequacy of sample size to avoid Type I and Type II error	Limited number of studies Low number of subjects studied and/or inadequate sample size within studies	Unsubstantiated by published research studies	Relevant studies have not been done
Clinical impact • Importance of studied outcomes • Magnitude of effect	Studied outcome relates directly to the question Size of effect is clinically meaningful Significant (statistical) difference is large	Some doubt about the statistical or clinical significance of the effect	Studied outcome is an intermediate outcome or surrogate for the true outcome of interest OR Size of effect is small or lacks statistical and/or clinical significance	Objective data unavailable	Indicates area for future research
Generalizability To population of interest	Studied population, intervention and outcomes are free from serious doubts about generalizability	Minor doubts about generalizability	Serious doubts about generalizability due to narrow or different study population, intervention or outcomes studied	Generalizability limited to scope of experience	NA

Adapted from the Academy of Nutrition and Dietetics (2022).

Next Steps:

In the following chapter, the results of each study will be evaluated. A conclusion will be drawn based on the analysis of the studies to confirm a best fit practice and direct further research.

Chapter 4: Results

Vitamin D is a nutrient of interest associated with mental health – specifically with depressive symptoms such as postpartum depression. It is questioned whether there is a link between Vitamin D concentration and postpartum depressive symptoms, and if treatment with vitamin D is beneficial in prevention of these symptoms in expectant women. Postpartum depression has negative impacts on the mother, infant, and family. A total of seven research articles were included in this evidence analysis project. This chapter will focus on evaluating the quality and findings of each of the articles included to determine best outcomes for expectant moms and postpartum depression.

Study Analysis

Abedi et al. (2018) – Quality Rating: Neutral

The Case Control Study by Abedi, et al. (2018) investigated the relationship between vitamin D blood levels and postpartum depression (PPD) in reproductive-aged Indian women. A total of 120 participants took part in this study, those of which were women ages eighteen to thirty-five years and were six to eight weeks postpartum. The study used a sociodemographic questionnaire and the Beck Depression Scale for data collection. The sociodemographic characteristics compared included age, body mass index (BMI), sunlight exposure, level of education, spousal level of education, economic status, and employment (home maker versus employee). The Beck scale included 21 questions that determined the level in mood disturbance among participants. Midwifery characteristics accounted for were mode of delivery, whether the mother breastfeed, history of abortion, and number of pregnancies. Venous blood draws were obtained to determine vitamin D lab values. The women were placed in case and control groups concerning age and vitamin D supplementation (n = 60 for each group). The classifications

concerning vitamin D status included: severe deficiency (<10ng/mL), moderate insufficiency (10-20ng/mL), mild insufficiency (20-30 ng/mL), and normal (>30ng/mL).

The data analysis showed a significantly lower mean of vitamin D concentration in women with postpartum depression compared to the control group of women without PPD. In addition, the women who were moderately insufficient (<20ng/mL) were significantly higher in the postpartum depression group in comparison from the control. It was found that 16.7% of the women who suffered from postpartum depression had a vitamin D deficiency (<10ng/mL) compared to 6.7% in the normal group (>30ng/mL). The authors concluded that women with PPD had a over overall mean vitamin D amount and those with moderate and severe vitamin D deficiency were found to be significantly higher in the postpartum depression group than the control. Other significant findings included differences in BMI. The normal group (no PPD) had significantly lower BMI ranges than the case group. Similarly, it was found that the women in the normal group had significantly less undesired pregnancies than those with postpartum depression.

One strength of this study (Abedi, et al. 2018) was the sample size. Both the control and the case group had an equal number of participants. The sample was also of adequate size (n=160). According to the author, this is also the first study to look at vitamin D in association with postpartum depression in Iranian women. Another important strength to point out is how vitamin D levels were assessed. This study assessed vitamin D levels through use of biological samples, which more accurately captures the concentrations than participant report on diet recall and sun exposure. Some weaknesses of the study noted by the authors included possible bias related to participant report of sunlight exposure and vitamin D supplementation. Another

weakness was that vitamin D measurements were done over two different seasons which can affect vitamin D exposure.

Accortt et al. (2021) – Quality Rating: Neutral

The purpose of the Accortt study (2021) was to investigate whether low vitamin D status predicts risk for postpartum depression in racially diverse women who participated in the Behavior in Pregnancy Studies (BIPS). In this study, a total of 98 participants were screened for postpartum depression and lab values were obtained to assess serum vitamin D metabolites. Women who were included in the study were those who gave birth to live infants, were English or Spanish speaking, had a singleton intrauterine pregnancy, were under 20 weeks gestation at the time of recruitment, and in the BIPS who had vitamin D data for at least one time point during pregnancy. Participant demographic and data on prenatal or postpartum depression were also required. Women were excluded from the study if they did not complete the PPD screening or lacked vitamin D metabolite data. The Beck Depression Inventory (BDI) is a tool validated for use in pregnant and postpartum women and is used to assess depressive symptoms. Symptoms of depression were measured during weeks 28-30 gestation using the BDI. At six to ten weeks postpartum, depressive symptoms were measured again with a different screening tool called the 21-item Center for Epidemiologic Studies Depression (CES-D) scale. Maternal plasma samples were taken during the second trimester (28-30 weeks gestation). These samples were used to measure vitamin D metabolites.

After analyzing the data, authors concluded that a total of 30 women (34%) developed postpartum depression and 59 women (66%) did not. There were more Hispanic/Latina women that experienced PPD (51.4%) compared to white women (12.5%). It was also found that those who had a lower vitamin D metabolite ratio (VMR) were more likely to have postpartum

depression than those without postpartum depression. The data from this study demonstrated that only lower VMR and Hispanic/Latina race were significantly associated with the higher risk for postpartum depression.

Accortt, et al. (2021) identified some key strengths of this study. One was that the study is a prospective design. This allowed for women to be evaluated multiple times throughout the study. Data collection periods included mid-pregnancy, at the time of delivery, and at six-ten weeks postpartum. Another strength is that the researchers accounted for confounding variables when they analyzed the data. Lastly, the use of biological samples improved accuracy when assessing vitamin D status. One weakness of this study was the missing data on postpartum depression symptoms for some of the participants. The authors concluded that the use of VMRs will enhance future vitamin D research and that additional studies are needed to test these relationships between vitamin D and postpartum depression.

Accortt et al. (2016) – Quality Rating: Neutral

Accortt's (2016) prospective study was used to examine associations between prenatal vitamin D status and postpartum depression symptoms. The study included only African American women due to the increased risk of vitamin D deficiency and postpartum depression among the population. To be included in the study, the participants (n = 91) had to be African American women, age 18-44, and in the second trimester gestation. The authors tested whether low prenatal vitamin D status predicted postpartum depression symptoms and whether high levels of prenatal inflammation interacted with low vitamin D in effects on PPD symptoms. Vitamin D status was assessed in the first trimester and during the first prenatal visit by maternal blood sample. Inflammatory markers were assessed with a second blood sample that was drawn during the second trimester. Depressive symptoms were assessed at the postpartum visit, usually

between four to six weeks post birth. Depressive symptoms were measured in the study by use of the Edinburgh Postnatal Depression Scale (EPDS). Other covariates that were reported included marital status, age, education level, employment status, pre-pregnancy BMI and cigarette smoking. History of mental illness was extracted from electronic medical records.

The data analysis was slightly significant ($p = 0.58$) association of vitamin D status and EPDS scores though the author's findings suggest lower levels of vitamin D in early pregnancy may increase PPD symptoms among African American women Accortt, et al. (2016). There was not enough evidence to support the direct effects of inflammatory markers on PPD symptoms. The authors suggest further research be conducted with larger sample size to be beneficial in future studies. Use of randomized controlled trials may also be beneficial in determining if increased vitamin D supplementation during pregnancy can reduce PPD symptoms.

Accortt, et al. (2016) prospective design is a strength, as it allowed for data to be obtained during pregnancy as well as in the postpartum period. The authors also found it beneficial to have access to medical and psychosocial data which allowed them to control for confounding variables. Another strength of the study was its focus on African American women since they are a population that is more at risk for vitamin D deficiency due to skin color and a higher risk of inflammation. A common strength among the studies, again is the use of serum samples to assess vitamin D status of the participants to allow for greater accuracy. Some important weaknesses to acknowledge in this study are the missing EPDS data due to participants failing to attend the appointment or failure of the clinician to document the EPDS results. This increased the dropout rate to over half due to the missing scores. It also would seem beneficial to assess postpartum depression symptoms more than a single time during the postpartum period. Lastly, the study did not track what supplementation the participants were using outside of the study and adherence to

supplementation use. It may also be beneficial to include data on dietary intake as well as sun exposure for future studies.

Nielsen et al. (2013) – Quality Rating: Positive

Through use of a case-control study within a large prospective cohort study the Danish National Birth Cohort (DNBC), Nielsen et al. (2013) focused to determine if low vitamin D status during pregnancy was associated with postpartum depression. A total of 1480 participants were interviewed, and blood samples were collected around 10-12 weeks and again at 25 weeks of pregnancy. Inclusion criteria for this study were: women residents of Denmark, singleton pregnancy, delivery of living child, and venous lab collected >25 weeks pregnancy. Women with antidepressant use within a year before delivery were excluded from the study, as well also those who were registered with the Central Psychiatric Register with a mental health illness prior to pregnancy. Blood samples were obtained during routine prenatal visits. The Authors identified potential cofounders that included in what season and gestational week the blood draws were taken, if the mother smoked cigarettes during pregnancy, socioeconomic status, pre-pregnancy BMI, physical activity during pregnancy, level of social support of mother, and multivitamin intake. This data was obtained through participants during the DNBC interviews.

Nielsen, et al. (2013) concluded that there was no overall association between vitamin D status during pregnancy and postpartum depression risk. This was not the Author's expected result. They authors hypothesized that there would be an association between low levels of vitamin D and an increased risk of PPD, however the opposite was found in the study. Higher levels of vitamin D were in pregnant women were found to have increased risk of PPD symptoms.

A strength of this study was the large sample size generated from being a part of the DNBC study, which allows for more reliability of the study. Since the study was part of a large prospective cohort study, the participants accounted for approximately 35% of pregnant women in Denmark when the study took place. Another strength of the study was the adjustments made for confounders. Lastly, the use of biological samples to assess vitamin D status is a strength of the study. Blood samples allowed for a more accurate classification of vitamin D status compared to a diet recall. An important weakness of the study to note is potential bias of the population. Nielsen, et al. (2013) noted that participants of the DNBS are generally more health conscious compared to non-participants. This can make for a less accurate depiction of the population studied and skew results.

Rouhi et al. (2018) – Quality Rating: Positive

The double blind, randomized control study by Rouhi et al. (2018) sought to determine the efficiency of vitamin D supplementation on postnatal depression and fatigue. The sample size included 80 participants who were recruited from six public health care centers. Participants included women who had a vaginal delivery, no medical or surgical restrictions, no history of psychiatric disorders, no prescribed medications and women who breastfed. The women completed the Edinburgh Postnatal Depression Scale (EPDS) and the Fatigue Identification Form (FIF) questions. Those with an EPDS ≥13 and FIF ≥20 were selected to participate and were placed into an intervention group (n=40) and a comparison group (n=40). The intervention group was supplemented with vitamin D3 (1000 IU daily) and the comparison group was given a placebo pills for six months. Participants were instructed not to take any other additional vitamin D supplement other than the provided. Each month, participants received a phone call to remind them to intake the supplement.

There were no statistical differences between the groups regarding age, past psychiatric illness, adverse events in previous months, unplanned or complicated pregnancy, material problems and obesity. There was no significant difference found at baseline in the scores of depression symptoms and fatigue between the two groups. Rouhi, et al. (2018) did find that Vitamin D supplementation decreased depression (EPDS scores) and fatigue (FIF scores) in the intervention group (P>0.001). Authors concluded that more research is needed on the topic, though vitamin D supplementation may be considered in the treatment of reducing PPD symptoms and fatigue among high risk women.

There were important strengths and weaknesses of the study addressed. First, the main strength of the study is the type, being a double-blind randomized, controled trial. Weaknesses addressed by the authors included: vitamin D status was not assessed by blood samples and the self-reported tools (EPDS and FIF) were utilized. Findings would be more reliable if depression symptoms were diagnosised by a clinician. Another limitation is the heavy reliance of subject participation, in other words the participants need to remember to take the supplement daily. This study was of smaller scale and more research was concluded by the authors for further correlation between postpartum depression and fatigue with vitamin D levels.

Vaziri, et al. (2016) – Quality Rating: Positive

Vaziri, et al. (2016) performed a single-blinded, randomized control trial to determine the effect of vitamin D3 supplementation on perinatal depression scores. A total of 169 participants were assigned to two groups: placebo and vitamin D supplemented. The vitamin D supplemented participants received 2000 IU vitamin D3 daily during beginning at 26-28 weeks of pregnancy until childbirth. Maternal vitamin D status was measured two times during the study – once at baseline and again at childbirth. Depression symptoms were assessed using the EPDS and were

evaluated four different times during the study: 26-28 weeks of gestation, 38-40 weeks of gestation, week 4 postpartum, and week 8 postpartum. Adult women (N=136) were included in the study if they had no history of mental illness or internal disease, were pregnant with a single living fetus, had no pregnancy complications, were at gestational age of 26-28 weeks, and had a depression EPDS score of 0-13. Exclusion criteria for women in this study include depression scores >13, failure to provide a blood sample at the onset of the study, < 8 weeks consumption of vitamin D3 supplement or irregular consumption (less than daily).

