

## The Impact of Minerals on Female Fertility: A Systematic Review

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**ADMINISTRATIVE INFORMATION****Support** - None.**Review Stage at time of this submission** - Data extraction.**Conflicts of interest** - None declared.**INPLASY registration number:** INPLASY202420097**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 23 February 2024 and was last updated on 23 February 2024.**INTRODUCTION**

**Review question / Objective** The main goal of this review is to gather and analyse existing research on the influence of specific minerals on female fertility. The motivation for this study arises from the lack of systematic reviews that connect the role of minerals with the female fertility issues.

**Background** Infertility, defined as the inability to conceive after a year or more of regular unprotected intercourse, affects approximately 10-15% of couples worldwide 1,2. The causes of infertility are diverse and often multifactorial, including ovulatory dysfunction, tubal or pelvic pathology, sperm abnormalities, as well as unexplained factors 1,2. Lifestyle factors such as weight, stress, smoking, and alcohol consumption can also significantly influence conception 3,4. This modern lifestyle, characterized by altered dietary habits, exposure to environmental pollutants, and increased stress, profoundly impacts an individual's mineral status 5,6. The

exposure to heavy metals like lead and cadmium can antagonize mineral absorption and function, potentially worsening fertility challenges 7. While the influence of minerals on male fertility has been intensively investigated 8–11, their role in women's reproductive health has been marginally addressed, often only in the context of specific reproductive pathologies 12, emphasizing vitamins and multivitamin supplementation. Notably, these studies frequently lack in-depth investigation of the role of minerals and the underlying mechanisms 13. This review aims to address these gaps. We focus on minerals and their distinct roles in miscarriage, hormonal regulation, ovulation, oxidative stress, and oocyte quality. It provides a comprehensive overview of the role of minerals in female fertility and gives insights into potential therapeutic approaches for fertility challenges by offering evidence-based recommendations for mineral intake in reproductive-age women.

**Rationale** The proposed review is essential to consolidate current knowledge on the impact of minerals on female fertility, specifically addressing

the notable gap in literature where, to our knowledge, no review has systematically analyzed the effects of minerals on female reproductive health. It will update the field by synthesizing the latest studies, including those as recent as 2023, to provide a comprehensive understanding of how different minerals influence reproductive health. Additionally, it will explore emerging trends, such as the role of specific minerals and their bioavailability, and the interaction with environmental factors, thus offering new insights beyond existing publications.

## METHODS

**Strategy of data synthesis** To compile a comprehensive list of relevant literature, we conducted searches across multiple electronic databases including MEDLINE (Ovid), EMBASE (Ovid) and CAB Direct. Our search strategy incorporated a combination of keywords and phrases such as "minerals," "female fertility," "infertility", "reproduction", "recurrent pregnancy loss (RPL)", "spontaneous abortion", "minerals", "trace elements" and specific Minerals, such as "iron", "selenium", "zinc", "calcium", "magnesium", "lead" and "copper". Boolean operators (AND, OR) were utilized to refine the search parameters. The literature search was confined to articles published from January 2005 to November 2023.

**Eligibility criteria** Our inclusion criteria were focused on studies that specifically investigated the role of minerals in female fertility, were conducted on human subjects, and published in peer-reviewed journals in English. We excluded studies that did not directly relate to the impact of minerals, were animal studies or in vitro studies, and those that were reviews, editorials, or commentaries without primary data.

**Source of evidence screening and selection** To ensure the inclusion of high-quality studies, we employed a rigorous quality assessment using PRISMA. This assessment covered various dimensions including study design, methodology, sample size, statistical robustness, and direct relevance to the research question. Studies that did not meet our predetermined quality threshold were excluded from the review. Through this structured and systematic methodology, we aimed to provide a thorough and unbiased analysis of the current literature on the impact of minerals on female fertility and reproductive health disorders.

**Data management** In this systematic review, we aimed to explore the impact of minerals on female

fertility. We focused on randomized controlled trials (RCTs), prospective cohort studies, case control studies, Nested Case-control and observational studies examining mineral supplementation and nutrition in women planning pregnancy or undergoing assisted reproduction technologies (ART).

### Reporting results / Analysis of the evidence

Among the 39 studies included in this review, a multifaceted approach was taken to evaluate the connection between mineral intake and female fertility outcomes. The studies are categorized as follows: embryo development (n=3), oocyte quality (n=7), oxidative stress (n=2), miscarriage (n=16), hormonal regulation (n=1), IVF outcomes (n=4), environmental exposure (n=1), and minerals as biomarkers (n=5). Our investigation is the first to offer a thorough overview of the complex functions of individual minerals in female fertility. By doing so, it seeks to enhance the understanding of their importance in reproductive health. Each mineral's contribution is analysed, considering their biological implications on female reproduction. The review methodically dissects the impact of minerals such as Zinc, Magnesium, Calcium, and Iron. Clinicians and healthcare providers can utilize the findings for potential therapeutic approaches and to guide appropriate mineral intake for female reproductive health.

**Language restriction** English.

**Country(ies) involved** Austria.

**Keywords** Fertility, Mineral intake, Reproductive Health, Hormonal regulation.

### Contributions of each author

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