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LITERATURE REVIEW

Micronutrient Intervention In The Preconception Period: Literature Review

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Abstract: Micronutrient intervention in the preconception period is an important strategy in improving maternal and child health as a whole. The pre-pregnancy period is a critical phase that affects the success of the pregnancy process and fetal growth. This study aims to systematically review various scientific findings regarding the impact of preconception micronutrient supplementation on maternal nutritional status, pregnancy outcomes, and child development. The method used is in the form of literature reviews of reputable international articles published between 2021 and 2025. A search was conducted for several articles, and 10 of them were selected based on inclusion criteria such as a focus on preconception interventions, available in full text, and from globally indexed journals. The results of the study showed that micronutrient supplementation such as iron, folic acid, and multivitamins can reduce the risk of premature birth and low birth weight babies, as well as improve children's cognitive abilities. Primary service-based interventions and communication technology are considered to be able to reach women of childbearing age effectively. However, low public awareness of the importance of preconception nutrition is still an obstacle in the implementation of the program. This study recommends the integration of preconception nutrition policies in the national health system in a sustainable manner.

Keywords: Preconception micronutrients, nutritional supplementation, pregnancy outcomes.

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INTRODUCTION

Improving the quality of reproductive health has become one of the global focuses in reducing maternal and infant mortality. Various health policies have been directed to reach women before pregnancy in order to optimize their nutritional status and physical condition. One of the approaches that has begun to be widely applied is the provision of micronutrient interventions during the preconception period.[1,2] This period is considered a critical period that determines a woman's biological readiness to face pregnancy optimally. When micronutrient deficiencies are not treated before pregnancy, the risk of complications such as preeclampsia and preterm labor tends to increase. This approach has been analyzed through various systematic reviews that show significant potential in preventing pregnancy disorders.[3,4]

Nutritional interventions given in the preconception period have shown a positive impact on various indicators of maternal and infant health. Researchers have traced the relationship between micronutrient supplementation and birth outcomes such as birth weight, body length, and gestational age at childbirth.[5,6] In low- and middle-income countries, this effort is becoming increasingly important as many women enter pregnancy with inadequate nutritional status. In addition, the factors of access to health services and dietary imbalances also worsen the condition. Some studies highlight that the success of these programs is highly dependent on cross-sectoral engagement, including education and primary services. A comprehensive review of various interventions showed improved maternal nutritional status and better birth outcomes.[7] Various studies conducted in the South Asian region have shown the effectiveness of preconception micronutrient supplementation in improving pregnancy outcomes.[8] Micronutrient interventions include supplementation of iron, folic acid, zinc, vitamin D, vitamin A, vitamin B-complex, and iodine which have been proven to support tissue oxygenation and DNA formation, fetal nervous system development, and reduce the risk of premature birth and low birth weight babies.[9] Women who received pre-pregnancy interventions generally experienced improvements in their nutritional status that continued until the first trimester.[10] These programs are often run through local communities and basic health care facilities with systematic supervision. However, the implementation of interventions is often faced with challenges such as delays in distribution and lack of public knowledge. Even so, empirical evidence suggests that the strategy is feasible to be widely implemented in developing countries.[11]

The long-term impact of micronutrient supplementation before pregnancy is not only seen on the physical aspects of the mother and baby, but also on the child's cognitive development.[12] Longitudinal

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studies show that children of mothers who receive nutritional interventions from preconception have higher intellectual scores at school age. This mechanism is thought to be related to intensive brain development in the early stages of conception.[2,13] Therefore, strengthening policies that integrate nutrition education and supplementation for adolescent girls is becoming increasingly relevant. A comprehensively designed intervention can reduce nutritional gaps and lower the multigenerational risk of developmental disorders.[13,14,15] One study in Vietnam confirmed the major contribution of preconception nutritional interventions to the quality of children's intellectual function.[5]

METHODS

This study uses a *literature review* approach that examines scientific articles from internationally reputable journals. Source selection is carried out systematically from accredited databases, with priority given to articles published between 2021 and 2025. The articles reviewed are the results of both primary research and systematic reviews that discuss micronutrient interventions during the preconception period. The goal is to summarize scientific evidence that can illustrate the effectiveness and impact of such interventions on maternal and infant health. The search was conducted through global health and nutrition journals using keywords such as micronutrient preconception, maternal outcome, and birth outcome. This approach is expected to provide a complete understanding of the practice of pre-pregnancy micronutrient supplementation based on the latest empirical findings.

The inclusion criteria in the selection of articles are as follows:

1. Articles are published between 2021 and 2025.
2. The article is available in full text.
3. The focus of the article is on micronutrient interventions in the preconception period.
4. Articles come from reputable international journals and are indexed by Scopus or Web of Science.
5. The type of article is in the form of primary research, systematic review, or relevant meta-analysis.

The exclusion criteria from article search include:

1. The article does not contain explicit information about the preconception period.
2. Articles in the form of opinions, editorials, or non-empirical narratives.
3. Articles that only discuss interventions during pregnancy or postpartum without covering the preconception phase.