In the data analysis, groups were similar in vitamin D status during the first measurement at baseline until post birth, the supplemented women had a significantly higher concentration of vitamin D levels compared to the control women. Vaziri, et al. (2016) concluded that 2000 IU vitamin D_3 per day for at least 8 weeks during late pregnancy can be effective in decreasing perinatal depression levels (at 38–40 weeks of gestation also, at 4 and 8 weeks after birth).

An important limitation of the Varizi (2016) study is that outside supplement use was not accounted for in the study protocol. It is unknown if the participants were taking other supplements during the timeframe of the study. This study also had a high reliance on the participants ability to stick to study protocol for supplement intake. Lastly, it was noted that the sample may not be representative of the target population since women who scored >13 on the EPDS were excluded from the study; results cannot be applied to mothers who have severe postpartum depression.

Williams et al. (2016) – Quality Rating: Positive

The last article is a prospective longitudinal study (Williams, et al. 2016) that was conducted to determine whether lower vitamin D during pregnancy is associated with depressive symptoms. The study included a secondary target to determine if vitamin D status is associated

with Mini International Neuropsychiatric Interview diagnoses of major depressive disorder (MDD), generalized anxiety disorder (GAD), or anxiety symptoms. The Edinburgh Postnatal Depression Scale was used to determine depression risk and participants completed the Beck Depression Inventory (BDI) and Mini International Neuropsychiatric Interview at 12–20 weeks, 26–28 weeks, 34–36 weeks, and 6–8 weeks postpartum. Vitamin D levels were measured at 12–20 weeks (N = 117) and 34–36 weeks (N = 112).

The authors addressed important strengths of the study. First, the use of biological samples to assess vitamin D status. Second, the measurements of depressive symptoms were taken over time at several different time points, during both prenatal and postpartum. Last, the authors assessed both depression symptom scores along with the depression diagnosis. Many of the previously evaluated studies did not use a diagnosis, which is unique to this study and of value. Some weaknesses of this study include that the parent study was not originally designed to assess vitamin D, but instead it was used to detect a reduction in BDI scores with the intervention that involve omega-3 fatty acids. This could lead to incorrect assumptions. Lastly, the BDI does not assess severity of depression. It is also noteworthy that participants were not excluded from the participating if antidepressant medication was administered during the study. Expectant mothers were also not excluded if supplementing with a multivitamin containing vitamin D during the study (400 IU vitamin D).

Conclusion Statement – Grade: III (Limited)

Supplementation with vitamin D potentially improves postpartum depression in expectant women. Of the studies included in this evidence analysis project, only three out of the seven studies showed statistically significant associations between vitamin D and postpartum depression. Three of the studies showed findings of no correlation or non-significant results on

the topic. Lastly, one study (Nelson et al. 2015) found that postpartum depression diagnosis and symptoms were found to be higher in women with higher levels of vitamin D. However, all but two of the analyzed studies found benefit with vitamin D supplementation in pregnant women to aid in preventing postpartum depression. The authors of one of those studies (Vazivi et al. 2016), found no correlation between vitamin D status and postpartum depression did have the possibility of error in that participants' vitamin D consumption was controlled through reminders on their phones. Authors of the second study to have found no association between vitamin D and postpartum depression, however, noted that participants of the study may have affected outcomes in biased participant background estimates (Nielson et al. 2013). Of the seven studies, four received neutral ratings while three received positive ratings.

Due to the lack of significant findings on the topic and limited research, it is difficult to assess clinical impact regarding vitamin D supplementation and postpartum depression in women. Though many of the findings in studies evaluated through this evidence analysis project concluded that supplementation with vitamin D during the postpartum period may benefit expectant women and those with postpartum depressive symptoms, stronger research findings are needed to be applied to clinical practice.

Table 4.

Overview Table

Author, Year, Study Design, Class, Rating	Study Purpose	Study Population	Intervention	Outcomes	Strengths and Weaknesses
Abedi, et al. (2018) Case Control Study *Class: C* *Rating: Neutral*	The purpose was to investigate the relationship between vitamin D and postpartum depression in reproductive-aged Indian women.	N = 120 Inclusion: Women ages 18-35 and 6-8 weeks post childbirth Exclusion: Neonate admitted to NICU, history of mental disorders, newborn with congenital anomalies, repeated casearian section, gestational diabetes, preeclampsia, tyroid disorders during pregnacy	Use of socio-demographic questionnaire, the Beck Depression Scale, and venous blood draw for data collection	Beck Depression Scale scores Lab values (vitamin D) BMI Socio-demographic data	Strengths: sample size is of larger size, with groups having an equal N first study on topic for Iranian women Use of biological samples Weaknesses: recall bias related to sunlight exposure and supplementation vitamin D measurements were done over two seasons

Author, Year, Study Design, Class, Rating	Study Purpose	Study Population	Intervention	Outcomes	Strengths and Weaknesses
Accortt, et al. (2021) Prospective Study *Class: B* *Rating: Neutral*	The purpose was to investigate whether low vitamin D status predicts risk for postpartum depression in racially diverse women.	N = 89 Inclusion: Women who gave birth to live infants, were English or Spanish speaking, had a singleton intrauterine pregnancy, were under 20 weeks gestation at the time of recruitment, and in the BIPS who had vitamin D data for at least one time point during pregnancy, demographic data, and data on prenatal or postpartum depression Exclusion: Women who did not complete the PPD screening and lacked vitamin D metabolite data	Interviews, depression screening, ultrasounds, and biomarkers: vitamin D metabolites	Beck Depression Inventory (BDI) scores Lab values (vitamin D metabolites) Socio-demographic data	<u>Strengths</u>: prospective design sample size women were evaluated multiple times throughout study inclusion of important confounding variables Use of biological samples <u>Weaknesses</u>: missing data on postpartum depression symptoms

Author, Year, Study Design, Class, Rating	Study Purpose	Study Population	Intervention	Outcomes	Strengths and Weaknesses
Accortt, et al. (2016) Prospective Study *Class: B* *Rating: Positive*	The purpose was to prospectively examine associations between prenatal vitamin D status and postpartum depressive symptoms in a sample of African American women.	N = 91 Inclusion: Pregnat African American women, age 18-44, second trimester gestation Exclusion: Women with ≥1 inflammatory biomarkers exceeding ±3 standard deviations from the mean for comparability with a prior study.	Self-reported demographic survey, lab blood draws, and depression screen	Edinburgh Postnatal Depression Scale (EPDS) scores Lab values (vitamin D) Socio-demographic data	<u>Strengths</u>: prospective design, during pregnancy and postpartum data sample size focus on African American women, of higher risk Use of biological samples <u>Weaknesses</u>: Missing EPDS data lacking data on depression symptoms more often than 6 weeks alone participant dropout rate (over half)

Author, Year, Study Design, Class, Rating	Study Purpose	Study Population	Intervention	Outcomes	Strengths and Weaknesses
Nielsen, et al. (2013) Case-Control Study *Class:C* *Rating: Positive*	The purpose was to determine if low vitamin D status during pregnancy was associated with postpartum depression.	N = 1480 Inclusion: Women who reside in Denmark, singleton pregnancy, delivery of living child, venous lab collected late in pregnacy (>25 weeks) Exclusion: Women with anti-depressant use registed in the Danish Register of Midicinal Product Statistics in the year before delivery and those registerd with in the Central Psychiatric Register with mental illness prior to DNBC pregnancy	Venous blood samples, pharmaceutical PPD prescription records	Postpartum depression Lab values (vitamin D) Sociodemographic data	<u>Strengths</u>: Part of the DNBC (large prospective cohort study) Accounted for approx. 35% of pregnant women in Denmark during time of the study Adjustments made for confounders Use of biological samples <u>Weaknesses</u>: Participants of the DNBC are generally more health conscious – questions accuracy of outcomes due to bias

Author, Year, Study Design, Class, Rating	Study Purpose	Study Population	Intervention	Outcomes	Strengths and Weaknesses
Rouhi, et al. (2018) Double blind, Randomized Controlled Trial *Class:A* *Rating: Positive*	The purpose was to determine the efficiency of vitamin D supplementation on postnatal depression and fatigue.	N = 80 Inclusion: Women who had a vaginal birth, no medical or surgical restrictions, no history of psychiatric disorders, no prescribed medications and breastfeeding. Exclusion: No specified	Supplementation of vitamin D3 1000 IU or placebo pill for 6 months, postpartum depression screening and fatigue screening	Edinburgh Postnatal Depression Scale (EPDS) scores Fatigue Identification form (FIF) scores Socio-demographic data	<u>Strengths</u>: Type of study: double-blind, randomized, control trial <u>Weaknesses</u>: Vitamin D status not assessed by blood samples Use of self-reported tools (EPDS and FIF) Participants reminded to take supplement by monthly phone calls

Author, Year, Study Design, Class, Rating	Study Purpose	Study Population	Intervention	Outcomes	Strengths and Weaknesses
Vaziri, et al. (2016) Randomized Control Trial, Single-Blind *Class:A* *Rating: Positive*	The purpose was to determine effect of vitamin D3 supplementation on perinatal depression scores.	N = 136 Inclusion: Women ≥18 years of age, no history of mental illness and internal diseases, pregnant with a singleton live fetus, without any pregnancy complications, gestational age of 26-28 weeks upon enrollment, and depression score of 0-13 Exclusion: Women with depression scores of >13, failure to provide blood sample at onset of the study, < than 8 weeks consumption of vitamin D3 or irregular consumption (less than daily).	2000 IU vitamin D3 supplementation of daily from 26-28 weeks gestation through childbirth or placebo pills composed of starch	Edinburgh Postnatal Depression Scale (EPDS) scores Vitamin D serum lab values Socio-demographic data	<u>Strengths</u>: Type of study: single-blind, randomized, control trial Large sample size Use of biological samples <u>Weaknesses</u>: Outside supplement use was not accounted for outside study protocol High reliance on participant ability to stick to protocol (intake of supplement) Sample may not be representative of the target population

Author, Year, Study Design, Class, Rating	Study Purpose	Study Population	Intervention	Outcomes	Strengths and Weaknesses
Williams, et al. (2016) Prospective, longitudinal Study *Class:A* *Rating: Positive*	The purpose was to determine whether low vitamin D during pregnancy is associated with depressive symptoms. As a secondary aim of this study, was to determine whether vitamin D levels were associated with Mini International Neuropsychiatric Interview diagnoses of major depressive disorder (MDD), generalized anxiety disorder (GAD), or anxiety symptoms.	N = 105 Inclusion: Women 18 years or older, EPDS scores between 9 and 19, singleton gesation, and gestational age between 12-20 weeks Exclusion: Women with EPDS scores > 19, history of bleeding, multiple gestation, bipolar disorder, major depressive disorder, current substance abuse, schizophrenia, and antidepressant use	Use of the Beck Depression Inventory (BDI), Mini international Neuropsychiatric Interview (MINI), and venous blood draw for data collection	Beck Depression Inventory (BDI) scores Serum vitamin D lab values MINI diagnosis	<u>Strengths</u>: Use of biological samples Measurements of depressive symptoms taken over time at several time points (during pregnancy and postpartum) Assessed both depression symptom scores along with depression diagnosis <u>Weaknesses</u>: Parent study was originally designed to detect a reduction In BDI score following intervention with omega-3 fatty acids Use of BDI (doesn't assess severity)

Chapter 5: Discussion

Evidence Summary

Postpartum women are at a higher risk of developing depression than women who are not experiencing postpartum. Vitamin D supplementation is a nutritional intervention investigated in hopes of reducing depression among women in postpartum. However, whether vitamin D supplementation aids in decreasing postpartum depression prevalence is still under investigation. This evidence analysis project is intended to determine the impact vitamin D supplementation has on postpartum depression symptoms in expectant women.

Seven studies that met inclusion criteria were encompassed in this evidence analysis project. The authors of each article evaluated whether vitamin D levels and postpartum depression are related. All studies were conducted on adult women of childbearing years that were published within the last 10 years. Study designs varied significantly, including prospective randomized control, prospective longitudinal, and case-control studies. The greatest variation between the studies analyzed was the instruments used to collect data in assessing vitamin D status and postpartum depression symptoms, as well as whether vitamin D was supplemented. Abedi, et al. (2018), Accortt, et al. (2021), and Williams, et al. (2016) each used the Beck Depression Scale to measure postpartum depression among participants. One important factor to note about this tool is that it does not account for seventy percent of the illness. Accortt, et al. (2016), Rouhi, et al. (2018), and Vaziri, et al. (2016) used the Edinburgh Postpartum Depression Scale to assess depression symptoms. On the other hand, Nielsen, et al. (2013) was the only study included in this project to use pharmaceutical postpartum depression records. Similarly, Williams, et al. (2016) also used the MINI diagnosis in addition to the BDS to account for

postpartum depression among participants. Vitamin D status was assessed by use of biological samples of participants in all studies, excluding Rouhi, et al. (2018). Based on the Quality Criteria Checklist, the quality of each study was assessed. Three of the studies were given a neutral rating, while four of the studies earned a positive rating. The findings of each article varied; however, majority of the authors found a correlation of a lower vitamin D status with an increase in postpartum depression.

