

Systematic Review

The Role of Micronutrients (Vitamin D, Vitamin E, Zinc, Magnesium) in Managing Primary Dysmenorrhea: Evidence and Gaps

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Abstract

Background: Primary dysmenorrhea impacts 95% of reproductive-age women. While NSAIDs are the primary pharmacological treatment as of yet, their negative impacts have spiked interest in alternative approaches. Micronutrients, including Vitamin D, Vitamin E, Zinc, and Magnesium, have been presented as better treatment options.

Objective: This review presents evidence on the role of micronutrients in the treatment of primary dysmenorrhea, critically analyses all available evidence, and sheds light on gaps present in already performed research.

Methods: A structured literature search was conducted across PubMed/MEDLINE and Google Scholar using the following terms: "primary dysmenorrhea," "dysmenorrhea AND micronutrients," "dysmenorrhea AND Vitamin D/E/Zinc/Magnesium," and "menstrual pain AND supplementation." Eligible studies included randomized controlled trials (RCTs), systematic reviews, and meta-analyses were considered while case reports and non-peer-reviewed sources were not included.

Results: All four micronutrients showed noticeable benefits in reducing menstrual pain intensity. Zinc supplementation (≥ 30 mg/day for ≥ 8 weeks) yielded the most consistent analgesic effects. Single high-dose Vitamin D reduced pain and NSAID dependence. Vitamin E has some anti-inflammatory benefits, whereas Magnesium aids uterine relaxation and decreases prostaglandin F_{2α} levels. The overall evidence, however, is limited by small sample sizes, varying dosing, and short durations.

Conclusion: Micronutrient supplementation displays a low-risk, cost-effective alternative to conventional management. Larger, well-managed trials are, however, needed to establish optimal long-term outcomes.

Introduction

Primary dysmenorrhea is a really common problem for many women, affecting around 95% of younger women. It's characterized by annoying lower abdominal pain or cramping that pops up during their periods. A key player in all this pain seems to be the overproduction of prostaglandin F_{2α}, which causes stronger contractions in the uterus, cuts blood flow, and leads to that discomfort. Still, we don't completely understand how everything works yet. Right now, the usual

go-to treatment is NSAIDs, but they often only give some relief and can also bring along side effects like gastrointestinal, kidney, and heart problems.

Micronutrients are, though they are only needed in minute amounts, crucial to a great many bodily functions-including, among others, antioxidant protection, cellular signaling and hormonal balance. Vitamin D not only regulates calcium and muscle function but also keeps COX-2 within limits, thereby decreasing the production of prostaglandins. Then there's

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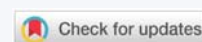
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vitamin E; it's a powerful antioxidant that protects endometrial cells from oxidative stress and hampers phospholipase A2, helping to cut down on prostaglandin production by limiting the release of arachidonic acid. Zinc has its own benefits too—it plays a part in ovulation and supports the immune system, both of which are key to reproductive health; it even helps improve blood flow to the uterus and lessen ischemia. Magnesium, on the other hand, works against calcium and targets the processes that cause menstrual pain by boosting blood flow to the uterus, lowering the levels of prostaglandin F2 α , and relaxing smooth muscle. Unfortunately, a lot of young women don't get enough essential nutrients, often because of poor eating habits and sunlight intake, which can make menstrual problems even tougher to handle [1].

Methodology

Databases consulted: A comprehensive electronic search was conducted across two databases: PubMed/MEDLINE and Google Scholar from 2018 to December 2024.

Search terms used: Using Boolean operators (AND, OR), the following terms were employed: "primary dysmenorrhea," "dysmenorrhea," "menstrual pain," "Vitamin D supplementation," "Vitamin E supplementation," "Zinc supplementation," "Magnesium supplementation," AND "micronutrients AND dysmenorrhea."

Eligibility criteria: Studies were included on the basis that they: (i) considered women of reproductive age with diagnosed primary dysmenorrhea; (ii) investigated supplementation with at least one of the four target micronutrients (Vitamin D, Vitamin E, Zinc, or Magnesium); (iii) reported measurable pain outcomes. Studies were not considered if they were case reports, editorials, or abstracts.

Study selection process: Titles and abstracts of selected papers were independently reviewed by two authors. Followed by screening of the full texts of all selected eligible articles and final inclusion decisions. Five studies that met the eligibility criteria were included in the final work. Reference lists of included studies were added.

