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Prevalence of vitamin D deficiency in Iranian children with acute respiratory infections: A systematic review and meta-analysis

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Abstract

Introduction: Vitamin D has an effective role in autoimmune and cardiovascular diseases as well as allergic and respiratory disorders. The aim of this study was to evaluate the prevalence of vitamin D deficiency in Iranian children with acute respiratory infections

Methods: The present systematic study has applied developed methods that are in line with accurate instruction of PRISMA checklist. Two researchers have separately investigated all studies conducted up to May 2019; the studies had been collected from international databases (PubMed, Google Scholar, and WOS) and national ones (SID and Magiran) without any time limitation in both English and Persian. The keywords applied in the research strategy include: Vitamin D , Acute Respiratory Infections , children, and Iran that were combined with Boolean operators such as AND, OR, and NOT

Results: As many as three studies conducted on 212 children were included in the meta-analysis. In asymptomatic children, according to the results of random effects mode, the Prevalence of Vitamin D Deficiency in Iranian Children with Acute Respiratory Infections was 17.4% in 212 children (95% CI: 12.5, 22.3; $I^2=88\%$).

Conclusion: Vitamin D deficiency can partially increase the likelihood of respiratory infections, and it is recommended to expose the children to the sunlight and to use vitamin D supplements to some extent prevent these infections.

Keywords: Vitamin D , Acute Respiratory Infections , children

Introduction

Vitamin D has a crucial role in calcium and phosphorous hemostasis as well as ossification (1). The shortage of vitamin D results in the incidence of Rickets in children and osteomalacia in adults (2). Moreover, this vitamin has an effective role in autoimmune and cardiovascular diseases as well as allergic and respiratory disorders (3). Even if Rickets is not regarded a prevalent disease, the shortage of vitamin D is globally increasing and it can be observed in the absence of nutritional Rickets (4).

Vitamin D has the regulatory feature for the immune system (5). By affecting the immune system, this vitamin can control the inflammatory cytokines and stimulate the production of antimicrobial peptides (6). In a course of a bacterial infectious disease, macrophages can change VitD OH, 25 existing in the blood flow into VitD OH 1, 25 (7). This substance produces the gene encoding antibacterial peptide (8). This peptide has an essential role in body's defense system against respiratory pathogens. Thus, not only is the immune response is reinforced but also bacterial cleansing is conducted from defensive barriers and immune cells (9).

Over the past few years, the evidence released has indicated that vitamin D has an effective role in infection prevention and control of the respiratory system (10).

Since respiratory diseases are known to be one of the most prevalent causes of death in developing countries, it is essential to investigate the effects of this vitamin in the prevention and control of respiratory diseases (11).

Materials and Methods

The present systematic study has applied developed methods that are in line with accurate instruction of PRISMA checklist. However, only observational studies including letters to the editors, journals, poor quality articles (based on HOY tool), and studies conducted on adult participants were removed from the study. It was attempted to include studies only in English and Persian. All observational studies with any sampling and statistical designs have been included in the present systematic study. Two researchers have separately investigated all studies conducted up to November 2018; the studies had been collected from international databases (PubMed, Google Scholar, and WOS) and national ones (SID and Magiran) without any time limitation in both English and Persian. The reference list of the existing studies has been also investigated to find more studies in this regard. Special research strategies have been adopted by a health science librarian (an expert on systematic studies) through applying MESH browsing vocabulary as well as free vocabulary based on PRESS standard (16). Moreover, MEDLINE research

strategy has been applied for searching other databases as well. The keywords applied in the research strategy include: Vitamin D , Acute Respiratory Infections , children, and Iran that were combined with Boolean operators such as AND, OR, and NOT. Two researchers have separately investigated the titles and abstracts by considering the qualification criteria. After excluding the repetitive studies, the full texts of the studies were investigated based on the qualification criteria and the required information was extracted. For solving the questions on qualifications, extra information was obtained from the authors whenever needed. Moreover, the required data on conditions, sample size, risk of bias, and the measurement of result were collected as well. The final extracted data were evaluated by using STAT 14.0.

Results

Study selection: In total, as many as 148 studies were selected from the initial research on PubMed, Google Scholar, SID, Magiran, and Web of Science from the beginning to may 1 of 2019. From 140 non-repetitive studies (in terms of title and abstract), as many as 128 studies were excluded in the screening process; their titles were unrelated. From the remaining 12 studies, 3 studies were qualified for having the required criteria. From 9 excluded studies, 1 studies were reviewed, 1 studies were sent to the editor in chief (letter to editor), 3 studies didn't have the full texts, and 4 studies didn't meet the minimum quality and standards required to be included in this study (Figure 1).