Limitation of Current Literature

There were several limitations in the literature uncovered by this evidence analysis project. The first, and most evident, limitation of literature is the quantity of studies on this topic. This population is at greater risk for developing postpartum depression compared to women who are not in the postpartum period. Nutritional considerations, like vitamin D, may have an impact on postpartum outcomes in postpartum women. In addition to the lack of supporting literature, another weakness determined by this project is the lack of accountability for sun exposure and other supplementation. Tools of participant self-report were used greatly by authors in the studies of this EAL and increase the incidence of error to occur due to participant recall bias. Sun exposure can vary greatly in the participants of the studies and can be difficult to account for. In addition, not all the analyzed studies accounted for other supplementation uses, such as a prenatal vitamin. The randomized controlled studies also relied heavily on participants' ability to stick to the study protocol regarding vitamin D supplementation. Though most of the studies assessed vitamin D status through biological samples, there was one study that did not. Rouhi, et al. (2018) included that a great limitation of the study was that vitamin D status was not assessed through maternal blood. Lastly, there is a limitation regarding a lack of guidance on amount of vitamin D to prevent postpartum depression. It is important that each of these limitations be

addressed in future studies concerning vitamin D and postpartum depression among expectant women.

Applications for Future Practice

This evidence analysis project reviewed current literature on postpartum depression and vitamin D status in expectant women. The purpose of the EAL was to determine if adequate vitamin D status during pregnancy will help to reduce risk of postpartum depression in expectant women. Analysis of the current literature is important to assess in determining nutritional guidelines for current practice of this at-risk population. Expectant women have a greater risk of developing postpartum depression and suffering from depressive symptoms than women of non-postpartum period, as why this EAL is of importance and can impact clinical practice. Though the current literature does not have enough sound evidence to conclude a best practice for vitamin D supplementation among these women, it does show the need for further investigation. Further research on the relationship of vitamin D and postpartum depression could benefit clinical outcomes for this high-risk population.

The present research shows promising outcomes for vitamin D supplementation and its effect on postpartum depression. Future research is needed on this topic, not only to aid in finding a best practice regarding the topic, but also to adjust for limitations in the current literature, as mentioned previously. To better serve this population, future research will need to develop improved ways to collect data and account for participant variability. It's important that future research assess vitamin D status through biological samples only to generate accurate data. By nature, it may be difficult not to have a heavy reliance on participant reports for variables of supplementation intake, sun exposure, diet recall and depressive symptoms. If these limitations can be addressed in future studies, findings will be more reliable for use in clinical care. If

findings favor vitamin D supplementation in expectant women, it will provide an effort in decreasing postpartum depression prevenance in women during a critical time that greatly affects mothers, families, and the care of the baby.

References

Abedi, P., Bovayri, M., Fakhri, A., & Jahanfar, S. (2018). The Relationship Between Vitamin D and Postpartum Depression in Reproductive-Aged Iranian Women. *Journal of medicine and life*, *11*(4), 286–292. https://doi.org/10.25122/jml-2018-0038

Abedian Z, Soltani N, Mokhber N, Esmaily H. Depression and Anxiety in Pregnancy and Postpartum in Women with Mild and 23. Severe Preeclampsia. *Iran J Nurs Midwifery Res.* 2015 Jul-Aug; 20(4): 454–459. Doi: 10.4103/1735-9066.161013

Academy of Nutrition and Dietetics. (2022). Evidence analysis manual: Steps in the academy evidence analysis process.

Accortt, E. E., Arora, C., Mirocha, J., Jackman, S., Liang, R., Karumanchi, S. A., Berg, A. H., & Hobel, C. J. (2021). Low Prenatal Vitamin D Metabolite Ratio and Subsequent Postpartum Depression Risk. *Journal of women's health (2002)*, *30*(1), 113–120. https://doi.org/10.1089/jwh.2019.8209

Accortt, E. E., Schetter, C. D., Peters, R. M., & Cassidy-Bushrow, A. E. (2016). Lower prenatal vitamin D status and postpartum depressive symptomatology in African American women: Preliminary evidence for moderation by inflammatory cytokines. *Archives of women's mental health*, *19*(2), 373–383. https://doi.org/10.1007/s00737-015-0585-1

Armony-Sivan, Shao, J., Li, M., Zhao, G., Zhao, Z., Xu, G., Zhou, M., Zhan, J., Bian, Y., Ji, C., Li, X., Jiang, Y., Zhang, Z., Richards, B. J., Tardif, T., & Lozoff, B. (2012). No Relationship between Maternal Iron Status and Postpartum Depression in Two Samples in China. *Journal of Pregnancy*, *2012*, 521431–521437. https://doi.org/10.1155/2012/521431

Bauman, B. L., Ko, J. Y., Cox, S., D'Angelo, MPH, D. V., Warner, L., Folger, S., Tevendale, H. D., Coy, K. C., Harrison, L., & Barfield, W. D. (2020). Vital signs: Postpartum depressive symptoms and provider discussions about perinatal depression — United States, 2018.

MMWR. Morbidity and Mortality Weekly Report, *69*(19), 575–581. https://doi.org/10.15585/mmwr.mm6919a2

Centers for Disease Control and Prevention. (2020, May 14). *Depression among women*. Centers for Disease Control and Prevention. Retrieved April 4, 2022, from https://www.cdc.gov/reproductivehealth/depression/index.htm#Postpartum

Centers for Disease Control and Prevention. (2022, May 23). *Depression among women*. Centers for Disease Control and Prevention. Retrieved December 3, 2022, from https://www.cdc.gov/reproductivehealth/depression/index.htm

Demelash, S. (2017, August 12). *The role of micronutrient for depressed patients*. OMICS International. Retrieved April 25, 2022, from https://www.omicsonline.org/open-access/the-role-of-micronutrient-for-depressed-patients-2472-095X-1000116.php?aid=92980#:~:text=Vitamin%20B1%2C%20B6%20and%20B12,strong%20association%20with%20mental%20wellbeing

Depression. Mental Health America. (n.d.). Retrieved December 3, 2022, from https://www.mhanational.org/conditions/depression

Dhiman, P., Pillai, R. R., Wilson, A. B., Premkumar, N., Bharadwaj, B., Ranjan, V. P., & Rajendiran, S. (2021). Cross-sectional association between vitamin B12 status and probable postpartum depression in Indian women. *BMC pregnancy and childbirth*, *21*(1), 146. https://doi.org/10.1186/s12884-021-03622-x

Edalati-Fard, Mirghafourvand, M., Mohammad-Alizadeh-Charandabi, S., & Farshbaf-Khalili, A. (2016). Relationship of Zinc and Magnesium Serum Levels with Postpartum Depression in Tabriz-Iran. *Global Journal of Health Science*, *8*(11), 120–126. https://doi.org/10.5539/gjhs.v8n11p120

Goshtasebi, Alizadeh, M., & Gandevani, S. B. (2013). Association between maternal anaemia and postpartum depression in an urban sample of pregnant women in Iran. *Journal of*

Health, Population and Nutrition, *31*(3), 398–402. https://doi.org/10.3329/jhpn.v31i3.16832

Hamazaki, K., Matsumura, K., Tsuchida, A., Kasamatsu, H., Tanaka, T., Ito, M., Inadera, H., & Japan Environment and Children's Study Group (2020). Dietary intake of fish and n-3 polyunsaturated fatty acids and risk of postpartum depression: a nationwide longitudinal study - the Japan Environment and Children's Study (JECS). *Psychological medicine*, *50*(14), 2416–2424. https://doi.org/10.1017/S0033291719002587

Hoge, A., Tabar, V., Donneau, A. F., Dardenne, N., Degée, S., Timmermans, M., Nisolle, M., Guillaume, M., & Castronovo, V. (2019). Imbalance between Omega-6 and Omega-3 Polyunsaturated Fatty Acids in Early Pregnancy Is Predictive of Postpartum Depression in a Belgian Cohort. *Nutrients*, *11*(4), 876. https://doi.org/10.3390/nu11040876

https://www.andeal.org/vault/2440/web/files/2022_December_EA_Manual.pdf

Increase the proportion of women who get screened for postpartum depression - mich-d01. Increase the proportion of women who get screened for postpartum depression - MICH-D01 - Healthy People 2030. (n.d.). Retrieved April 4, 2022, from https://health.gov/healthypeople/objectives-and-data/browse-objectives/pregnancy-and-childbirth/increase-proportion-women-who-get-screened-postpartum-depression-mich-d01

Jani, R., Knight-Agarwal, C. R., Bloom, M., & Takito, M. Y. (2020). The Association Between Pre-Pregnancy Body Mass Index, Perinatal Depression and Maternal Vitamin D Status: Findings from an Australian Cohort Study. *International journal of women's health*, *12*, 213–219. https://doi.org/10.2147/IJWH.S239267

Khodadad, M., Bahadoran, P., Kheirabadi, G. R., & Sabzghabaee, A. M. (2021). Can Vitamin B6 Help to Prevent Postpartum Depression? A Randomized Controlled Trial. *International journal of preventive medicine*, *12*, 136. https://doi.org/10.4103/ijpvm.IJPVM_240_19

Lin, Y. H., Chen, C. M., Su, H. M., Mu, S. C., Chang, M. L., Chu, P. Y., & Li, S. C. (2019). Association between Postpartum Nutritional Status and Postpartum Depression Symptoms. *Nutrients*, *11*(6), 1204. https://doi.org/10.3390/nu11061204

Mckoy , J. (2021, October 7). *Depression rates in US tripled when the pandemic first hit-now, they're even worse*. Boston University. Retrieved April 25, 2022, from https://www.bu.edu/articles/2021/depression-rates-tripled-when-pandemic-first-hit/

Mermer, M., & Şanlıer, N. (2017). Correlation between postpartum depression and omega-3, micronutrients. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology*, *6*(11), 4737. https://doi.org/10.18203/2320-1770.ijrcog20174979

MM KAVITHA, Shravya Dharambhat, Narayan Mutalik, SH Chandrashekaraya, & SV Kashinakunti. (2021). Correlation of Serum Zinc Levels with Postpartum Depression- A Casecontrol Study in North Karnataka. *Journal of Clinical and Diagnostic Research*, *15*(8), BC01–BC03. https://doi.org/10.7860/JCDR/2021/49513.15211

Moldenhauer, J. S. (2022, April 18). *Postpartum Depression - gynecology and obstetrics*. Merck Manuals Professional Edition. Retrieved April 25, 2022, from https://www.merckmanuals.com/professional/gynecology-and-obstetrics/postpartum-care-and-associated-disorders/postpartum-depression

Nielsen, Strøm, M., Boyd, H. A., Andersen, E. W., Wohlfahrt, J., Lundqvist, M., Cohen, A., Hougaard, D. M., & Melbye, M. (2013). Vitamin D status during pregnancy and the risk of subsequent postpartum depression: a case-control study. *PloS One*, *8*(11), e80686–e80686. https://doi.org/10.1371/journal.pone.0080686

Rouhi, Rouhi, N., Mohamadpour, S., & Tajrishi, H. P.-R. (2018). Vitamin D reduces postpartum depression and fatigue among Iranian women. *British Journal of Midwifery*, *26*(12), 787–793. https://doi.org/10.12968/bjom.2018.26.12.787

Sheikh, Hantoushzadeh, S., Shariat, M., Farahani, Z., & Ebrahiminasab, O. (2015). The efficacy of early iron supplementation on postpartum depression, a randomized double-blind placebo-controlled trial. *European Journal of Nutrition*, *56*(2), 901–908. https://doi.org/10.1007/s00394-015-1140-6

Singh, A., Trumpff, C., Genkinger, J., Davis, A., Spann, M., Werner, E., & Monk, C. (2017). Micronutrient Dietary Intake in Latina Pregnant Adolescents and Its Association with Level of Depression, Stress, and Social Support. *Nutrients*, *9*(11), 1212. https://doi.org/10.3390/nu9111212

Vaz, J., Farias, D. R., Adegboye, A., Nardi, A. E., & Kac, G. (2017). Omega-3 supplementation from pregnancy to postpartum to prevent depressive symptoms: a randomized placebo-controlled trial. *BMC pregnancy and childbirth*, *17*(1), 180. https://doi.org/10.1186/s12884-017-1365-x

Vaziri, F., Nasiri, S., Tavana, Z., Dabbaghmanesh, M. H., Sharif, F., & Jafari, P. (2016). A randomized controlled trial of vitamin D supplementation on perinatal depression: in Iranian pregnant mothers. *BMC pregnancy and childbirth*, *16*, 239. https://doi.org/10.1186/s12884-016-1024-7

Webb, A. R., Kazantzidis, A., Kift, R. C., Farrar, M. D., Wilkinson, J., & Rhodes, L. E. (2018). Colour Counts: Sunlight and Skin Type as Drivers of Vitamin D Deficiency at UK Latitudes. Nutrients, 10(4), 457.

What is postpartum depression? (n.d.). Retrieved April 4, 2022, from https://www.psychiatry.org/patients-families/postpartum-depression/what-is-postpartum-depression.

