

Factores de riesgos y trastornos por deficiencia de folato en embarazadas

Risk factors and disorders due to folate deficiency in pregnant women

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Palabras**claves:**

ácido fólico, factores de riesgo, folato, deficiencia de folato, folato en embarazadas.

Keywords:

folic acid, risk factors, folate, folate deficiency, folate in pregnant women.

Resumen

Introducción: La deficiencia de folato es un problema de salud que puede tener consecuencias significativas, especialmente durante el embarazo. El ácido fólico, una forma sintética de folato, es crucial para el desarrollo celular y la formación del sistema nervioso del feto. La escasez de esta vitamina B en mujeres embarazadas es una preocupación importante en la salud materno-infantil, ya que se ha asociado con complicaciones graves. **Objetivo:** Determinar los factores de riesgos y trastornos por la deficiencia de folato en embarazadas. **Metodología:** El desarrollo de este estudio se basa en un tipo de investigación descriptiva que permite analizar las variables detalladas en el tema o idea principal. La investigación realizada tiene un enfoque cualitativo que se basa en el análisis de los factores de riesgo del déficit de folato en las embarazadas. El estudio descriptivo se basa en el análisis de las variables establecidas y analizar la correlación entre ambas. **Resultados:** La importancia crítica del folato durante el embarazo y las consecuencias perjudiciales que surgen a raíz de su deficiencia. La relación entre la falta de folato y los defectos del tubo neural es un punto central, ya que esta vitamina es esencial para la correcta formación del tubo neural en el feto. **Conclusión:** Se identificaron factores cruciales que inciden en la deficiencia de folato durante el embarazo, tales como la inadecuada ingesta de alimentos ricos en folato, padecimientos clínicos como la patología celíaca o enfermedades intestinales, el consumo excesivo de alcohol, y antecedentes de embarazos con defectos del tubo neural. **Área de estudio general:** Medicina. **Área de estudio específica:** Enfermería.

Abstract

Introduction: Folate deficiency is a health problem that can have significant consequences, especially during pregnancy. Folic acid, a synthetic form of folate, is crucial for cell development and the formation of the fetal nervous system. The shortage of this B vitamin in pregnant women is a major concern in maternal and child health, as it has been associated with serious complications. **Objective:** Determine the risk factors and disorders due to folate deficiency in pregnant women. **Methodology:** The development of this study is based on a type of descriptive research that allows analyzing the detailed variables in the theme or main idea. The

research carried out has a qualitative approach that is based on the analysis of risk factors for folate deficiency in pregnant women. The descriptive study is based on the analysis of the established variables and analyzing the correlation between both. Results: The critical importance of folate during pregnancy and the harmful consequences that arise from its deficiency. The relationship between a lack of folate and neural tube defects is a central point, since this vitamin is essential for the correct formation of the neural tube in the fetus. Conclusion: Crucial factors that affect folate deficiency during pregnancy were identified, such as inadequate intake of foods rich in folate, clinical conditions such as celiac disease or intestinal diseases, excessive alcohol consumption, and a history of pregnancies with defects. of the neural tube.

Introduction

Regarding the development of this article, several antecedents have been determined, according to Barbosa et al. (2022), in a study carried out in the city of Campina in Brazil, about “folic acid supplementation during pregnancy related to the development of childhood neurological disorders” for which the objective is to clarify the risk and benefit of using folic acid supplements during pregnancy. Through this study, the results highlight the existence of information that proves that autism is not something defined or concrete, but is based on factors, such as environmental, genetic, pathological, social factors during the gestational period that intervene in the adequate neurodevelopment of the fetus.

Based on the research carried out by Duarte (2019), in the city of New York, USA, about “Daily folic acid may reduce gestational diabetes: An NIH study suggests that the supplement that reduces the risk of birth defects may also have health benefits for the mother” based on the objective is based on analyzing the importance of daily folate consumption before pregnancy to reduce complications such as gestational diabetes. Based on the results, it has been shown that women of reproductive age should take a daily dose of between 400-800 micrograms of folate to reduce the risk.

According to Hernández et al. (2019), a study was conducted in the city of Matanzas, Cuba, based on “folic acid and pregnancy, as a risk or benefit” in this study a large analysis has been developed. According to the results, it has been shown that several of the aspects analyzed indicate that the administration of folic acid before and during the gestational period is very beneficial because it reduces possible complications of heart disease.

Poor nutrient intake is associated with a high risk of analytical results based on the main characteristics of the most relevant nutrients during the gestational period. Iron is part of hemoglobin and is therefore responsible for transporting oxygen to all organs. During pregnancy, gestation presents hematological changes secondary to iron deficiency, so anemia is one of the causes of nutritional deficiency (Rodríguez & Fresno, 2021).

