The Association Between Maternal Nutritional Status During Pregnancy and Caries Experience in Their Offspring: A Literature Review

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Abstract
Previous studies have discovered intergenerational linkage between maternal nutritional status and the subsequent health of their offspring. This literature review aimed to explore the connection between the nutritional status of mothers during pregnancy and the occurrence of dental caries in their children. PubMed and Scopus were used for searching articles, adhering to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) protocol. The process involved eliminating duplicate articles, and further refinement included articles published within the timeframe of 2013-2023 and those published in the English language. Review articles, studies involving animals, letters to the editor, book sections, and conference proceedings were excluded. Articles that did not provide information on the variables of interest and sample details were also excluded. Data extraction included author names, article titles, publication years, study designs, indicators of maternal nutritional status, type of dentition under consideration, and the reported outcomes. After meticulous removal of duplicate articles and careful application of the inclusion and exclusion criteria, 7 articles met the study's eligibility criteria. The study results collectively indicated that lower levels and intake of maternal plasma vitamin D, reduced maternal plasma folate levels, inadequate gestational weight gain, and overall poor maternal nutritional status were associated with an increased risk of dental caries in their children. It is crucial for mothers to maintain a diet that guarantees the adequate nutrition of the developing fetus.

Introduction
Previous studies have discovered intergenerational linkage between maternal nutritional status and the subsequent health of their offspring. A study based on data from the Bangladesh Demographic and Health Surveys, focused on mothers aged 15–49 and their children aged 0–59 months, identified that mothers shorter than 145 cm in height carry an increased risk of stunting in their children [1]. Furthermore, maternal obesity and excessive weight gain during pregnancy can impact their children's susceptibility to obesity [2], potentially due to the inheritance of diet-related behaviors [3]. The nutritional status of children, such as stunting and obesity, has shown correlations with the occurrence of dental caries [4,5].
It is crucial that mothers maintain an appropriate diet during pregnancy to support the optimal development of their baby's teeth and oral health [6]. Despite the existence of several studies underlining the significance of nutrition during pregnancy, it is clear that this matter has yet to receive sufficient attention. This literature review aimed to explore the connection between the nutritional status of mothers during pregnancy and the occurrence of dental caries in their children. The objective was to enhance awareness among mothers and healthcare professionals regarding the pivotal role of nutrition in dental and oral health during pregnancy.

**Methods**
This study conducted a comprehensive search for articles using two key databases, namely PubMed and Scopus. The search criteria involved specific keywords, including "maternal," "nutritional status," "pregnancy," "offspring," and "caries." The article selection adhered to the guidelines established by the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) protocol.

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Data extraction encompassed a range of variables such as author names, article titles, publication years, study designs, indicators of maternal nutritional status, type of dentition under consideration, and the reported outcomes. The classification of dentition types was based on the developmental stages of teeth, distinguishing between primary and permanent dentition.

**Results**
The article selection process is visually outlined in Figure 1. A total of 569 articles were initially identified through the designated keywords in PubMed and Scopus. After meticulous removal of duplicate articles and careful application of the inclusion and exclusion criteria, 7 articles met the study's eligibility criteria.

Table 1 provides a summary of the extracted data from the selected studies. Of the 7 included studies, 6 were categorized as cohort studies. Each of these studies focused on mothers at varying stages of pregnancy. The majority of the studies (85.7%) investigated the occurrence of caries in the primary teeth of the offspring. The study results collectively indicated that lower levels and intake of maternal plasma vitamin D, reduced maternal plasma folate levels, diminished gestational weight gain, and overall poor maternal nutritional status were associated with an increased risk of dental caries in their children.

![Figure 1: The article selection process flow diagram](image-url)
Table 1: Data extracted from included studies