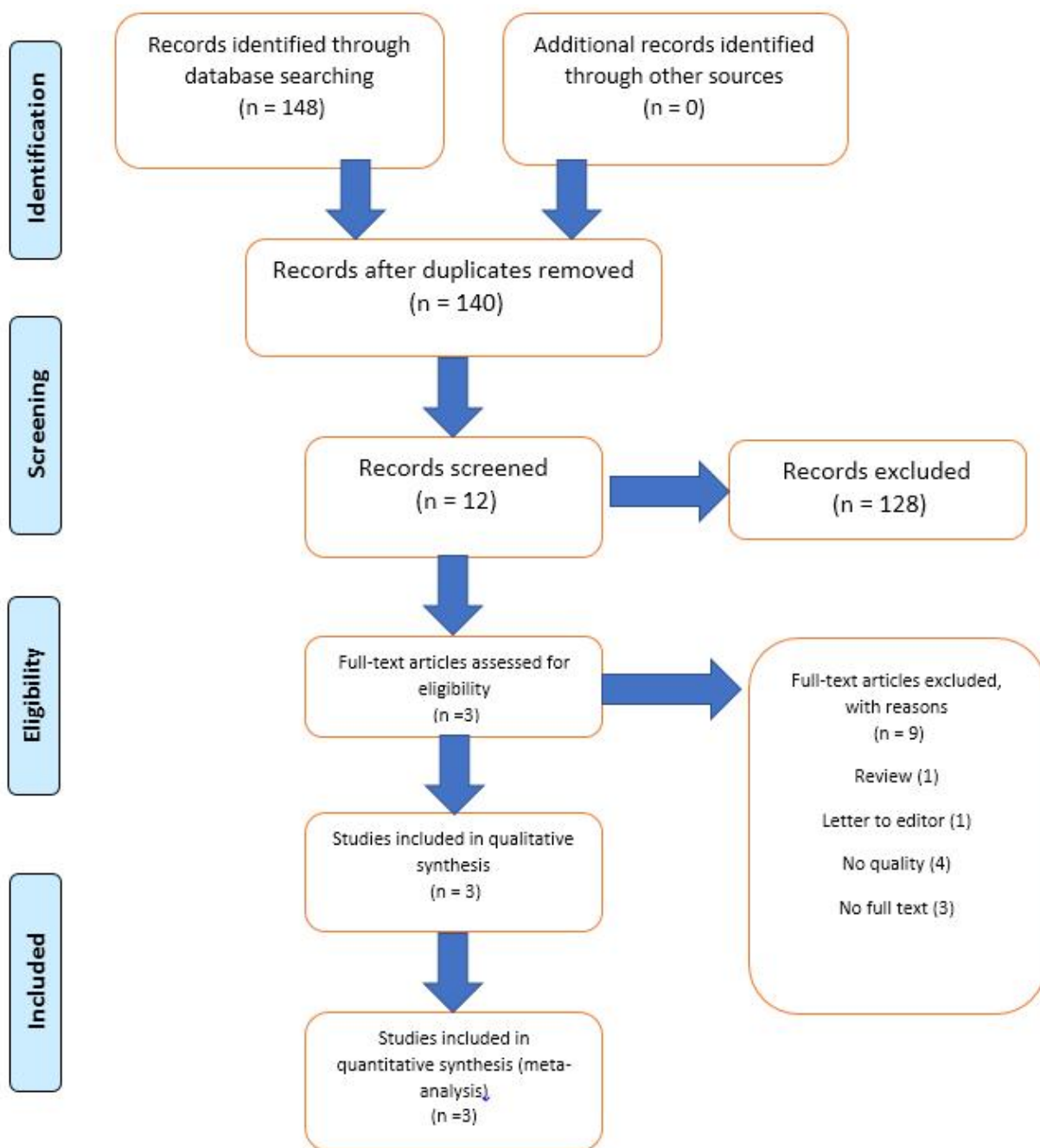


Fig 1. PRISMA flow diagram

Research characteristics:

These 3 studies had been conducted on 212 Iranian children aged <14 years. From these 3 studies, 1 study have provided cross-sectional data, and two studies were a prospective research. Moreover, each of Zanjan

, Tehran and shiraz provinces accounted for one study. The most common sampling method applied was convenience sampling method (n=3). More than 50% of the studies had low risk of bias. Hospital was the most prevalent place for conducting the studies (n=3).