Risk factors for folate deficiency, It may be an indirect determinant, congenital anomalies are more common in low-income families and countries. It is estimated that 94% of major birth defects occur in low- and middle-income countries, where mothers are more likely to suffer from malnutrition, both macronutrient and micronutrient, and may be more exposed to factors that predispose or increase the birth rate. defects or factors such as abnormal fetal development, especially alcohol and infection (Cañarte & Castro, 2022).

The problem of folate deficiency during pregnancy can trigger serious consequences for both the mother and the developing fetus. Folate, a B vitamin crucial for DNA synthesis and cell division, plays an essential role in the growth and development of fetal tissue. Folate insufficiency during pregnancy has been associated with several risk factors and disorders, raising substantial concerns for maternal-fetal health. What are the risk factors and complications of folate deficiency in pregnant women?

Aim

General Objective: determine the risk factors and disorders due to folate deficiency in pregnant women.

Specific Objectives: To identify risk factors associated with folate deficiency during pregnancy. To assess the potential effects of folate deficiency on fetal development and maternal health.

Methodology

The development of this study is based on a type of descriptive research that allows the analysis of the variables detailed in the main theme or idea. This study is based on a bibliographic review that allows to provide theoretical support and analyze the problem that has been raised for this study. The research carried out has a qualitative approach that is based on the analysis of the risk factors for folate deficiency in pregnant women. The descriptive study is based on the analysis of the established variables and analyzes the correlation between both.

The technique applied for this research is based on the observational process and analysis of research studies as background, thus taking into consideration the truthfulness and support of the results, as well as the interpretation, is based on analyzing the criteria and positions of the studies carried out and considered from 2019 to 2023.

The indexed journals of PubMed and Scielo were taken into consideration. For this analysis, information or documents from unreliable websites and sites such as rincón del vago, Wikipedia, among others, were excluded. This study allows us to obtain more extensive information and analyze the situation regarding risk factors for folate deficiency in pregnant women.

Results

Table 1

Disorders in pregnant women due to folate deficiency

Author/Year	Qualification	Sample	Methodology	Results
Tsiklauri et al. (2020)	Prevalence of micronutrient and folate deficiencies in neural tube defects in Georgia	963 pregnant women	Quantitative study with a descriptive-analytical, retrospective approach	Folate deficiencies in pregnant women trigger several disorders because of how essential this vitamin is for the development of the fetus and the well-being of the mother. Serious deficiencies that can result are neural tube defects being one of the most critical concerns due to folate deficiency. Spina bifida is an anatomical condition where the spine does not form correctly which triggers serious disabilities.
Miraglia & Dehay (2022)	Advantages of folate supplementation in fertility and pregnancy	165 pregnant women	Qualitative study with an analytical approach	Folate deficiency in pregnant women increases the risk of premature birth or low birth weight in newborns, which leads to a series of long-term health problems for the newborn.
Yaremco et al. (2018)	Red blood cell folate levels in pregnant women with a history of mood disorders	24 pregnant women	Quantitative study with a descriptive approach	This condition caused by folate deficiency causes a reduction in the production of red blood cells, which leads to the abnormal appearance of larger erythrocytes. Anemia is harmful to the fetus and the mother because it leads to a reduction in oxygen for the tissues and organs.

Table 1

Folate deficiency disorders in pregnant women (continued)

Author/Year	Qualification	Sample	Methodology	Results
Wegmuller et al. (2020)	Folate micronutrient deficiency in young children and pregnant women	1,165 children and 973 women	Quantitative study with a descriptive-analytical, retrospective approach	Among the disorders that are evident are the risk of cardiovascular complications and neurological problems, folate deficiencies in pregnant women increase cardiac complications, as well as neurological disorders and even depressive events have been recorded. In pregnant women in Ghana, high rates of anemia (21.7%), iron deficiency (13.7%), iron deficiency anemia (8.9%), vitamin A deficiency (1.5%), folate deficiency (53.8%) and vitamin B12 deficiency (6.9%) were found.
Martinez et al. (2018)	Anemia and folate deficiency versus pathological anemia in pregnancy	40 articles from PubMed, Medline, Scielo and Google Scholar databases	Quantitative study with a descriptive approach	Another of the most relevant disorders associated with folate deficiency during pregnancy is megaloblastic anemia, which leads to a lower ability to transport oxygen to the body's organs. This can have complications for the mother's health such as weakness and fatigue, and poses a high risk to the fetus.