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4. The article is not available in full-text version.
5. The article is published in an unverified or unreputable journal.

A total of 10 main references published in the last 5 years were selected for analysis in this review. The articles reviewed included the results of a systematic review, randomized controlled trials, and longitudinal studies evaluating the impact of preconception micronutrient interventions on maternal nutritional status and birth outcomes. Some studies have also assessed long-term effects on child development.

The literature selection took into account the diversity of geographical locations, the design of the study, and the type of intervention used. These studies are the main foundation in formulating more targeted and evidence-based conclusions.

The diversity of methodologies and research populations of the reviewed articles enriched insights into the implementation of interventions in various social and economic conditions.

RESULTS

Table 1. Literature Search Results

No	Author	Title	Year
1	Gunabalasingam et al.[1]	Micronutrient supplementation interventions in preconception and pregnant women...	2023
2	Lassi et al.[2]	Effects of Preconception care and periconception interventions on maternal nutritional status...	2021
3	Saville et al.[3]	Effects of preconception nutrition interventions on pregnancy and birth outcomes in South Asia	2025
4	Partap et al.[4]	Preconception and periconception interventions to prevent low birth weight...	2022
5	Nguyen et al.[5]	Preconception micronutrient supplementation positively affects child intellectual functioning...	2021
6	Das et al.[6]	Effect of preconception multiple micronutrients vs. iron–folic acid supplementation...	2024
7	Soepnel et al.[9]	Evaluation of a text messaging intervention to promote preconception micronutrient supplement use	2022
8	Haridas et al.[10]	Micronutrient interventions among vulnerable population over a decade: A systematic review...	2022
9	Taneja et al.[12]	Impact of a package of health, nutrition, psychosocial support, and WaSH interventions...	2022
10	Stocker et al.[15]	Nutrition for preconception health and fertility	2025

DISCUSSION

After analysing the selected literature, a number of interesting findings related to micronutrient interventions in the preconception period were found:

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Preconception interventions have been shown to significantly improve maternal nutritional status: Some studies show that giving micronutrient supplements before pregnancy has an impact on increasing hemoglobin, iron, and folic acid levels in the body. This condition helps women prepare their bodies optimally before conception occurs. This intervention is particularly useful in areas with a high prevalence of anemia in women of childbearing age. This improvement in early nutritional status is an important foundation in supporting a healthy pregnancy and preventing nutritional complications.[1,2,6]

Supplementation before pregnancy plays a role in lowering the risk of babies being born with low body weight: Research from developing countries indicates that the administration of micronutrients in the preconception phase can reduce the risk of *low birth weight* and *small for gestational age*. This effect is considered more optimal when compared to interventions that are only given when pregnancy has taken place. The timing factor of supplementation is the key to success in influencing birth outcomes. These results confirm the importance of attention to women's nutrition even before pregnancy begins.[1,3,4]

Preconception interventions also have a positive impact on children's cognitive development: Longitudinal studies have found that children of mothers who get micronutrients from before pregnancy show better cognitive abilities at school age. Brain development that occurs in the early stages of pregnancy is greatly influenced by the availability of adequate nutrition. Therefore, preconception nutritional status is one of the determining factors for optimal child growth and development. This nutritional intervention also has long-term value that goes beyond the pregnancy itself.[5,12,15]

Intervention strategies involving technology and primary services are more effective in reaching women of childbearing age: One study evaluated the use of text messages as a medium of counseling and reminders to take supplements in women before pregnancy. This technology is considered to be able to increase compliance with regular supplement consumption. In addition, the involvement of primary services such as health centers strengthens the distribution and supervision of programs. The combination of technology approaches and community-based services has been proven to increase the effectiveness of preconception programs.[1,9,10]

The main challenge in the implementation of preconception interventions is the low public awareness of the importance of the pre-pregnancy period: Most women only get nutritional information and interventions after pregnancy occurs. The lack of education and health promotion programs

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regarding the importance of the preconception phase weakens the achievement of interventions. In addition, limited data and funding in several countries are also technical obstacles. Therefore, it is necessary to strengthen policies and integrate preconception programs into the national health system in a sustainable manner.[2,9,10]

CONCLUSION

Based on the results of a review of ten selected scientific articles, micronutrient interventions in the preconception period make a real contribution to improving maternal nutritional status and better pregnancy outcomes. Supplementation of micronutrients such as iron, folic acid, zinc, vitamin D, vitamin A, vitamin B-complex, vitamin E and iodine before pregnancy has been shown to support tissue oxygenation and DNA formation, support the development of the fetal nervous system, and reduce the risk of low birth weight and premature babies. In addition, the mother's better nutritional status before pregnancy also supports the cognitive development of children at school age. Intervention strategies that combine primary services and communication technologies also significantly increase program effectiveness. However, public awareness and access to preconception information are still major challenges that must be overcome. Therefore, the integration of education and empowerment programs for women of childbearing age needs to be strengthened in the health system. Further research is needed to expand the scope of these interventions in different regions with diverse socioeconomic conditions.

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