Results and discussion

The next section displays the integration of our findings from all eligible studies, along with a critical appraisal of evidence quality.

1. Zinc

Results from clinical trials and meta-analyses have been encouraging. A systematic review found that supplementing with micronutrients significantly reduces the severity of pain in primary dysmenorrhea. The best results are always obtained from supplementing with zinc, especially if taken for at least eight weeks [2]. Zinc has proven to increase uterine blood flow, support immune regulation, along with reducing ischemia-related pain.

2. Vitamin D

A randomized clinical trial reported significant reductions in pain severity by VAS score and a significant reduction in NSAID consumption in women with primary dysmenorrhea after a single high-dose (300,000 IU) Vitamin D administration [3]. The proposed mechanism is the inhibitory effect of Vitamin D on the expression of cyclooxygenase-2 (COX-2), which reduces prostaglandin synthesis and uterine contractility.

3. Vitamin E

Vitamin E supplementation has demonstrated a moderate benefit in reducing pain, inflammation, and menstrual blood loss. Matsas, et al. (2023) conducted a systematic review on the analgesic and anti-inflammatory effects of Vitamin E supplementation in primary dysmenorrhea [4]. Results showed moderate decreases in pain intensity, inflammation markers, and menstrual blood loss. Vitamin E inhibits phospholipase A2, which decreases the release of arachidonic acid.

4. Magnesium

In a randomised controlled trial by Yaralizadeh, et al. (2024), Magnesium supplementation (250–500 mg/day) was administered for 2–3 months [5]. Results indicated significant improvements in uterine muscles' relaxation, serum prostaglandin F2 α levels, and total symptom severity. Magnesium antagonises calcium-dependent contraction of smooth muscle, providing a biologically coherent mechanism for the observations.

Overall evidence appraisal

The aforementioned factors were compromised by non-synchronized doses and short-duration experiments with small samples, hence making their evidence weak. More credible results can be obtained if we standardize the procedures and match the nutrient baseline assessment to them.

A comparative summary of the evidence is provided in Table 1 below.

Conclusion

From the clinical and public health perspectives, the cost-effective approach of adding micronutrient supplementation in tandem with any pharmaceutical intervention seems reasonable since it bears a low risk. Nutrition analysis and micronutrient screening, integrated into routine gynecological clinics, may aid in targeting interventions and detecting early deficiencies, while health education among young women and adolescents may instill dietary habits that favor improved menstrual health.

In conclusion, however, the available evidence is limited by methodological variation, smaller sample sizes, and



Table 1: Comparative Summary of Micronutrient Supplementation in Primary Dysmenorrhea

Micronutrient	Dosage Used in Trials	Duration	Reported Outcomes	Study Limitations	Strength of Evidence
Vitamin D	300,000 IU (single dose) or 50,000 IU/week	1–3 months	Reduced pain severity; decreased NSAID use	Small samples; single-dose designs; short follow-up	RCT 2024
Vitamin E	200–500 mg/day	2–3 months	Reduced pain, inflammation, and menstrual blood loss	Heterogeneous doses; small samples	systematic review; 2023
Zinc	30–50 mg/day	≥8 weeks	Greatest pain reduction; improved uterine blood flow	Varied dosing protocols; limited long-term data	meta-analysis; 2024
Magnesium	250–500 mg/day	2–3 months	Reduced prostaglandin F2α; uterine muscle relaxation; symptom improvement	Short-duration trials; small sample sizes	RCT 2024

Links for strength of evidence:
Vitamin D → Lin, et al., *Nutrients* 2024 (doi:10.3390/nu16071089) + PubMed PMC link
Vitamin E → Matsas, et al., *Life* 2023 (doi:10.3390/life13061308) + PubMed PMC link
Zinc → Hsu, et al., *Nutrients* 2024 (doi:10.3390/nu16234116) + PubMed PMC link
Magnesium → Yaralizadeh, et al., *IJWHRS* 2024 (Vol.12, No.2) + Semantic Scholar record link

the lack of standardized protocols; any conclusions must therefore be interpreted cautiously. Any future investigation must prioritize larger-scale and standardized, multi-center RCTs that have sufficient follow-up durations to ensure long-term efficacy and sediment evidence-based supplementation guidelines.

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