Williams, J. A., Romero, V. C., Clinton, C. M., Vazquez, D. M., Marcus, S. M., Chilimigras, J. L., Hamilton, S. E., Allbaugh, L. J., Vahratian, A. M., Schrader, R. M., & Mozurkewich, E. L. (2016). Vitamin D levels and perinatal depressive symptoms in women at risk: a

secondary analysis of the mothers, omega-3, and mental health study. *BMC pregnancy and childbirth, 16*(1), 203. https://doi.org/10.1186/s12884-016-0988-7

Yang, C., Zhao, A., Lan, H., Ren, Z., Zhang, J., Szeto, I. M.-Y., Wang, P., & Zhang, Y. (2021). Association between dietary quality and postpartum depression in lactating women: A cross-sectional survey in Urban China. *Frontiers in Nutrition, 8*. https://doi.org/10.3389/fnut.2021.705353

Appendix I. Evidence Abstract Worksheet

Citation	Abedi, Bovayri, M., Fakhri, A., & Jahanfar, S. (2018). The Relationship Between Vitamin D and Postpartum Depression in Reproductive-Aged Iranian Women. Journal of Medicine and Life, 11(4), 286–292. https://doi.org/10.25122/jml-2018-0038
Study Design	Case Control Study
Class	C
Quality Rating	☐ + (Positive) ☐ - (Negative) ☒ ⊘ (Neutral)
Research Purpose	To assess the relationship between vitamin D and postpartum depression in reproductive-aged Indian women.
Inclusion Criteria	• Women 18-35 years old • 6-8 weeks post childbirth
Exclusion Criteria	• Neonate admitted to NICU • History of mental disorders • Newborn with congenital abnormalities • Repeated caesarian section • Gestational diabetes diagnosis • Preeclampsia • Thyroid disorders during pregnancy
Description of Study Protocol	Recruitment: Selection from public health centers in Izeh, Iran. Design: Women in the case and control groups were matched regarding age and taking vitamin D supplements. A sociodemographic questionnaire and Beck Depression Scale were used for data collection. The ELISA method was used for measuring vitamin D levels. The participants were classified according to their vitamin D level: D < 10ng/ml considered as severe deficiency, 10–20 ng/ml as moderate insufficiency, 20–30 ng/ml as mild insufficiency and >30ng/ml as normal.

	Blinding used (if applicable): N/A Intervention (if applicable): N/A Statistical Analysis: The chi-square test was used for comparing categorical data. The logistic regression analysis was conducted for assessing the relationship between vitamin D and depression adjusting for age, education, education of husband, economic situation and body mass index. A p-value <0.05 was considered significant.
Data Collection Summary	Timing of Measurements: November 2016 - May 2017. This period involves winter and spring seasons. A sociodemographic questionnaire and Beck Depression Scale were used for data collection. The ELISA method was used for measuring vitamin D. Dependent Variables: Beck Depression Scale scores Independent Variables: Vitamin D serum levels Control Variables: Women without PPD
Description of Actual Data Sample	Initial: 120 Attrition (final N): 120 (0 Males 120 Females) Age: 18-35 years Ethnicity: Iranian Other relevant demographics: N/A Location: Public health centers in Izeh, Iran.
Summary of Results	Key Findings: • Significant differences between vitamin D levels in women with postpartum depression and normal women ($p < 0.001$) • Significant correlation between women with vitamin D <10ng/mL and postpartum depression group compared to the normal group (53.3% vs 31.7%, $p = 0.005$)

	• Women with vitamin D less than 20ng/ml compared to vitamin D>20ng/ml were 3.30 times more likely to have postpartum depression Other Findings: • The body mass index in women with postpartum depression was higher than that in normal women (23.3% vs. 6.7%, p=0.01) • Women in the postpartum depression group had significantly more undesired pregnancies than those in the normal group (p=0.002)
Author Conclusion	The Author's results showed that women with postpartum depression had a lower mean of 25-OH-D. Also, the number of women with moderate insufficiency and severe deficiency was significantly higher in the postpartum depression group compared to normal women.
Reviewer Comments	• *Study strengths: sample size is large, with both groups having equal number of participants. It's also the only study known to have been conducted on Iranian women regarding PPD and vitamin D* • *Study Limitations: supplementation and sunlight exposure data may be inaccurate due to recall bias. Vitamin D measurements were done over two seasons (winter and spring) which could affect the level of vitamin D exposure.*
Funding Source	Ahvaz Jundisahpur University of Medical Sciences, Ahvaz, Iran.

Symbols Used	*Explanation*
+	*Positive – Indicates that the report has clearly addressed issues of inclusion/exclusion, bias, generalizability, and data collection and analysis*

--	*Negative – Indicates that these issues have not been adequately addressed.*
⦸	*Neutral – indicates that the report is neither exceptionally strong nor exceptionally week*

Select a rating from the drop-down menu ↓

Relevance Questions		
1. Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (NA for some Epi studies)	1	Yes
2. Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	2	Yes
3. Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to dietetics practice?	3	Yes
4. Is the intervention or procedure feasible? (NA for some epidemiological studies)	4	Yes
If the answers to all of the above relevance questions are "Yes," the report is eligible for designation with a plus (+) on the Evidence Quality Worksheet, depending on answers to the following validity questions.		
Validity Questions		
1. Was the <u>research question</u> clearly stated?	1	Yes
1.1. Was the specific intervention(s) or procedure (independent variable(s)) identified?	1.1	Yes
1.2. Was the outcome(s) (dependent variable(s)) clearly indicated?	1.2	Yes
1.3. Were the target population and setting specified?	1.3	Yes
2. Was the <u>selection</u> of study subjects/patients free from bias?	2	Yes
	2.1	Yes

2.1. Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study? 2.2. Were criteria applied equally to all study groups? 2.3. Were health, demographics, and other characteristics of subjects described? 2.4. Were the subjects/patients a representative sample of the relevant population?	2.2	Yes
	2.3	Yes
	2.4	Yes
3. Were <u>study groups comparable</u>? 3.1. Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT) 3.2. Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline? 3.3. Were concurrent controls used? (Concurrent preferred over historical controls.) 3.4. If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis? 3.5. If case control study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	3	Yes
	3.1	No
	3.2	Yes
	3.3	Yes
	3.4	N/A
	3.5	N/A
	3.6	N/A

3.6. If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?		

4. Was method of handling <u>withdrawals</u> described?	4	No
4.1. Were follow up methods described and the same for all groups?	4.1	N/A
	4.2	N/A
4.2. Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	4.3	Yes
	4.4	N/A
4.3. Were all enrolled subjects/patients (in the original sample) accounted for?	4.5	N/A
4.4. Were reasons for withdrawals similar across groups		
4.5. If diagnostic test, was decision to perform reference test not dependent on results of test under study?		
5. Was <u>blinding</u> used to prevent introduction of bias?	5	No
5.1. In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	5.1	No
	5.2	Yes
5.2. Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	5.3	N/A
	5.4	Yes
5.3. In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	5.5	N/A
5.4. In case control study, was case definition explicit and case ascertainment not influenced by exposure status?		
5.5. In diagnostic study, were test results blinded to patient history and other test results?		

6. Were <u>intervention</u>/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were <u>intervening factors</u> described? 6.1. In RCT or other intervention trial, were protocols described for all regimens studied? 6.2. In observational study, were interventions, study settings, and clinicians/provider described? 6.3. Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect? 6.4. Was the amount of exposure and, if relevant, subject/patient compliance measured? 6.5. Were co-interventions (e.g., ancillary treatments, other therapies) described? 6.6. Were extra or unplanned treatments described? 6.7. Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups? 6.8. In diagnostic study, were details of test administration and replication sufficient?	6 6.1 6.2 6.3 6.4 6.5 6.6 6.7 6.8	Unclear Yes N/A Yes Unclear No N/A Unclear N/A
7. Were <u>outcomes</u> clearly defined and the <u>measurements valid and reliable</u>? 7.1. Were primary and secondary endpoints described and relevant to the question? 7.2. Were nutrition measures appropriate to question and outcomes of concern? 7.3. Was the period of follow-up long enough for important outcome(s) to occur? 7.4. Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	7 7.1 7.2 7.3 7.4 7.5 7.6 7.7	Yes Yes Yes Unclear Unclear Yes Yes

7.5. Was the measurement of effect at an appropriate level of precision? 7.6. Were other factors accounted for (measured) that could affect outcomes? 7.7. Were the measurements conducted consistently across groups?		

8. Was the <u>statistical analysis</u> appropriate for the study design and type of outcome indicators? 8.1. Were statistical analyses adequately described the results reported appropriately? 8.2. Were correct statistical tests used and assumptions of test not violated? 8.3. Were statistics reported with levels of significance and/or confidence intervals? 8.4. Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)? 8.5. Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)? 8.6. Was clinical significance as well as statistical significance reported? 8.7. If negative findings, was a power calculation reported to address type 2 error?	8 8.1 8.2 8.3 8.4 8.5 8.6 8.7	Yes Yes Yes Yes Unclear Yes Yes N/A
9. **Are <u>conclusions supported by results</u> with biases and limitations taken into consideration?** 9.1. Is there a discussion of findings? 9.2. Are biases and study limitations identified and discussed?	9 9.1 9.2	Yes Yes Yes

10. Is bias due to study's <u>funding or sponsorship</u> unlikely? 10.1. Were sources of funding and investigators' affiliations described? 10.2. Was there no apparent conflict of interest?	10 10.1 10.2	Yes Yes Yes
MINUS/NEGATIVE (-) *If most (six or more) of the answers to the above validity questions are "No," the report should be designated with a minus (-) symbol on the Evidence Worksheet.*		
NEUTRAL (∅) *If the answers to validity criteria questions 2, 3, 6, and 7 do not indicate that the study is exceptionally strong, the report should be designated with a neutral (∅) symbol on the Evidence Worksheet.*		
PLUS/POSITIVE (+) *If most of the answers to the above validity questions are "Yes" (including criteria 2, 3, 6, 7 and at least one additional "Yes"), the report should be designated with a plus symbol (+) on the Evidence Worksheet.*		

Citation	Accortt, Arora, C., Mirocha, J., Jackman, S., Liang, R., Karumanchi, S. A., Berg, A. H., & Hobel, C. J. (2021). Low Prenatal Vitamin D Metabolite Ratio and Subsequent Postpartum Depression Risk. Journal of Women's Health (Larchmont, N.Y. 2002), 30(1), 113–120. https://doi.org/10.1089/jwh.2019.8209
Study Design	Secondary data analysis of a prospective study
Class	B
Quality Rating	☐ + (Positive) ☐ - (Negative) ☒ ⊘ (Neutral)
Research Purpose	To find whether lower vitamin D status predicited risk for postpartum depressionin in racially diverse women from the Behavior In Pregnancy Study (BIPS).
Inclusion Criteria	• Birthed live infants

	• English or Spanish speaking • Singleton intrauterine pregnancy • < 20 weeks gestation at time of recruitment • Had vitamin D data for at least one time during pregnancy, demographic data, and data on prenatal or postpartum
Exclusion Criteria	• Incomplete PPD screening • Women who lacked vitamin D metabolite data
Description of Study Protocol	Recruitment: Participants were obtained in prenatal clinics and private practice lovations across Los Angeles, CA. Design: By secondary data analyis with the sample from the BIPS. The BIPS enrolled women in the frist trimester of pregnancy and followed them into postpartum. Interviews, ultrasounds, and biomarkers, including vitamin D metabolites were obtained. Blinding used (if applicable): N/A Intervention (if applicable): N/A Statistical Analysis: Multiple logistic regression models were used to assess the association between variables: VMR, BMI, maternal age, smoking, race, prenatal depression and PPD. A two-sided 0.05 significance level was used.
Data Collection Summary	Timing of Measurements: Depressive symptoms were assessed in the third trimester of pregnancy (28-30 weeks gestation), and then again 6-10 weeks postpartum. Maternal plasma was drawn in the second trimester (18-20 weeks gestation). Dependent Variables: Prenatal and/or postpartum depression symptoms

	Independent Variables: Vitamin D levels, demographic variables including: maternal age, heigh and weight, education, marital status, and race-ethnicity. Medical variables: fetal sex and prenatal infections. Control Variables: N/A
Description of Actual Data Sample	Initial: 160 (0 Males 160 Females) Attrition (final N): 89 Age: Adult women (on average 27.8 years old) Ethnicity: Hispanic/Latina (42%), Black (29%), white (27%), and Asian (2%) Other relevant demographics: N/A Anthropometrics: BMI not at PPD risk: 24.37 on average and BMI at PPD risk: 26.17 on average. Location: Las Angeles, CA
Summary of Results	Key Findings: • Women with PPD had lower VMR than women without PPD (p= 0.003) Other Findings: • More Hispanic/Latina women had PPD (51.4%) compared to white women who had PPD (12.5%)
Author Conclusion	By use of the VMR can enhance the assessment of vitamin D sufficiency. Additional studies are needed to explore whether the relationship between vitamin D levels predicts PPD. Routine prenatal screening for vitamin D metabolites, especially of those in Hispanic/Latina individuals, may be beneficial in identifying woemn at risk for PPD.
Reviewer Comments	• *Study strengths: Prospective design of the study. Women in the sample were studied multiple times throughout; mid pregnancy, at the time of delivery, and 6-10 weeks postpartum. Inclusion of*

	important variables such as maternal age, race/ethnicity, and medical variables. • *Study Limitations: missing data on postpartum depression sysmptoms*
Funding Source	National Center for Advancing Translational Sciences (NCATS) Grant

Symbols Used	*Explanation*
+	*Positive – Indicates that the report has clearly addressed issues of inclusion/exclusion, bias, generalizability, and data collection and analysis*
--	*Negative – Indicates that these issues have not been adequately addressed.*
⊘	*Neutral – indicates that the report is neither exceptionally strong nor exceptionally week*

Select a rating from the drop-down menu ↓

Relevance Questions		
5. Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (NA for some Epi studies)	1	Yes
6. Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	2	Yes
7. Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to dietetics practice?	3	Yes
8. Is the intervention or procedure feasible? (NA for some epidemiological studies)	4	N/A

If the answers to all of the above relevance questions are "Yes," the report is eligible for designation with a plus (+) on the Evidence Quality Worksheet, depending on answers to the following validity questions.		
Validity Questions		
11. Was the <u>research question</u> clearly stated?	1	Yes
11.1. Was the specific intervention(s) or procedure (independent variable(s)) identified?	1.1	Yes
	1.2	Yes
11.2. Was the outcome(s) (dependent variable(s)) clearly indicated?	1.3	Yes
11.3. Were the target population and setting specified?		
12. Was the <u>selection</u> of study subjects/patients free from bias?	2	Yes
12.1. Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	2.1	Unclear
	2.2	Yes
	2.3	Yes
12.2. Were criteria applied equally to all study groups?	2.4	Yes
12.3. Were health, demographics, and other characteristics of subjects described?		
12.4. Were the subjects/patients a representative sample of the relevant population?		
13. Were <u>study groups comparable</u>?	3	Unclear
13.1. Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	3.1	Yes
	3.2	N/A
13.2. Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	3.3	N/A
	3.4	Yes
13.3. Were concurrent controls used? (Concurrent preferred over historical controls.)	3.5	N/A
	3.6	N/A

13.4. If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis? 13.5. If case control study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.) 13.6. If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?		