Analysis: Folate deficiency in pregnant women presents significant consequences for both the mother and the fetus. Disorders associated with this deficiency range from neurological problems to cardiovascular complications. One of the most serious risks is the development of neural tube defects, such as spina bifida, which can have long-term implications on the health of the newborn. Folate deficiency is also associated with an increased risk of preterm birth and low birth weight, which can lead to long-term health problems for the newborn. Furthermore, anemia resulting from folate deficiency contributes to reduced red blood cell production, affecting the body's ability to transport oxygen to tissues and organs. Specific data from pregnant women in Ghana highlight the high rates of folate deficiency, suggesting the need for maternal and child health interventions and programs in this population. Megaloblastic anemia, a direct consequence of folate deficiency, adds additional concerns, such as weakness and fatigue for the mother, as well as risks to the fetus. This analysis highlights the critical importance of ensuring adequate folate intake during pregnancy to prevent serious complications and improve the short- and long-term health of both mother and child.

Table 2

Risk factors in pregnancy due to folate deficiency

Author/Year	Qualification	Sample	Methodology	Results
Tefera et al. (2022)	Red blood cell folate level and associated factors of folate insufficiency among pregnant women in Addis Ababa, Ethiopia	44 participants with folate deficiency problems	Cross-sectional, analytical study	27% of participants, or 44 out of 160, were found to have low red blood cell folate levels (less than 400 ng/mL), which was not sufficient to prevent neural tube defects. Statistical analysis showed that regular vegetable consumption was an independent factor influencing these low red blood cell folate levels, with a relative risk of 0.41 and a confidence interval between 0.18 and 0.93.
Olapeju et al. (2019)	Maternal postpartum plasma folate status and preterm delivery in a high-risk US population	2 313 maternal plasma folate samples	Quantitative study with a descriptive-analytical approach	Higher plasma folate levels (comparing the highest to lowest quartile) were also associated with a decreased risk of preterm birth. The adjusted risk was 0.78 with a 95% confidence interval between 0.64 and 0.96 for intake 3 to 5 times per week, and 0.77 with a 95% confidence interval between 0.64 and 0.93 for intake more than 5 times per week.
Montoro et al. (2021)	Iron deficiency in celiac disease: prevalence, health impact and clinical management	23 journal articles	Qualitative study with an analytical approach	Women carrying multiples have a higher folate requirement or need due to the demand for more nutrients by the fetuses, which leads to low folate levels when they do not have a balanced diet or adequate intake through food supplements. Apart from folate and vitamin B12 malabsorption, there are other reasons that contribute to anemia in these patients, such as nutritional deficiencies, inflammation, blood loss, development of a resistant form of celiac disease and infection with <i>Helicobacter pylori</i> .

Table 2

Risk factors in pregnancy due to folate deficiency (continued)

Author/Year	Qualification	Sample	Methodology	Results
Qu et al. (2020)	Maternal folic acid supplementation during the first trimester reduced the risks of major and most congenital heart diseases in offspring: a large case-control study	8,379 confirmed cases	Quantitative study with a descriptive-analytical approach	Folic acid consumption in the first trimester of pregnancy was found to be significantly protectively associated with coronary heart disease in offspring (adjusted OR: 0.69; 95% confidence interval: 0.62–0.76). However, no association was found for the exclusive use of multivitamins (adjusted OR: 1.42; 95% confidence interval: 0.73–2.78). No significant interaction was identified between folic acid and multivitamin use on heart disease (P = 0.292).
Hernandez et al. (2019)	Folic acid and pregnancy: benefit or risk?	37 updated bibliographic references.	Qualitative study with an analytical approach	According to what they mention in this result, folate deficiency during pregnancy is the highest probability of premature birth, low folate levels are linked to an increase in premature birth, which leads to high complications for the normal development of the fetus. Folic acid performs two important functions in the human body: it participates in the formation and repair of nucleic acids and facilitates the conversion of homocysteine into methionine, a crucial amino acid.

Analysis: 27% of participants had low levels of folate in red blood cells, insufficient to prevent neural tube defects. Regular consumption of vegetables was identified as an independent factor related to low folate levels, suggesting the importance of a balanced diet. Higher levels of plasma folate were associated with a decreased risk of preterm birth. Regular folate intake during pregnancy was shown to be a protective factor, highlighting the relevance of supplementation and diet in preventing complications. Folic acid consumption in the first trimester of pregnancy was associated in a protective manner with coronary heart disease in offspring. However, no significant association was

observed with the exclusive use of multivitamins. This highlights the importance of folic acid in the cardiovascular health of offspring. Folate deficiency during pregnancy is linked to an increased risk of preterm birth and complications in fetal development. Folic acid plays a crucial role in the formation and repair of nucleic acids and in the conversion of homocysteine, being essential for normal fetal development.