Prevalence of Vitamin D Deficiency in Iranian Children with Acute Respiratory Infections :

As many as three studies conducted on 212 children were included in the meta-analysis. In asymptomatic

children, according to the results of random effects mode, the Prevalence of Vitamin D Deficiency in Iranian Children with Acute Respiratory Infections was 17.4% in 212 children (95% CI: 12.5, 22.3; $I^2=88%$) [Table1].

Table 1: Characteristics of final included studies

Author	year	City	N	ES	95% conf. Interval		Weight
					Low	Up	
Karamifar	2002	Shiraz	80	0.125	0.053	0.197	45.94
Hoseininejad	2015	Tehran	50	0.440	0.303	0.577	12.73
Kazemi	2013	Zanjan	82	0.146	0.070	0.222	41.33
Pooled ES	----	-----	212	0.174	0.125	0.223	100

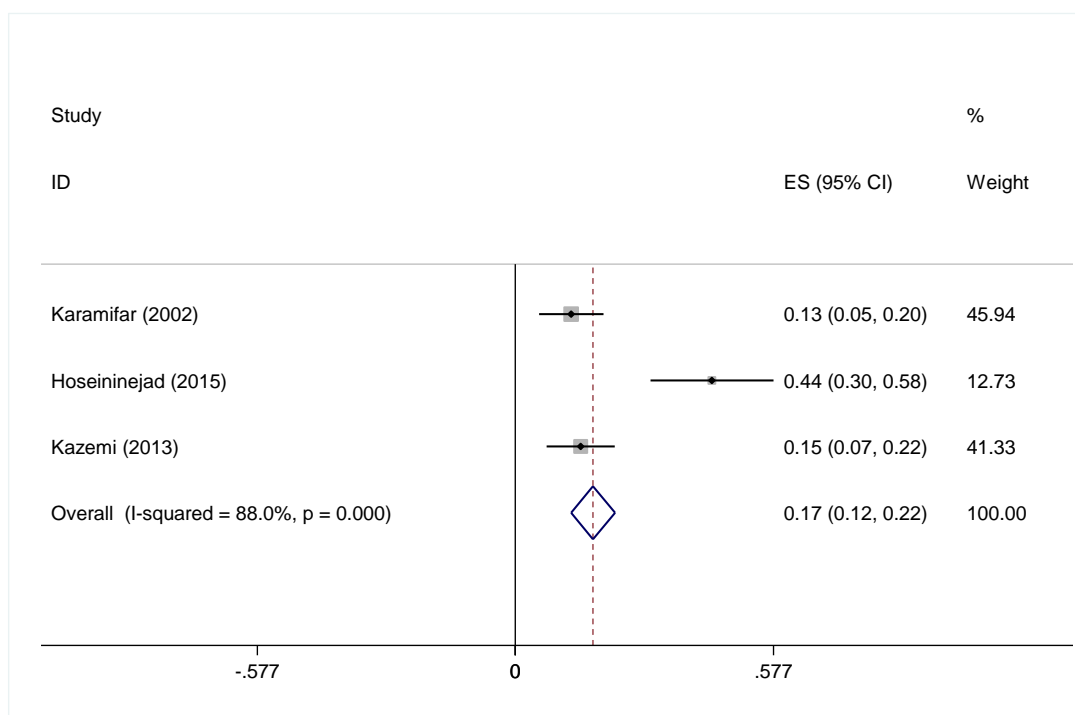


Fig 2.Prevalence of Vitamin D Deficiency in Iranian Children with Acute Respiratory Infections and its 95% interval for the studied cases according to the year and the city where the study was conducted based on the model of the random effects model. The midpoint of each section of the line estimates the% value and the length of the lines showing the 95% confidence interval in each study. The oval sign shows Prevalence of Vitamin D Deficiency in Iranian Children with Acute Respiratory Infections