<table>
<thead>
<tr>
<th>No.</th>
<th>Authors</th>
<th>Title</th>
<th>Publication Year</th>
<th>Study Design</th>
<th>Maternal nutritional status indicator</th>
<th>Type of dentition</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>K. Tanaka; S. Hitsumoto; Y. Miyake; H. Okubo; S. Sasaki; N. Miyatake; M. Arakawa [7]</td>
<td>Higher vitamin D intake during pregnancy is associated with reduced risk of dental caries in young Japanese children</td>
<td>2015</td>
<td>Cohort</td>
<td>Dietary vitamin D intake between the 5th and 39th week of pregnancy</td>
<td>Primary</td>
<td>Increased maternal vitamin D intake during pregnancy could potentially correlate with a reduced likelihood of dental caries in offspring.</td>
</tr>
<tr>
<td>2</td>
<td>I. A. Badruddin; M. Khansa; R. R. Darwita; A. Rahardjo [8]</td>
<td>The relation of mothers’ nutritional status to primary teeth dental caries</td>
<td>2017</td>
<td>Cross-sectional</td>
<td>Mid-arm circumference during pregnancy</td>
<td>Primary</td>
<td>The likelihood of experiencing dental caries was 1.85 times greater among children whose mothers had a poor nutritional status compared to those born to mothers with a good nutritional status.</td>
</tr>
<tr>
<td>3</td>
<td>C. Un Lam; L. W. Khin; A. C. Kalhan; R. Yee; Y. S. Lee; M. F. Chong; K. Kwek; S. M. Saw; K. Godfrey; Y. S. Chong; C. Y. Hsu [9]</td>
<td>Identification of Caries Risk Determinants in Toddlers: Results of the GUSTO Birth Cohort Study</td>
<td>2017</td>
<td>Cohort</td>
<td>Plasma folate at 26-28 weeks of pregnancy</td>
<td>Primary</td>
<td>Low maternal plasma folate levels, defined as below 6 ng/mL, pose a risk factor for the development of early childhood caries in their offspring.</td>
</tr>
<tr>
<td>4</td>
<td>Y. Wu; E. C. Jansen; K. E. Peterson; B. Foxman; J. M. Goodrich; H. Hu; M. Solano-González; A. Cantoral; M. M. Téllez-Rojo; E. A. Martinez-Mier [10]</td>
<td>The associations between lead exposure at multiple sensitive life periods and dental caries risks in permanent teeth</td>
<td>2019</td>
<td>Cohort</td>
<td>Plasma lead at trimester 1, 2, and 3 of pregnancy</td>
<td>Primary and permanent</td>
<td>Exposure to lead (Pb) during critical developmental periods did not exhibit a statistically significant association with the risk of dental caries after adjusting for potential confounding factors. Nonetheless, a potential association is indicated between Pb exposure and caries among children with high sugar-sweetened beverage intake.</td>
</tr>
<tr>
<td>6</td>
<td>R. J. Singleton; G. M. Day; T. K. Thomas; J. A.</td>
<td>Impact of a Prenatal Vitamin D</td>
<td>2022</td>
<td>Cohort</td>
<td>Plasma vitamin D (25(OH) D)</td>
<td>Primary</td>
<td>Offspring of women with insufficient 25(OH)D</td>
</tr>
</tbody>
</table>
Supplementation Program on Vitamin D Deficiency, Rickets and Early Childhood Caries in an Alaska Native Population

levels at >20 weeks of pregnancy

concentrations in late pregnancy had higher dmft scores compared to those with sufficient 25(OH)D

Discussion

Vitamin D is widely recognized for its essential role in the formation and strengthening of bones and teeth. It ensures the normal mineralization of both alveolar bones and teeth by regulating the concentration of calcium and phosphorus ions in the bloodstream [14]. Vitamin D deficiency leads to reduced calcium and phosphate levels in these tissues, making them more susceptible to fractures and decay [15]. The initiation of primary tooth development takes place during the prenatal period, commencing around the fourth week of gestation. Mineralization, on the other hand, usually begins during the 12th to 13th weeks of gestation. Maternal vitamin D deficiency during pregnancy can elevate the risk of dental caries in the fetus, as the fetus relies entirely on the mother for the supply of vitamin D [7,16]. Additionally, research has demonstrated that vitamin D supplementation during pregnancy can effectively reduce the risk of dental caries in children [12].

Folate, also known as vitamin B9, plays a pivotal role in bolstering the body's immune system. Deficiency in folate is intricately linked to the initiation and progression of the cariogenic process. Reduced plasma folate levels are associated with elevated concentrations of homocysteine in the bloodstream, which, in turn, leads to an increase in the levels of oxidative stress markers found in saliva. This cascade of events is considered one of the primary factors responsible for both the onset and exacerbation of dental caries [17]. Consequently, maintaining adequate folate levels during pregnancy may hold significant importance in optimizing the caries-preventive effects related to the developing immune system and fetal tissue factors in early life [9].

Maternal diet is very important to ensure the nutritional sufficiency of the developing fetus. An optimal diet is manifested through appropriate weight gain during pregnancy. Insufficient weight gain during gestation has been correlated with an elevated likelihood of preterm birth and reduced birth weight among infants [18]. Furthermore, infants affected by these conditions have been observed to be at an augmented risk of developing enamel defects in their primary dentition [13,19]. Throughout pregnancy, it is imperative for expectant mothers to maintain a well-rounded and nutritionally balanced diet to adequately address both maternal and fetal nutritional requirements. A diverse food intake enhances the likelihood of fulfilling these needs effectively. Furthermore, mothers are encouraged to actively engage in the maintenance of their oral hygiene. The oral and dental well-being of the mother during pregnancy significantly impacts her overall health and that of the developing fetus.

Conclusion

The nutritional status of mothers during pregnancy significantly impacts the development of dental caries in their children, with specific regard to vitamin D, folate, and normal weight gain. It is crucial for mothers to maintain a diet that guarantees the adequate nutrition of the developing fetus.

Conflict of Interests

Authors declare no conflict of interest.

References