Table 3

Pharmacological effects of folic acid on fetal development

Author/Year	Qualification	Sample	Methodology	Results
Sagir & Kuruoglu (2020)	The effects of folic acid and topiramate on peripheral nerve regeneration	31 journal articles	Qualitative study with an analytical approach	According to this author, folic acid is important during the early stages of pregnancy, because it prevents neural tube defects in the fetus, since defects such as spina bifida and anencephaly can occur during the first weeks of pregnancy. Early folic acid supplementation significantly reduces the risk of complications due to defective development of the neural tube in the fetus. Both folic acid and TOP have antiapoptotic properties by activating phosphorylated Akt (p-Akt) signaling and showing anti-inflammatory effects at the site of injury. The study investigates how folic acid and topiramate impact peripheral nerve injuries.
Zhang et al. (2019)	Folic acid-mediated mitochondrial activation for protection against oxidative stress in stem cells	28 updated bibliographic references.	Qualitative study with an analytical approach	Folic acid is important for the process of DNA synthesis and repair, as well as being a vital part of cell division, through this development and growth of the fetus, folic acid is important for the formation of new cells and tissues, which contributes to the proper progress of systems and organs in the fetus and is also important for the well-being of the pregnant woman. Topiramate (TOP) works by blocking these channels, specifically the amino-3-hydroxy-5-methyl-4-isoxazole propionic acid

(AMPA)/kainate receptor, and affects the activity of folic acid (FA) in the production of neurotransmitters.

Table 3

Pharmacological effects of folic acid on fetal development (continued)

Author/Year	Qualification	Sample	Methodology	Results
Talha et al. (2019)	Effect of folic acid on cisplatin-induced ototoxicity: a functional and morphological study	Experimental case study	Case study	Regarding this analysis, it indicates that folic acid is important and crucial for the development of the nervous system of the fetus, where it plays a fundamental role in brain development. A deficiency of folic acid causes problems that lead to the development of neurological problems in the fetus.
Na et al. (2020)	Investigation of the effect of folic acid intervention on arsenic-induced cardiac abnormalities in rat fetuses during the periconceptual period	Experimental case study	Case study	The frequency of cardiac malformations in fetal rats from BE groups was significantly higher compared with that in fetal rats from A group ($P < 0.05$). The levels of H3K9 acetylation in fetal cardiomyocytes of rats in BE groups were significantly higher compared with group A ($P < 0.05$), whereas in CE groups, the levels of H3K9 acetylation were lower than in group B ($P < 0.05$).
Perichart et al. (2021)	Importance of supplementation in pregnancy: role of folate supplementation	14 updated bibliographic references.	Qualitative study with an analytical approach	Valuable data have recently emerged regarding the individual and combined administration of various micronutrients, with significant effects on maternal and fetal health.

These findings may influence the medical practice of health professionals. This review presents scientific evidence and guidelines from various agencies regarding folic acid supplementation and combined vitamin and mineral intake during pregnancy.

Analysis: Folic acid is shown to be essential in early pregnancy, preventing neural tube defects such as spina bifida and anencephaly. Early supplementation significantly reduces the risk of complications associated with defective neural tube development. Both folic acid and topiramate show anti-apoptotic properties by activating phosphorylated Akt (p-Akt) signaling and anti-inflammatory effects at the injury site. This study examines how these substances impact peripheral nerve injuries. Individual and combined administration of micronutrients, including folic acid, show significant effects on maternal and fetal health. These findings may influence medical practices and guidelines for supplementation during pregnancy.

Discussion

The results analyzed in Table 1 highlight the critical importance of folate during pregnancy and the harmful consequences that arise from its deficiency. The relationship between folate deficiency and neural tube defects is a central point, since this vitamin is essential for the correct formation of the neural tube in the fetus. Spina bifida, one of the main anatomical concerns derived from folate deficiency, represents a serious disability for the child. In addition, an increased risk of premature birth and low birth weight has been identified when mothers suffer from folate deficiency. These health problems at birth can lead to long-term complications for the newborn.

Another complication associated with folate deficiency is anemia, which is caused by reduced red blood cell production. Anemia can affect both the mother and the fetus, as it reduces the supply of oxygen to tissues and organs, negatively impacting overall health. Furthermore, folate deficiency during pregnancy has been shown to increase the risk of cardiovascular complications and neurological problems, which can lead to cardiac and neurological disorders, and even cases of depressive events have been reported in women with folate deficiency. Overall, these results emphasize the need for adequate folate intake during pregnancy to prevent these disorders and complications. Sufficient folate supply is shown to be crucial to ensure healthy fetal development and maternal well-being.