14. Was method of handling <u>withdrawals</u> described?	4	Yes
14.1. Were follow up methods described and the same for all groups?	4.1	Yes
	4.2	Yes
14.2. Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	4.3	Yes
	4.4	Unclear
14.3. Were all enrolled subjects/patients (in the original sample) accounted for? 14.4. Were reasons for withdrawals similar across groups 14.5. If diagnostic test, was decision to perform reference test not dependent on results of test under study?	4.5	N/A
15. Was <u>blinding</u> used to prevent introduction of bias?	5	Unclear
	5.1	Unclear
	5.2	Yes

15.1. In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate? 15.2. Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.) 15.3. In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded? 15.4. In case control study, was case definition explicit and case ascertainment not influenced by exposure status? 15.5. In diagnostic study, were test results blinded to patient history and other test results?	5.3	Yes
	5.4	N/A
	5.5	N/A
16. Were <u>intervention</u>/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were <u>intervening factors</u> described? 16.1. In RCT or other intervention trial, were protocols described for all regimens studied? 16.2. In observational study, were interventions, study settings, and clinicians/provider described? 16.3. Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect? 16.4. Was the amount of exposure and, if relevant, subject/patient compliance measured? 16.5. Were co-interventions (e.g., ancillary treatments, other therapies) described? 16.6. Were extra or unplanned treatments described? 16.7. Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	6	N/A
	6.1	N/A
	6.2	N/A
	6.3	N/A
	6.4	N/A
	6.5	N/A
	6.6	N/A
	6.7	N/A
	6.8	N/A

16.8. In diagnostic study, were details of test administration and replication sufficient?		
17. Were <u>outcomes</u> clearly defined and the <u>measurements valid and reliable</u>?	7	Yes
	7.1	Yes
17.1. Were primary and secondary endpoints described and relevant to the question?	7.2	Yes
	7.3	Yes
17.2. Were nutrition measures appropriate to question and outcomes of concern?	7.4	Yes
	7.5	Unclear
17.3. Was the period of follow-up long enough for important outcome(s) to occur?	7.6	Yes
17.4. Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	7.7	Yes
17.5. Was the measurement of effect at an appropriate level of precision?		
17.6. Were other factors accounted for (measured) that could affect outcomes?		
17.7. Were the measurements conducted consistently across groups?		

18. Was the <u>statistical analysis</u> appropriate for the study design and type of outcome indicators?	8	Yes
	8.1	Yes
18.1. Were statistical analyses adequately described the results reported appropriately?	8.2	Yes
	8.3	Yes
18.2. Were correct statistical tests used and assumptions of test not violated?	8.4	N/A
	8.5	N/A
18.3. Were statistics reported with levels of significance and/or confidence intervals?	8.6	Yes
	8.7	N/A

18.4. Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)? 18.5. Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)? 18.6. Was clinical significance as well as statistical significance reported? 18.7. If negative findings, was a power calculation reported to address type 2 error?		
19. **Are <u>conclusions supported by results</u> with biases and limitations taken into consideration?** 19.1. Is there a discussion of findings? 19.2. Are biases and study limitations identified and discussed?	9 9.1 9.2	Yes Yes Yes
20. Is bias due to study's <u>funding or sponsorship</u> unlikely? 20.1. Were sources of funding and investigators' affiliations described? 20.2. Was there no apparent conflict of interest?	10 10.1 10.2	Yes Yes Yes
MINUS/NEGATIVE (-) *If most (six or more) of the answers to the above validity questions are "No," the report should be designated with a minus (-) symbol on the Evidence Worksheet.*		
NEUTRAL (∅) *If the answers to validity criteria questions 2, 3, 6, and 7 do not indicate that the study is exceptionally strong, the report should be designated with a neutral (∅) symbol on the Evidence Worksheet.*		
PLUS/POSITIVE (+)		

If most of the answers to the above validity questions are "Yes" (including criteria 2, 3, 6, 7 and at least one additional "Yes"), the report should be designated with a plus symbol (+) on the Evidence Worksheet.

Citation	Accortt, E. E., Schetter, C. D., Peters, R. M., & Cassidy-Bushrow, A. E. (2016). Lower prenatal vitamin D status and postpartum depressive symptomatology in African American women: Preliminary evidence for moderation by inflammatory cytokines. Archives of women's mental health, 19(2), 373–383. https://doi.org/10.1007/s00737-015-0585-1
Study Design	Prospective Study
Class	B
Quality Rating	☒ + (Positive) ☐ - (Negative) ☐ ⊘ (Neutral)
Research Purpose	To examine associations between prenatal vitamin D status and postpartum depressive symptoms in a sample of African American women.
Inclusion Criteria	• African American women • 18-44 years • Second trimester of pregnancy
Exclusion Criteria	• >/= 1 inflammatory biomarkers exceeding +/- 3 standard deviations from the mean for comparability with prior study
Description of Study Protocol	Recruitment: February 2009-June 2010, subjects were patients in the Henry Ford Health System (Detroit, MI). Potential participants were identified by accessing patient appointment lists in the electronic medical record (EMR) of nine HFHS obstetrics and gynecology (OB/GYN) clinics. Clinics were chosen based on the likelihood that they would have many African American patients of varying socioeconomic status.

	Design: Eligible women provided self-reported demographic information, and a 10-ml blood sample was obtained during the second trimester research visit (13-28 weeks gestation). The final analytic sample consisted of 91 women with a first trimester Vitamin D measurement, second trimester measure of inflammatory markers, and who had a postpartum visit during which the depression screening was completed (N=98 did not return for postpartum visit). Blinding used (if applicable): N/A Intervention (if applicable): N/A Statistical Analysis: Linear regression models were adjusted to estimate associations between prenatal vitamin D (ng/ml), inflammatory markers, and postpartum depressive symptoms. Statistical significance was defined as $p < 0.05$ and marginal effects were interpreted at $.05 < p < .10$.
Data Collection Summary	Timing of Measurements: Blood samples were collected during each trimester, research visit Dependent Variables: Postpartum depression symptoms Independent Variables: age, marital status, education, employment status, and cigarette smoking, vitamin D biomarker Control Variables: N/A
Description of Actual Data Sample	Initial: 203 (0 Males 203 Females) Attrition (final N): 91 Age: 18-44 (average age of 26 years) Ethnicity: African American

	Other relevant demographics: Women unmarried 75%, currently employed 63%, high school diploma (58%), history of depression (7%), non-smokers (98%). Anthropometrics: Many women were overweight (N=24, BMI 25-30) or obese (N=34, BMI>30); average BMI was 29.2. Location: Detroit, MI
Summary of Results	Key Findings: • Higher levels of vitamin D early in pregnancy among African American women may reduce postpartum depressive symptoms, though the association of vitamin D status and EPDS scores was boarderline significant (p = 0.058).
Author Conclusion	A possible association between vitamin D and PPD symptoms controlling for prenatal depressive symptoms and also for history of depression; but further research is needed.
Reviewer Comments	• *Study strengths: Larger sample size allowed for adequate testing interactions between variables. Women were studied in both postpartum and during their pregnancies. The participants were also solely African American.who are at higher risk of inflammation and low vitamin D status.* • *Study Limitations: Missing data on depressive sumptoms 6 weeks postpartum. Not assessing depression symptoms more often than in the first 6 weeks.The drop out rate of particpants was over half due to lack of EPDS scores.*
Funding Source	Institute for Population Sciences, Health Assessment, Administration, Services, and Economics (INPHAASE)

Symbols Used	*Explanation*

+	*Positive – Indicates that the report has clearly addressed issues of inclusion/exclusion, bias, generalizability, and data collection and analysis*
--	*Negative – Indicates that these issues have not been adequately addressed.*
⊘	*Neutral – indicates that the report is neither exceptionally strong nor exceptionally week*

Select a rating from the drop-down menu ↓

Relevance Questions		
9. Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (NA for some Epi studies)	1	Yes
10. Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	2	Yes
11. Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to dietetics practice?	3	Yes
12. Is the intervention or procedure feasible? (NA for some epidemiological studies)	4	Yes
If the answers to all of the above relevance questions are "Yes," the report is eligible for designation with a plus (+) on the Evidence Quality Worksheet, depending on answers to the following validity questions.		
Validity Questions		
21. Was the <u>research question</u> clearly stated?	1	Yes
21.1. Was the specific intervention(s) or procedure (independent variable(s)) identified?	1.1	Yes
	1.2	No
21.2. Was the outcome(s) (dependent variable(s)) clearly indicated?	1.3	Yes
21.3. Were the target population and setting specified?		

22. Was the <u>selection</u> of study subjects/patients free from bias?	2	Yes
22.1. Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	2.1	Yes
	2.2	Yes
	2.3	Yes
22.2. Were criteria applied equally to all study groups?	2.4	Yes
22.3. Were health, demographics, and other characteristics of subjects described?		
22.4. Were the subjects/patients a representative sample of the relevant population?		
23. Were <u>study groups comparable</u>?	3	Yes
23.1. Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	3.1	Unclear
	3.2	Yes
23.2. Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	3.3	Yes
	3.4	N/A
23.3. Were concurrent controls used? (Concurrent preferred over historical controls.)	3.5	N/A
23.4. If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	3.6	N/A
23.5. If case control study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)		

23.6. If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?		

24. Was method of handling <u>withdrawals</u> described?	4	Yes
24.1. Were follow up methods described and the same for all groups?	4.1	Yes
	4.2	Yes
24.2. Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	4.3	Yes
	4.4	Yes
24.3. Were all enrolled subjects/patients (in the original sample) accounted for?	4.5	Unclear
24.4. Were reasons for withdrawals similar across groups		
24.5. If diagnostic test, was decision to perform reference test not dependent on results of test under study?		
25. Was <u>blinding</u> used to prevent introduction of bias?	5	Unclear
25.1. In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	5.1	N/A
	5.2	Yes
25.2. Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	5.3	Unclear
	5.4	Unclear
25.3. In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	5.5	Yes
25.4. In case control study, was case definition explicit and case ascertainment not influenced by exposure status?		

25.5. In diagnostic study, were test results blinded to patient history and other test results?		
26. Were <u>intervention</u>/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were <u>intervening factors</u> described?	6	Yes
	6.1	N/A
	6.2	N/A
26.1. In RCT or other intervention trial, were protocols described for all regimens studied?	6.3	Yes
	6.4	Yes
26.2. In observational study, were interventions, study settings, and clinicians/provider described?	6.5	No
	6.6	No
26.3. Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	6.7	Yes
26.4. Was the amount of exposure and, if relevant, subject/patient compliance measured? 26.5. Were co-interventions (e.g., ancillary treatments, other therapies) described? 26.6. Were extra or unplanned treatments described? 26.7. Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups? 26.8. In diagnostic study, were details of test administration and replication sufficient?	6.8	Yes
27. Were <u>outcomes</u> clearly defined and the <u>measurements valid and reliable</u>?	7	Yes
	7.1	Yes
27.1. Were primary and secondary endpoints described and relevant to the question?	7.2	Yes
	7.3	Yes
27.2. Were nutrition measures appropriate to question and outcomes of concern?	7.4	Yes
	7.5	Yes
27.3. Was the period of follow-up long enough for important outcome(s) to occur?	7.6	Yes
	7.7	Yes

27.4. Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures? 27.5. Was the measurement of effect at an appropriate level of precision? 27.6. Were other factors accounted for (measured) that could affect outcomes? 27.7. Were the measurements conducted consistently across groups?		

