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Review

Effect of magnesium supplementation on insulin resistance in humans: A systematic review

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ABSTRACT

Objectives: Recent studies have demonstrated that minerals play a role in glucose metabolism disorders in humans. Magnesium, in particular, is an extensively studied mineral that has been shown to function in the management of hyperglycemia, hyperinsulinemia, and insulin resistance (IR) action. The aim of this study was to investigate the effect of magnesium supplementation on IR in humans via systematic review of the available clinical trials.

Methods: This review was conducted in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) recommendations. A survey was conducted to select clinical trials related to the effects of this mineral in insulin sensitivity using the following databases: PubMed, SciVerse Scopus, ScienceDirect, and SciVerse Cochrane.

Results: After the selection process, 12 articles were identified as eligible, representing different clinical conditions and being free of restriction with regard to sex, age, ethnicity, and differential dosing/shape of magnesium. The results of eight clinical trials showed that supplementation with magnesium influences serum fasting glucose concentrations, and five trials determined an effect on fasting insulin levels. The results of seven studies demonstrated that mineral supplementation reduced homeostasis model assessment for IR values.

Conclusions: The data of this systematic review provide evidence as to the benefits of magnesium supplementation in reducing IR in patients with hypomagnesemia presenting IR. However, new intervention studies are needed to elucidate the role of the nutrient in protection against this metabolic disorder, as well as the standardization of the type, dose, and time of magnesium supplementation.

Introduction

Insulin resistance (IR) is a metabolic disorder characterized by impairment of insulin-mediated glucose transport to peripheral cells, which leads to increased concentrations of this hormone in the circulatory system as a compensatory mechanism. IR is associated with the development of various diseases, such as cardiovascular disease, metabolic syndrome, obesity, cancer, and type 2 diabetes mellitus (T2DM) [1–4].

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Recent studies have demonstrated the participation of minerals in glucose metabolism disorders in humans. Magnesium participates directly in this process by acting as a cofactor for many enzymes involved in energy metabolism, and modulating the insulin secretion and action in target tissues through interaction with receptors of this hormone. Mineral deficiency, in particular, appears to be associated with hyperglycemia, hyperinsulinemia, and IR action [1,4,5].

Reduction in magnesium food intake is associated with the increase in consumption of processed foods containing reduced amounts of the mineral. Consuming processed foods instead of whole grains causes deficiency of this nutrient [6–8].

Scientific evidence concerning the effects of magnesium supplementation on IR is still scarce and controversial. Recent research has shown that magnesium supplementation possibly helps to control IR and improve glucose metabolism [9,10], whereas other related studies were inconclusive [3,11].

Therefore, the aim of this study was to describe, in a systematic review, the outcomes of clinical trials on magnesium supplementation and IR.

Methods

Data sources and study selection

The search for articles was conducted in PubMed, Scopus, ScienceDirect, and Cochrane, by two authors (JBSM and JSS) independently. Research conducted by these authors was compared and verified in equivalence of search and selection of items.

The PICO strategy (patient, intervention, comparison, and outcomes) was used for the guiding question of this review setting. The following descriptors were used in the search for articles: "magnesium and (insulin resistance or insulin sensitivity) and clinical trial," "magnesium and supplementation and (insulin resistance or insulin sensitivity)," and "magnesium" and "supplementation" and clinical trial."

Included in this systematic review were randomized placebo-controlled clinical trials published in English, with no publication year limit; these trials evaluated the effect of magnesium supplementation on IR in humans, with different clinical conditions without restriction of sex, age, or ethnicity. The following were excluded form this review: case studies, cross-sectional studies, case–control studies, review articles, and animal research studies. The study selection details are presented in Figure 1.

Relevant information was collected from the articles in this review, including author names, year of publication, survey location, sample size, sex and age of the study population, dose and duration of supplementation, control or placebo group, and parameters of IR evaluation methods.

Assessment of risk of bias

The recommendations of PRISMA were followed to conduct this review. The Cochrane collaboration's tool was used to assess the risk for bias of the trials included in this study.