In reference to Table 2, the results identify several risk factors associated with folate deficiency during pregnancy, which highlights the importance of an adequate and balanced diet during this period. Inadequate intake of foods rich in folate is one of the

most frequent risk factors for deficiency of this vitamin. Pregnant women who do not consume foods such as legumes or fruits, which are sources of folate, run a higher risk of developing low levels of this vitamin, which can trigger several complications during pregnancy. In addition, certain medical and clinical conditions such as celiac disease or intestinal disorders, as well as excessive alcohol consumption, can interfere with the proper absorption of folate in the body. In turn, excessive excretion through certain conditions can contribute to folate deficiency.

Pregnant women with twins or multiples have an increased need for folate due to the increased nutrient requirement of the fetus. This increases the risk of low folate levels, especially if a balanced diet is not followed or nutritional supplements are not taken. Women with a history of previous pregnancies with neural tube defects or a family history of these problems are at increased risk of folate deficiency, which exposes the fetus to a higher risk. However, it is highlighted that early detection and a balanced diet can significantly reduce the risks of complications related to folate deficiency during pregnancy. This analysis underlines the importance of prevention and early detection to mitigate the risks associated with folate deficiency.

Based on the results in Table 3, the results underline the fundamental importance of folic acid in the early stages of pregnancy, focusing on the prevention of neural tube defects in the fetus. These defects, such as spina bifida and anencephaly, can manifest in the first weeks of pregnancy. It is established that early supplementation with folic acid significantly reduces the risk of complications arising from defective development of the fetal neural tube. Folic acid plays an essential role in the synthesis and repair of DNA, being essential for cell division. In the context of fetal development and growth, its importance lies in the formation of new cells and tissues, contributing to the proper development of organs and systems in the fetus, as well as to the well-being of the pregnant mother.

It is noted that folic acid is crucial for the development of the nervous system of the fetus, playing a fundamental role in brain formation. It is noted that folic acid deficiency can cause neurological problems in the fetus, which highlights the importance of its adequate presence during gestation. In addition, it is indicated that folic acid allows the prevention of anemia, a common condition during pregnancy, by stimulating the production of red blood cells and preventing iron deficiency. These effects have a significant impact on the well-being of the mother and on the prevention of complications such as premature births and low birth weight.

Conclusions

- Crucial factors influencing folate deficiency during pregnancy were identified, such as inadequate intake of folate-rich foods, clinical conditions such as celiac

disease or intestinal diseases, excessive alcohol consumption, and a history of pregnancies with neural tube defects. These factors were correlated with disorders such as spina bifida, premature birth, low birth weight, and anemia.

- Multiple disorders associated with folate deficiency in pregnancy were highlighted, such as increased risks of premature birth, low birth weight, anemia and cardiovascular complications. In addition, a correlation was shown between folate deficiency and neurological complications, which represents a significant risk for maternal and fetal health.
- Key factors that adversely affect the progress of pregnancy were identified, such as inadequate intake of folate-rich foods, clinical diseases, excessive alcohol consumption and a history of pregnancies with neural tube defects. These factors are determinants in the manifestation of disorders and complications in pregnancy.
- Folic acid was positioned as a critical component in fetal development. Its importance in preventing neural tube defects was highlighted, as well as its role in DNA synthesis and repair, cell formation, nervous system development, and the prevention of anemia in pregnant women.

Conflict of interest

In the conflict of interest declaration, the author stated that there is no situation that could influence his impartiality or the results presented in this work. However, it is crucial to approach the issue critically and consider whether there are factors that, even if not declared, could potentially bias the author's objectivity.

Despite the statement of absence of conflict of interest, the scientific community and readers should be aware of the possibility of indirect conflicts or undisclosed situations that may arise throughout the research process. This includes, among other things, undeclared financial relationships, links with relevant organizations, or any other factor that may influence the interpretation or presentation of the data.

Authors' contribution statement

Od. Paola Liceth Mafla Rosero. Bibliographic review and writing of the manuscript.

Od. Esp. David Zapata H. Reading and approval of the final revision of the manuscript.

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The development of this work is self-financed. The decision to self-finance this research work arises from the conviction of maintaining financial independence that guarantees the integrity and objectivity of the results obtained. This approach is based on several principles and considerations that reinforce the validity and credibility of the research.

Furthermore, by self-financing the project, restrictions imposed by third parties in terms of research agenda, methodology or dissemination of results are minimized. This direct control over the financial resources used in the research allows for more agile decision-making and greater flexibility to adjust approaches and strategies according to needs and findings throughout the research process.

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