28. Was the <u>statistical analysis</u> appropriate for the study design and type of outcome indicators? 28.1. Were statistical analyses adequately described the results reported appropriately? 28.2. Were correct statistical tests used and assumptions of test not violated? 28.3. Were statistics reported with levels of significance and/or confidence intervals? 28.4. Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)? 28.5. Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)? 28.6. Was clinical significance as well as statistical significance reported? 28.7. If negative findings, was a power calculation reported to address type 2 error?	8 8.1 8.2 8.3 8.4 8.5 8.6 8.7	Yes Yes Yes Yes Yes Yes N/A
	9	Yes

29. **Are <u>conclusions supported by results</u> with biases and limitations taken into consideration?** 29.1. Is there a discussion of findings? 29.2. Are biases and study limitations identified and discussed?	9.1	Yes
	9.2	Yes
30. Is bias due to study's <u>funding or sponsorship</u> unlikely?	10	Yes
30.1. Were sources of funding and investigators' affiliations described?	10.1	Yes
30.2. Was there no apparent conflict of interest?	10.2	Yes
MINUS/NEGATIVE (-) *If most (six or more) of the answers to the above validity questions are "No," the report should be designated with a minus (-) symbol on the Evidence Worksheet.*		
NEUTRAL (∅) *If the answers to validity criteria questions 2, 3, 6, and 7 do not indicate that the study is exceptionally strong, the report should be designated with a neutral (∅) symbol on the Evidence Worksheet.*		
PLUS/POSITIVE (+) *If most of the answers to the above validity questions are "Yes" (including criteria 2, 3, 6, 7 and at least one additional "Yes"), the report should be designated with a plus symbol (+) on the Evidence Worksheet.*		

Citation	Nielsen, Strøm, M., Boyd, H. A., Andersen, E. W., Wohlfahrt, J., Lundqvist, M., Cohen, A., Hougaard, D. M., & Melbye, M. (2013). Vitamin D status during pregnancy and the risk of subsequent postpartum depression: a case-control study. PloS One, 8(11), e80686–e80686. https://doi.org/10.1371/journal.pone.0080686
Study Design	Case-control
Class	C

Quality Rating	☐ + (Positive) ☐ - (Negative) ☒ ⊘ (Neutral)
Research Purpose	To determine if low vitamin D status during pregnancy was associated with postpartum depression.
Inclusion Criteria	• Born in Denmark • Singleton pregnancy • Delivery of living child • Blood collection late in pregnancy (>25 weeks gestation)
Exclusion Criteria	• Anti-depressant use registed in the Danish Register of Midicinal Product Statistics in the year before delivery • Registerd with in the Central Psychiatric Register with mental illness prior to DNBC pregnancy
Description of Study Protocol	Recruitment: Participants were selected from the DNBC (a cohort of Danish women investigated for the impact of a wide range of prenatal exposures on peri- and postpartum outcomes in mothers and children). The recruitment took place over the period of 1996-2002 and gave birth to about 94,000 children between years 1997-2003. Design: The study investigated whether or not vitamin D concentrations during pregnancy are associated with increased risk of PPD. This case-control study used the Danish National Birth Cohort (DNBC) to select participants. Blood samples of the participants were collected during routine visitis and then sent to Statens Serum Insititute for processing.The vitamin D serum concentrations were then categorized into six different groups (<15, 15-24, 25-49, 80-00, and >100) and evaluated for association with PPD. Blinding used (if applicable): N/A

	Intervention (if applicable): N/A Statistical Analysis: Logistic regression as used to estimate odds ratios to evaluate the association between vitamin D concentrations and PPD risk.
Data Collection Summary	Timing of Measurements: Blood samples were taken at routine prenatal visits 1996-2002. Dependent Variables: PPD risk/symptoms Independent Variables: Vitamin D serum concentrations Control Variables: Women without PPD (n=875)
Description of Actual Data Sample	Initial: 1480 (0 Males 1480Females) Attrition (final N): 1480 Age: 18-34+ Ethnicity: Danish Other relevant demographics: N/A Anthropometrics: N/A Location: Denmark
Summary of Results	Key Findings: • No overall association between vitamin D status during pregnancy and PPD risk (p = 0.08). In contrast with the author's hypothesis, women with higher concentrations of vitamin D had significantly increased risks of PPD compared with women in the reference category.
Author Conclusion	Biological mechanisms are involved in the relationship between vitamin D during pregnancy and the risk of PPD. Recommendations of vitamin D supplementation to pregnant women should be considered with caution.
Reviewer Comments	• *Study strengths: The study was part of the DNBC (large prospective cohort) and recruited approximately 35% of pregnant*

	women in Denmark between the noted years. The authors adjusted for cofounders (smoking, BMI, socioeconomic status, supplement use, social support, and physical activity during pregnancy).The study also reduced the possibility of misclassification of vitamin D concentrations by use of biological samples versus on reported diet. • *Study limitations: It's noted that the participants in the DNBC are generally more health-conscious than non-participants which could affect outcomes in biased estimates.*
Funding Source	Danish Research Council for Health and Disease and the Lundbeck Foundation

Symbols Used	*Explanation*
+	*Positive – Indicates that the report has clearly addressed issues of inclusion/exclusion, bias, generalizability, and data collection and analysis*
--	*Negative – Indicates that these issues have not been adequately addressed.*
⃠	*Neutral – indicates that the report is neither exceptionally strong nor exceptionally week*

Select a rating from the drop-down menu ↓

Relevance Questions		
13. Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (NA for some Epi studies)	1	Yes
14. Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	2	Yes

15. Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to dietetics practice?	3	Yes
16. Is the intervention or procedure feasible? (NA for some epidemiological studies)	4	Yes
If the answers to all of the above relevance questions are "Yes," the report is eligible for designation with a plus (+) on the Evidence Quality Worksheet, depending on answers to the following validity questions.		
Validity Questions		
31. Was the <u>research question</u> clearly stated?	1	Yes
31.1. Was the specific intervention(s) or procedure (independent variable(s)) identified?	1.1	Yes
	1.2	Yes
31.2. Was the outcome(s) (dependent variable(s)) clearly indicated?	1.3	Yes
31.3. Were the target population and setting specified?		
32. Was the <u>selection</u> of study subjects/patients free from bias?	2	Unclear
32.1. Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	2.1	Yes
	2.2	Yes
	2.3	Yes
32.2. Were criteria applied equally to all study groups?	2.4	Yes
32.3. Were health, demographics, and other characteristics of subjects described?		
32.4. Were the subjects/patients a representative sample of the relevant population?		
33. Were <u>study groups comparable</u>?	3	Yes
	3.1	Unclear
	3.2	Unclear

33.1. Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT) 33.2. Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline? 33.3. Were concurrent controls used? (Concurrent preferred over historical controls.) 33.4. If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis? 33.5. If case control study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.) 33.6. If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	3.3	Yes
	3.4	N/A
	3.5	Yes
	3.6	N/A

34. Was method of handling <u>withdrawals</u> described? 34.1. Were follow up methods described and the same for all groups? 34.2. Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	4	No
	4.1	Yes
	4.2	Unclear
	4.3	Yes
	4.4	Unclear
	4.5	N/A

34.3. Were all enrolled subjects/patients (in the original sample) accounted for? 34.4. Were reasons for withdrawals similar across groups 34.5. If diagnostic test, was decision to perform reference test not dependent on results of test under study?		
35. Was <u>blinding</u> used to prevent introduction of bias? 35.1. In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate? 35.2. Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.) 35.3. In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded? 35.4. In case control study, was case definition explicit and case ascertainment not influenced by exposure status? 35.5. In diagnostic study, were test results blinded to patient history and other test results?	5 5.1 5.2 5.3 5.4 5.5	No N/A Yes N/A Yes N/A
36. Were <u>intervention</u>/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were <u>intervening factors</u> described? 36.1. In RCT or other intervention trial, were protocols described for all regimens studied? 36.2. In observational study, were interventions, study settings, and clinicians/provider described? 36.3. Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	6 6.1 6.2 6.3 6.4 6.5 6.6 6.7 6.8	Yes Yes N/A Yes Yes No N/A Yes N/A

36.4. Was the amount of exposure and, if relevant, subject/patient compliance measured? 36.5. Were co-interventions (e.g., ancillary treatments, other therapies) described? 36.6. Were extra or unplanned treatments described? 36.7. Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups? 36.8. In diagnostic study, were details of test administration and replication sufficient?		
37. Were <u>outcomes</u> clearly defined and the <u>measurements valid and reliable</u>? 37.1. Were primary and secondary endpoints described and relevant to the question? 37.2. Were nutrition measures appropriate to question and outcomes of concern? 37.3. Was the period of follow-up long enough for important outcome(s) to occur? 37.4. Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures? 37.5. Was the measurement of effect at an appropriate level of precision? 37.6. Were other factors accounted for (measured) that could affect outcomes? 37.7. Were the measurements conducted consistently across groups?	7 7.1 7.2 7.3 7.4 7.5 7.6 7.7	Yes Yes Yes Yes Yes Yes Yes Yes

38. Was the <u>statistical analysis</u> appropriate for the study design and type of outcome indicators?	8 8.1	Yes Yes

38.1. Were statistical analyses adequately described the results reported appropriately? 38.2. Were correct statistical tests used and assumptions of test not violated? 38.3. Were statistics reported with levels of significance and/or confidence intervals? 38.4. Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)? 38.5. Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)? 38.6. Was clinical significance as well as statistical significance reported? 38.7. If negative findings, was a power calculation reported to address type 2 error?	8.2 8.3 8.4 8.5 8.6 8.7	Yes Yes Yes Yes Yes Yes
39. **Are <u>conclusions supported by results</u> with biases and limitations taken into consideration?** 39.1. Is there a discussion of findings? 39.2. Are biases and study limitations identified and discussed?	9 9.1 9.2	Yes Yes Yes
40. Is bias due to study's <u>funding or sponsorship</u> unlikely? 40.1. Were sources of funding and investigators' affiliations described? 40.2. Was there no apparent conflict of interest?	10 10.1 10.2	Yes Yes Yes
MINUS/NEGATIVE (-) *If most (six or more) of the answers to the above validity questions are "No," the report should be designated with a minus (-) symbol on the Evidence Worksheet.*		
NEUTRAL (∅)		

If the answers to validity criteria questions 2, 3, 6, and 7 do not indicate that the study is exceptionally strong, the report should be designated with a neutral (∅) symbol on the Evidence Worksheet.
PLUS/POSITIVE (+) *If most of the answers to the above validity questions are "Yes" (including criteria 2, 3, 6, 7 and at least one additional "Yes"), the report should be designated with a plus symbol (+) on the Evidence Worksheet.*

Citation	Rouhi, Rouhi, N., Mohamadpour, S., & Tajrishi, H. P.-R. (2018). Vitamin D reduces postpartum depression and fatigue among Iranian women. British Journal of Midwifery, 26(12), 787–793. https://doi.org/10.12968/bjom.2018.26.12.787
Study Design	Double blind, randomized controlled trial
Class	A
Quality Rating	☒ + (Positive) ☐ - (Negative) ☐ ⊘ (Neutral)
Research Purpose	To determine the efficiency of vitamin D supplement on postnatal depression and fatigue.
Inclusion Criteria	• Vaginal birth • No medical or surgical restrictions • No history of psychiatric disorders • No prescribed medications • Breast feeding
Exclusion Criteria	• Not specified
Description of Study Protocol	Recruitment: There were six public health care centres in Mahabad, and participants were recruited from all centres. The subjects were selected by convenience sampling.

	Design: 80 women, who scored ≥13 and ≥20 on the Edinburgh Postnatal Depression Scale and the Fatigue Identification form, were randomly distributed into the control and intervention groups over 4-10 months following birth. Groups received vitamin D3 1000IU and placebo pills daily for 6 months. Blinding used (if applicable): double-blind Intervention (if applicable): Supplementation of vitamin D3 1000IU or placebo pill for 6 months Statistical Analysis: Logistic regression tests assessed the relation between variables. To compare the group's demographic characteristics, a paired T-test was used. Descriptive statistics were used to characterise participants. Analysis of variance (ANOVA), chi-square ($\chi 2$) test, Fisher's exact test and T-test was used to analyse the results. Statistical significant was considered at $P \leq 0.05$.
Data Collection Summary	Timing of Measurements: Data collection took place between 2014 and 2015 Dependent Variables: PPD risk scores Independent Variables: Supplementation of vitamin D3 Control Variables: Placebo supplementation
Description of Actual Data Sample	Initial: 95 (0 Males 95 Females) Attrition (final N): 80 Age: 18+ (mean age 24.7 years) Ethnicity: Iranian Other relevant demographics: N/A Anthropometrics: N/A

	Location: Health centres in Mahabad, Iran
Summary of Results	Key Findings: • Vitamin D decreased depression scores and fatigue scores in the intervention group (P < 0.001). • At baseline, the mean score of depression in the intervention group and placebo group were 15.05 and 15.27, respectively with no significant differences (P=0.484). The mean score of fatigue in the intervention group and placebo group were 23.25 and 25.23, respectively, with no significant differences (P=0.725). • Six months after treatment, FIF scores among those randomised to the intervention group decreased by 12 points or more (CI=4.38–7.71; P=0.001) and EPDS scores by 7 points (CI=3.02–5.35; P=0.001). • There were no significant differences in mean FIF and EPDS scores in the control group.
Author Conclusion	Considering vitamin D supplements as routine postpartum care among high-risk women would be useful. However, more studies are needed to support this conclusion.
Reviewer Comments	• Study strengths: Type of study: double-blind, randomized, control trial • *Study limitations: Vitamin D deficiency was not assessed by blood samples. Depression and fatigue were based on EPDS and FIF scales, which are self-reported tools, not a clinician's diagnosis- leaves room for data error*
Funding Source	This research received no specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Symbols Used	*Explanation*

+	*Positive – Indicates that the report has clearly addressed issues of inclusion/exclusion, bias, generalizability, and data collection and analysis*
--	*Negative – Indicates that these issues have not been adequately addressed.*
⊘	*Neutral – indicates that the report is neither exceptionally strong nor exceptionally week*