Results

Selected articles

We identified 1720 articles by searching the following databases: PubMed (n = 562), SciVerse Scopus (n = 690), SciVerse

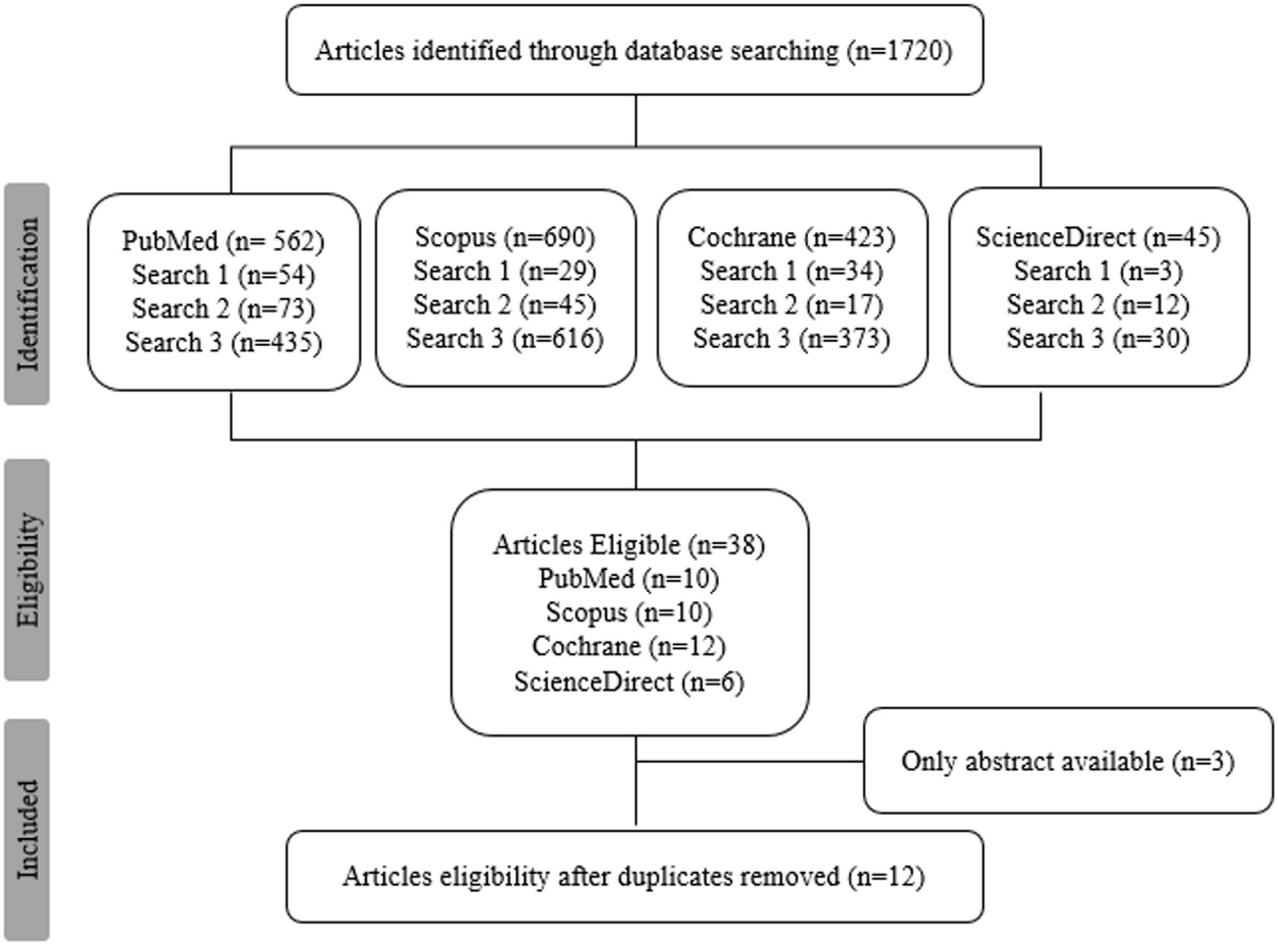

Fig. 1. Flow diagram of the study selection. Search 1: "magnesium and (insulin resistance or insulin sensitivity) and clinical trial"; search 2: "magnesium and supplementation and (insulin resistance or insulin sensitivity)"; search 3: "magnesium" and "supplementation" and clinical trial."