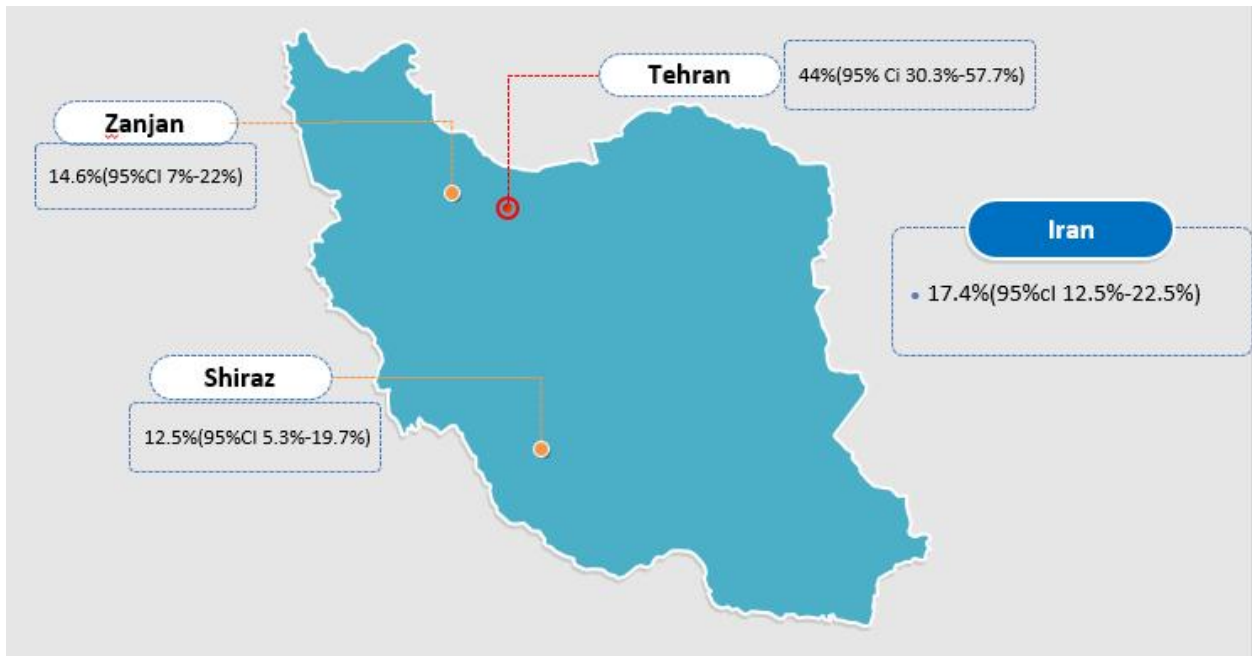


Fig 3 . Prevalence of Vitamin D Deficiency in Iranian Children with Acute Respiratory Infections (according to the frequency in children in each province)

Discussion

As many as three studies conducted on 212 children were included in the meta-analysis. In asymptomatic children, according to the results of random effects mode, the Prevalence of Vitamin D Deficiency in Iranian Children with Acute Respiratory Infections was 17.4% in 212 children (95% CI: 12.5, 22.3; $I^2=88\%$). The studies have indicated that proper nutrition can be regarded an effective defensive factor against acute respiratory infections, and using micronutrients is associated with the reduced incidence rate of respiratory infections (12). Vitamin D is supplied from two main sources i.e. sunlight and foodstuffs. An ultraviolet ray produces vitamin D precursors in skin and its completion process is conducted in liver (25-hydroxyvitamin D) and it is converted to an active form (1,25-dihydroxyvitamin D) in kidney (13). In addition to maintaining a proper level of calcium, vitamin D can also function as a hormone: it has a protective function for diseases including bone diseases, cardiovascular diseases, diabetes, and cancer (14).

The shortage of vitamin D in pregnant mothers, its shortage during breastfeeding, shortage of exposure to sunlight, malnutrition, and reduced serum level of vitamin D3 (resulted from long-term use of antiepileptic drugs) bring about vitamin D deficiency

in the public; the complications of vitamin D deficiency are observed in childhood and adulthood (15). There is not enough vitamin D in breast milk. Thus, vitamin D deficiency is more common in infants merely taking the breast milk (16). If the mother has a vitamin D deficiency herself, the problem will be more severe(17). For this purpose, mothers are recommended to provide their infants with formula, enriched milk, nutritional supplement containing vitamin D including vitamin AD and vitamin D drops, and multivitamins, so that the shortage of vitamin D will be compensated (18). Increased incidence rate of bronchiolitis cases and pneumonia in winter months is resulted from vitamin D deficiency and reduced defensive power of the body (19). Vitamin D deficiency has been reported to be prevalent in different countries including Iran; the protective effect of vitamin D for the prevention of different diseases has been confirmed in numerous studies.

Conclusion

Vitamin D deficiency can partially increase the likelihood of respiratory infections, and it is recommended to expose the children to the sunlight and to use vitamin D supplements to some extent prevent these infections

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