Select a rating from the drop-down menu ↓

Relevance Questions		
17. Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (NA for some Epi studies)	1	Yes
18. Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	2	Yes
19. Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to dietetics practice?	3	Yes
20. Is the intervention or procedure feasible? (NA for some epidemiological studies)	4	Yes
If the answers to all of the above relevance questions are "Yes," the report is eligible for designation with a plus (+) on the Evidence Quality Worksheet, depending on answers to the following validity questions.		
Validity Questions		
41. Was the <u>research question</u> clearly stated?	1	Yes
41.1. Was the specific intervention(s) or procedure (independent variable(s)) identified?	1.1 1.2	Yes Yes
41.2. Was the outcome(s) (dependent variable(s)) clearly indicated? 41.3. Were the target population and setting specified?	1.3	Yes

42. Was the <u>selection</u> of study subjects/patients free from bias?	2	Yes
42.1. Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	2.1	Yes
	2.2	Yes
	2.3	Unclear
42.2. Were criteria applied equally to all study groups?	2.4	Yes
42.3. Were health, demographics, and other characteristics of subjects described?		
42.4. Were the subjects/patients a representative sample of the relevant population?		
43. Were <u>study groups comparable</u>?	3	Yes
43.1. Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	3.1	Yes
	3.2	Yes
43.2. Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	3.3	N/A
	3.4	Unclear
43.3. Were concurrent controls used? (Concurrent preferred over historical controls.)	3.5	N/A
43.4. If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	3.6	N/A
43.5. If case control study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)		

43.6. If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?		

44. Was method of handling <u>withdrawals</u> described?	4	Yes
44.1. Were follow up methods described and the same for all groups?	4.1	Yes
	4.2	Yes
44.2. Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	4.3	Yes
	4.4	Unclear
44.3. Were all enrolled subjects/patients (in the original sample) accounted for?	4.5	N/A
44.4. Were reasons for withdrawals similar across groups		
44.5. If diagnostic test, was decision to perform reference test not dependent on results of test under study?		
45. Was <u>blinding</u> used to prevent introduction of bias?	5	Yes
45.1. In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	5.1	N/A
	5.2	Yes
45.2. Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	5.3	N/A
	5.4	Yes
45.3. In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	5.5	N/A
45.4. In case control study, was case definition explicit and case ascertainment not influenced by exposure status?		

45.5. In diagnostic study, were test results blinded to patient history and other test results?		
46. Were <u>intervention</u>/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were <u>intervening factors</u> described?	6	Yes
	6.1	Yes
	6.2	N/A
46.1. In RCT or other intervention trial, were protocols described for all regimens studied?	6.3	Yes
	6.4	Yes
46.2. In observational study, were interventions, study settings, and clinicians/provider described?	6.5	N/A
	6.6	N/A
46.3. Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	6.7	Yes
46.4. Was the amount of exposure and, if relevant, subject/patient compliance measured? 46.5. Were co-interventions (e.g., ancillary treatments, other therapies) described? 46.6. Were extra or unplanned treatments described? 46.7. Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups? 46.8. In diagnostic study, were details of test administration and replication sufficient?	6.8	N/A
47. Were <u>outcomes</u> clearly defined and the <u>measurements valid and reliable</u>?	7	Yes
	7.1	Yes
47.1. Were primary and secondary endpoints described and relevant to the question?	7.2	Yes
	7.3	Yes
47.2. Were nutrition measures appropriate to question and outcomes of concern?	7.4	Yes
	7.5	Yes
47.3. Was the period of follow-up long enough for important outcome(s) to occur?	7.6	Yes
	7.7	Yes

47.4. Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures? 47.5. Was the measurement of effect at an appropriate level of precision? 47.6. Were other factors accounted for (measured) that could affect outcomes? 47.7. Were the measurements conducted consistently across groups?		

48. Was the <u>statistical analysis</u> appropriate for the study design and type of outcome indicators? 48.1. Were statistical analyses adequately described the results reported appropriately? 48.2. Were correct statistical tests used and assumptions of test not violated? 48.3. Were statistics reported with levels of significance and/or confidence intervals? 48.4. Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)? 48.5. Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)? 48.6. Was clinical significance as well as statistical significance reported? 48.7. If negative findings, was a power calculation reported to address type 2 error?	8 8.1 8.2 8.3 8.4 8.5 8.6 8.7	Yes Yes Yes Yes Yes Unclear Yes Yes
	9	Yes

49. **Are <u>conclusions supported by results</u> with biases and limitations taken into consideration?** 49.1. Is there a discussion of findings? 49.2. Are biases and study limitations identified and discussed?	9.1 9.2	Yes Yes
50. Is bias due to study's <u>funding or sponsorship</u> unlikely? 50.1. Were sources of funding and investigators' affiliations described? 50.2. Was there no apparent conflict of interest?	10 10.1 10.2	Yes Yes Yes
MINUS/NEGATIVE (-) *If most (six or more) of the answers to the above validity questions are "No," the report should be designated with a minus (-) symbol on the Evidence Worksheet.*		
NEUTRAL (∅) *If the answers to validity criteria questions 2, 3, 6, and 7 do not indicate that the study is exceptionally strong, the report should be designated with a neutral (∅) symbol on the Evidence Worksheet.*		
PLUS/POSITIVE (+) *If most of the answers to the above validity questions are "Yes" (including criteria 2, 3, 6, 7 and at least one additional "Yes"), the report should be designated with a plus symbol (+) on the Evidence Worksheet.*		

Citation	Vaziri, F., Nasiri, S., Tavana, Z., Dabbaghmanesh, M. H., Sharif, F., & Jafari, P. (2016). A randomized controlled trial of vitamin D supplementation on perinatal depression: in Iranian pregnant mothers. BMC pregnancy and childbirth, 16, 239. https://doi.org/10.1186/s12884-016-1024-7
Study Design	Randomized Control Trial
Class	A

Quality Rating	☒ + (Positive) ☐ - (Negative) ☐ ⊘ (Neutral)
Research Purpose	To determine the effect of vitamin D3 supplementation on perinatal depression scores.
Inclusion Criteria	• > 18 years of age • No history of mental illness or internal diseases • Singleton living fetus • Free of pregnancy complications • Gestational age 26-28 weeks upon enrollment • Depression score of 0-13
Exclusion Criteria	• Depression score > 13 • Failure to provide blood sample at onset of the study • < 8 weeks consumption of vitamin D3 supplementation or irregular consumption (< than daily)
Description of Study Protocol	Recruitment: Expectant women who were under prenatal care in Hafez hospital which is a tertiary hospital in Shiraz, Iran, affiliated to Shiraz University of Medical Sciences were recruited for this study. Design: The Edinburgh Postnatal Depression scale was used to evaluate depression scores. Participants were assigned in two groups of placebo and vitamin D supplementation through block randomization design. The vitamin D group received 2000 IU vitamin D3 daily from 26 to 28 weeks of gestation until childbirth. Maternal serum 25-hydroxyvitamin D concentrations were measured at baseline and childbirth. Depression scores were evaluated four times: at 26–28 and 38–40 weeks of gestation, and 4 and 8 weeks after birth. Blinding used (if applicable): Single-blind

	Intervention (if applicable): 2000 IU supplementation of D3 daily from 26-28 weeks gestation through childbirth or placebo pills composed of starch daily from 26-28 weeks gestation through childbirth. Statistical Analysis: P-values < 0.05 were considered as statistically significant. The data was evaluated using the Kolmogorov-Smirnov test. The means of normal distribution data were analyzed using parametric tests, Student's t-test or paired t- test. A non-parametric test (Mann Whitney U test) was used whenever the continuous measures were not normally distributed
Data Collection Summary	Timing of Measurements: Maternal blood samples were obtained at 26–28 weeks of gestation (at baseline) and once more, at childbirth (during first 24 h after birth in postpartum onward). Depression scores were determined four times: at 26–28 weeks of gestation (baseline), at 38–40 weeks of gestation, and finally at 4 and 8 weeks after birth. Dependent Variables: PPD symptoms Independent Variables: Supplementation of vitamin D Control Variables: Control group received 2 placebo pills daily
Description of Actual Data Sample	Initial: 169 (0 Males 169 Females) Attrition (final N): 136 Age: 18-39 years Ethnicity: Iranian Other relevant demographics: occupation (house wife/employed), and education level Anthropometrics: N/A Location: Shiraz, Iran
Summary of Results	Key Findings:

	• At childbirth, the vitamin D group had a significantly higher vitamin D concentration in comparison to the control group ($p < 0.001$). At baseline, no correlation was observed between 25-hydroxyvitamin D concentration and depression score ($r = 0.13$, $p = 0.09$). • There was no significant difference between the two study groups in relation to the baseline depression score. The vitamin D group had greater reduction in depression scores than the control group at 38–40 weeks of gestation ($p = 0.01$) also, at 4 and 8 weeks after birth ($p < 0.001$).
Author Conclusion	The present trial showed that consuming 2000 IU vitamin D3 daily during late pregnancy was effective in decreasing perinatal depression levels. Further clinical trial in pregnant mothers who are at risk for postnatal depression is suggested.
Reviewer Comments	• *Study strengths: The two study groups were similar regarding to age, job, education, parity and sun exposure. However, they were different regarding to using other supplements outside the study's protocol and planned pregnancy.* • *Study limitations: Vitamin D consumption by mothers was controlled through reminders during prenatal care visits or over the phone. The participants' honesty could lead to error. The participants were selected from one prenatal clinic. The group of participants may not be an accurate representation of the target population. Mothers with depression level of >13 were excluded from this study, the results can not determine mothers with high levels of depression. More than 95% of the mothers had lower than 30 ng/mL serum vitmain D concentration, it is not clear if the same results would be observed in mothers with higher levels*

Funding Source	Research Vice-chancellor of Shiraz University of Medical Sciences

Symbols Used	*Explanation*
+	*Positive – Indicates that the report has clearly addressed issues of inclusion/exclusion, bias, generalizability, and data collection and analysis*
--	*Negative – Indicates that these issues have not been adequately addressed.*
⊘	*Neutral – indicates that the report is neither exceptionally strong nor exceptionally week*

Select a rating from the drop-down menu ↓

Relevance Questions		
21. Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (NA for some Epi studies)	1	Yes
22. Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	2	Yes
23. Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to dietetics practice?	3	Yes
24. Is the intervention or procedure feasible? (NA for some epidemiological studies)	4	Yes
If the answers to all of the above relevance questions are "Yes," the report is eligible for designation with a plus (+) on the Evidence Quality Worksheet, depending on answers to the following validity questions.		
Validity Questions		
51. Was the <u>research question</u> clearly stated?	1	Yes
	1.1	Yes

51.1. Was the specific intervention(s) or procedure (independent variable(s)) identified? 51.2. Was the outcome(s) (dependent variable(s)) clearly indicated? 51.3. Were the target population and setting specified?	1.2	Yes
	1.3	Yes
52. Was the <u>selection</u> of study subjects/patients free from bias?	2	Yes
52.1. Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	2.1	Yes
	2.2	Yes
	2.3	Yes
52.2. Were criteria applied equally to all study groups? 52.3. Were health, demographics, and other characteristics of subjects described? 52.4. Were the subjects/patients a representative sample of the relevant population?	2.4	Unclear
53. Were <u>study groups comparable</u>?	3	Yes
53.1. Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	3.1	Yes
	3.2	Yes
53.2. Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	3.3	Yes
	3.4	N/A
53.3. Were concurrent controls used? (Concurrent preferred over historical controls.)	3.5	Yes
53.4. If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	3.6	N/A

53.5. If case control study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.) 53.6. If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?		

54. Was method of handling <u>withdrawals</u> described?	4	Yes
54.1. Were follow up methods described and the same for all groups?	4.1	Yes
	4.2	Yes
54.2. Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	4.3	Yes
	4.4	Yes
54.3. Were all enrolled subjects/patients (in the original sample) accounted for? 54.4. Were reasons for withdrawals similar across groups 54.5. If diagnostic test, was decision to perform reference test not dependent on results of test under study?	4.5	N/A
55. Was <u>blinding</u> used to prevent introduction of bias?	5	Yes
55.1. In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	5.1	Yes
	5.2	Yes
	5.3	N/A
55.2. Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	5.4	Unclear
	5.5	N/A

55.3. In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded? 55.4. In case control study, was case definition explicit and case ascertainment not influenced by exposure status? 55.5. In diagnostic study, were test results blinded to patient history and other test results?		
56. Were <u>intervention</u>/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were <u>intervening factors</u> described? 56.1. In RCT or other intervention trial, were protocols described for all regimens studied? 56.2. In observational study, were interventions, study settings, and clinicians/provider described? 56.3. Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect? 56.4. Was the amount of exposure and, if relevant, subject/patient compliance measured? 56.5. Were co-interventions (e.g., ancillary treatments, other therapies) described? 56.6. Were extra or unplanned treatments described? 56.7. Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups? 56.8. In diagnostic study, were details of test administration and replication sufficient?	6 6.1 6.2 6.3 6.4 6.5 6.6 6.7 6.8	Yes Yes N/A Yes No Yes Yes Yes N/A
57. Were <u>outcomes</u> clearly defined and the <u>measurements valid and reliable</u>? 57.1. Were primary and secondary endpoints described and relevant to the question?	7 7.1 7.2 7.3 7.4	Yes Yes Yes Yes Yes

57.2. Were nutrition measures appropriate to question and outcomes of concern?	7.5	Yes
	7.6	Yes
57.3. Was the period of follow-up long enough for important outcome(s) to occur? 57.4. Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures? 57.5. Was the measurement of effect at an appropriate level of precision? 57.6. Were other factors accounted for (measured) that could affect outcomes? 57.7. Were the measurements conducted consistently across groups?	7.7	Yes

58. Was the <u>statistical analysis</u> appropriate for the study design and type of outcome indicators?	8	Yes
	8.1	Yes
58.1. Were statistical analyses adequately described the results reported appropriately?	8.2	Yes
	8.3	Yes
58.2. Were correct statistical tests used and assumptions of test not violated?	8.4	Yes
	8.5	Yes
58.3. Were statistics reported with levels of significance and/or confidence intervals?	8.6	Yes
58.4. Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)? 58.5. Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	8.7	Yes

58.6. Was clinical significance as well as statistical significance reported? 58.7. If negative findings, was a power calculation reported to address type 2 error?		
59. **Are <u>conclusions supported by results</u> with biases and limitations taken into consideration?**	9	Yes
59.1. Is there a discussion of findings?	9.1	Yes
59.2. Are biases and study limitations identified and discussed?	9.2	Yes
60. Is bias due to study's <u>funding or sponsorship</u> unlikely?	10	Yes
60.1. Were sources of funding and investigators' affiliations described?	10.1	Yes
60.2. Was there no apparent conflict of interest?	10.2	Yes
MINUS/NEGATIVE (-) *If most (six or more) of the answers to the above validity questions are "No," the report should be designated with a minus (-) symbol on the Evidence Worksheet.*		
NEUTRAL (∅) *If the answers to validity criteria questions 2, 3, 6, and 7 do not indicate that the study is exceptionally strong, the report should be designated with a neutral (∅) symbol on the Evidence Worksheet.*		
PLUS/POSITIVE (+) *If most of the answers to the above validity questions are "Yes" (including criteria 2, 3, 6, 7 and at least one additional "Yes"), the report should be designated with a plus symbol (+) on the Evidence Worksheet.*		

Citation	Williams, J. A., Romero, V. C., Clinton, C. M., Vazquez, D. M., Marcus, S. M., Chilimigras, J. L., Hamilton, S. E., Allbaugh, L. J., Vahratian, A.

	M., Schrader, R. M., & Mozurkewich, E. L. (2016). Vitamin D levels and perinatal depressive symptoms in women at risk: a secondary analysis of the mothers, omega-3, and mental health study. BMC pregnancy and childbirth, 16(1), 203. https://doi.org/10.1186/s12884-016-0988-7
Study Design	Secondary Analyis of a Randomized Trial
Class	A
Quality Rating	☒ + (Positive) ☐ - (Negative) ☐ ⊘ (Neutral)
Research Purpose	To determine whether low vitamin D during pregnancy is associated with depressive symptoms as assessed by the Beck Depression Inventory score at three time points during pregnancy. As a secondary aim to determine whether vitamin D levels were associated with Mini International Neuropsychiatric Interview diagnoses of major depressive disorder (MDD), generalized anxiety disorder (GAD), or anxiety symptoms.
Inclusion Criteria	• > 18 years • EPDS scores between 9-19 • Singleton gestation • Gestational age between 12-20 weeks
Exclusion Criteria	• EPDS score >19 • History of bleeding • Multiple gestation • Bipolar disorder diagnosis • Major depressive disorder diagnosis • Current substance abuse • Schizophrenia • Antidepressant use

Description of Study Protocol	Recruitment: October 2008 - May 2011, expectant women at risk for depression from prenatal clinics associated with The University of Michigan Hospital in Ann Arbor, Michigan, and St. Joseph Mercy Hospital in Ypsilanti, Michigan were enrolled in this study Design: Pregnant women from Michigan who were at risk for depression based on Edinburgh Postnatal Depression Scale Score or history of depression were enrolled. Participants completed the Beck Depression Inventory (BDI) and Mini International Neuropsychiatric Interview at 12–20 weeks, 26–28 weeks, 34–36 weeks, and 6–8 weeks postpartum. Vitamin D levels were measured at 12–20 weeks and 34–36 weeks Blinding used (if applicable): N/A Intervention (if applicable): N/A Statistical Analysis: The relationship between vitamin D as a continuous variable and BDI scores were assessed at 12–20 weeks, 34–36 weeks and the 6–8 week postpartum visits. Using a generalized linear models (ANCOVA) approach authors entered winter and vitamin D at visit 1 into the model as predictors of the BDI score at visit 1 (study entry), at 34–36 weeks gestation and at 6–8 weeks postpartum. Outomes compaired according to vitamin D suffi- ciency versus insufficiency in our population, we per- formed a secondary analysis selecting a vitamin D level of ≥ 20 ng/mL at enrollment (n = 98) as our reference group and <20 ng/mL (n = 19) as our “low vitamin group.

Data Collection Summary	Timing of Measurements: completion of the Beck Depression Inventory (BDI) and Mini International Neuropsychiatric Interview at 12–20 weeks, 26–28 weeks, 34–36 weeks, and 6–8 weeks postpartum. Vitamin D levels were measured at 12–20 weeks and 34–36 weeksx Dependent Variables: PPD symptoms/risk Independent Variables: Vitamin D level Control Variables: N/A
Description of Actual Data Sample	Initial: 117 (0 Males 117 Females) Attrition (final N): 105 Age: 18+ years Ethnicity: Non-specified Other relevant demographics: N/A Anthropometrics: N/A Location: University of Michigan Hospital in Ann Arbor, Michigan, and St. Joseph Mercy Hospital in Ypsilanti, Michigan
Summary of Results	Key Findings: • Vitamin D levels at 12–20 weeks were inversely associated with BDI scores both at 12—20 and at 34–36 weeks gestation ($P < 0.05$, both). For every one unit increase in vitamin D in early pregnancy, the average decrease in the mean BDI score was .14 units. • Vitamin D levels were not associated with diagnoses of major depressive disorder or generalized anxiety disorder. • When evaluating “low vitamin D” as a categorical variable, there was no association seen between vitamin D level at 12–20 weeks and BDI score at that time ($P = 0.11$) or with postpartum BDI score ($P = 0.97$).

	• Low vitamin D at enrollment was significantly associated with higher BDI score at 34–36 weeks gestation (P = 0.05).
Author Conclusion	In women at risk for depression, early pregnancy low vitamin D levels are associated with higher depressive symptom scores in early and late pregnancy. Authors concluded an association between low vitamin D levels in early pregnancy and depressive symptoms during pregnancy but not in postpartum. Future investigations should study whether vitamin D supplementation in early pregnancy may prevent perinatal depressive symptoms.
Reviewer Comments	• *Study strengths: a prospective, longitudianl study design - allowing for measuremtn of depressive symptoms at several time points throughout pregnancy amd postpartum. Vitamin D measured longitudinally in early and late pregnancy. The study was assessed both depression symptoms scores (use of BDI) as well as depression diagnoses (use of MINI). The study also evaluated women at risk for depression.* • *Study limitations: of secondary analysis of a randomized, controlled trial, designed to detect a reduction In BDI score following intervention with omega-3 tatty acids - results should then be interpreted with caution. Even with control for confounding related to omega-3 fatty acid levels, could have led to inappropriate conclusions. The sample size for the randomized controlled trial was chosen based on the hypothesized response to the omega-3 fatty acid interventions under study on the BDI score, rather than as a study to detect an association. Also, the use of BDI rather than the EPDS to assess depressive symptom severity.*

	• *All participating women were taking prenatal vitamins; Participants were not excluded from initiating antidepressant medications during the trial.*
Funding Source	NIH R21 AT004166-03S1 (NCCAM), as well as a University of Michigan Clinical Research Initiatives grant and the University of Michigan General Clinical Research Center.

Symbols Used	*Explanation*
+	*Positive – Indicates that the report has clearly addressed issues of inclusion/exclusion, bias, generalizability, and data collection and analysis*
--	*Negative – Indicates that these issues have not been adequately addressed.*
⊘	*Neutral – indicates that the report is neither exceptionally strong nor exceptionally week*

Select a rating from the drop-down menu ↓

Relevance Questions		
25. Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (NA for some Epi studies)	1	Yes
26. Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	2	Yes
27. Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to dietetics practice?	3	Yes
28. Is the intervention or procedure feasible? (NA for some epidemiological studies)	4	Yes

If the answers to all of the above relevance questions are "Yes," the report is eligible for designation with a plus (+) on the Evidence Quality Worksheet, depending on answers to the following validity questions.		
Validity Questions		
61. Was the <u>research question</u> clearly stated?	1	Yes
61.1. Was the specific intervention(s) or procedure (independent variable(s)) identified?	1.1	Yes
	1.2	Yes
61.2. Was the outcome(s) (dependent variable(s)) clearly indicated?	1.3	Yes
61.3. Were the target population and setting specified?		
62. Was the <u>selection</u> of study subjects/patients free from bias?	2	Yes
62.1. Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	2.1	Yes
	2.2	Yes
	2.3	No
62.2. Were criteria applied equally to all study groups?	2.4	Yes
62.3. Were health, demographics, and other characteristics of subjects described?		
62.4. Were the subjects/patients a representative sample of the relevant population?		
63. Were <u>study groups comparable</u>?	3	Yes
63.1. Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	3.1	Unclear
	3.2	Unclear
63.2. Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	3.3	N/A
	3.4	Unclear
63.3. Were concurrent controls used? (Concurrent preferred over historical controls.)	3.5	N/A
	3.6	N/A

63.4. If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis? 63.5. If case control study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.) 63.6. If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?		

64. Was method of handling <u>withdrawals</u> described?	4	Unclear
64.1. Were follow up methods described and the same for all groups?	4.1	Yes
	4.2	Unclear
64.2. Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.) 64.3. Were all enrolled subjects/patients (in the original sample) accounted for? 64.4. Were reasons for withdrawals similar across groups 64.5. If diagnostic test, was decision to perform reference test not dependent on results of test under study?	4.3	Yes
	4.4	Unclear
	4.5	N/A
65. Was <u>blinding</u> used to prevent introduction of bias?	5	Unclear
	5.1	N/A
	5.2	Yes

65.1. In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate? 65.2. Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.) 65.3. In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded? 65.4. In case control study, was case definition explicit and case ascertainment not influenced by exposure status? 65.5. In diagnostic study, were test results blinded to patient history and other test results?	5.3 5.4 5.5	Yes N/A N/A
66. Were <u>intervention</u>/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were <u>intervening factors</u> described? 66.1. In RCT or other intervention trial, were protocols described for all regimens studied? 66.2. In observational study, were interventions, study settings, and clinicians/provider described? 66.3. Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect? 66.4. Was the amount of exposure and, if relevant, subject/patient compliance measured? 66.5. Were co-interventions (e.g., ancillary treatments, other therapies) described? 66.6. Were extra or unplanned treatments described? 66.7. Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	6 6.1 6.2 6.3 6.4 6.5 6.6 6.7 6.8	Yes Yes N/A Yes Yes Yes Yes Yes N/A

66.8. In diagnostic study, were details of test administration and replication sufficient?		
67. Were <u>outcomes</u> clearly defined and the <u>measurements valid and reliable</u>? 67.1. Were primary and secondary endpoints described and relevant to the question? 67.2. Were nutrition measures appropriate to question and outcomes of concern? 67.3. Was the period of follow-up long enough for important outcome(s) to occur? 67.4. Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures? 67.5. Was the measurement of effect at an appropriate level of precision? 67.6. Were other factors accounted for (measured) that could affect outcomes? 67.7. Were the measurements conducted consistently across groups?	7 7.1 7.2 7.3 7.4 7.5 7.6 7.7	Yes Yes Yes Yes Yes Yes Yes Yes

68. Was the <u>statistical analysis</u> appropriate for the study design and type of outcome indicators? 68.1. Were statistical analyses adequately described the results reported appropriately? 68.2. Were correct statistical tests used and assumptions of test not violated? 68.3. Were statistics reported with levels of significance and/or confidence intervals?	8 8.1 8.2 8.3 8.4 8.5 8.6 8.7	Yes Yes Yes Yes N/A Unclear Yes Yes

68.4. Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)? 68.5. Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)? 68.6. Was clinical significance as well as statistical significance reported? 68.7. If negative findings, was a power calculation reported to address type 2 error?		
69. **Are <u>conclusions supported by results</u> with biases and limitations taken into consideration?**	9	Yes
69.1. Is there a discussion of findings?	9.1	Yes
69.2. Are biases and study limitations identified and discussed?	9.2	Yes
70. Is bias due to study's <u>funding or sponsorship</u> unlikely?	10	Yes
70.1. Were sources of funding and investigators' affiliations described?	10.1	Yes
70.2. Was there no apparent conflict of interest?	10.2	Yes
MINUS/NEGATIVE (-) *If most (six or more) of the answers to the above validity questions are "No," the report should be designated with a minus (-) symbol on the Evidence Worksheet.*		
NEUTRAL (∅) *If the answers to validity criteria questions 2, 3, 6, and 7 do not indicate that the study is exceptionally strong, the report should be designated with a neutral (∅) symbol on the Evidence Worksheet.*		
PLUS/POSITIVE (+)		

If most of the answers to the above validity questions are "Yes" (including criteria 2, 3, 6, 7 and at least one additional "Yes"), the report should be designated with a plus symbol (+) on the Evidence Worksheet.