



## Prevalence of stunting in Iranian children under five years of age: Systematic review and meta-analysis

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### Abstract

**Background:** Children in all countries, especially in developing countries, constitute a vulnerable group. Therefore, attention to their health issues is very important. The aim of this study was to determine the prevalence of stunting in Iranian children under-five years.

**Methods:** All original studies were searched by complex search syntax from international databases including Medline (PubMed), Web of sciences, Google scholar, Scopus, CINHALL and the Iranian databases consist of SID (Scientific Information Database, [www.sid.ir](http://www.sid.ir)), Irandoc (Iranian Research Institute for Information Science and Technology, [Irandoc.ac.ir](http://Irandoc.ac.ir)), Iranmedex ([www.iranmedex.com](http://www.iranmedex.com)), and Magiran ([www.magiran.com](http://www.magiran.com)) from January 1989 to August 2017. Two independent reviewers identified relevant studies in several steps. We employed a random effect model to generate a pooled prevalence. The reported prevalence is presented as percent and 95% confidence interval (CI). Sources of heterogeneity among the studies were determined using subgroup analysis and meta-regression.

**Results:** Finally, 16 studies from different settings remained for meta-analysis in order to have a pooled prevalence estimate, which prevalence of total stunting was 12% (95%CI: 10–14). Subgroup analysis for gender showed that the prevalence of stunting in both boys and girls children were equal to 10% (95%CI: 8–11) and 9% (CI 95% 8–10), respectively. Also pooled prevalence of stunting in southern provinces are higher than other provinces.

**Conclusion:** The prevalence of stunting in some regions of Iran is higher than others. Although, in recent years much effort has been made to address deprivation such as economical, nutritional and social supporting, improvement of the quality of life, there are still nutritional problems in these areas of Iran.

**Keywords:** Prevalence, Stunting, Children under 5 years, Iran

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### Introduction

Children in all countries, especially in developing countries, constitute a vulnerable group. Therefore, attention to their health issues is very important. Protein

Energy Malnutrition (PEM) is a common nutritional problem in children under the age of 5 years (1, 2). The PEM in the first years of life leads to growth retardation,

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#### ↑What is “already known” in this topic:

Children’s health is one of the priorities in most societies. Nevertheless, the highest prevalence rate of stunting occurs among under five-year-old children worldwide. In Iran the prevalence of stunting in studies are different. Therefore, the estimate of the pooled prevalence of stunting is important.

#### →What this article adds:

The prevalence of total stunting was 12%. This study showed that the prevalence of stunting in Iran’s under five-year-old children is high. There are still no overviews addressing this important issue in Iran. Therefore, this result could be of great help to the health sector policymakers to baby’s development in embryonic time, growth monitoring and baby nutrition plans.

stunting, and reduction of the mental development of children with repeated infections, resistance to treatment and reduced physical activity (3, 4). The malnutrition is a major cause of reduction of lifetime and pathogens in children, and malnourished children are at higher risk of illness and death than healthy children (5-7). Generally, about 60% of more than 7 million deaths in under-five children are attributed to malnutrition (8). The malnutrition can have irreversible consequences in the first years of life. In the world, about 25% of children under the age of 5 suffer from stunting, and it is estimated that 80% of these children live in developing countries. This is a tragedy for 165 million children under the age of 5 who are suffering from stunting (8). Of every 5 children in developing countries, a child has malnutrition and malnutrition is associated with half of all deaths of children in the world (5, 9).

The global estimates of malnutrition indicate that 35.8% of pre-school children are underweight, 42.7% of them are stunting, and also 9.2 % are wasting in the developing countries (10). Usually, the WHO standards and NCHS (National Center for Health Statistics) are used to assess child growth and also malnutrition. Initially, WHO (World Health Organization) standards based on Multicenter studies were collected and designed in Brazil, Canada, India, Norway, Oman and America between 1997 and 2003, and in 2006, WHO provided new standards for assessment of child development. The WHO standard includes weight for age, height for age and weight for height and BMI for age for girls and boys 0 to 60 months old (11).

The studies have shown that the prevalence of stunting in children under-five is 26% in the world, but this figure was 26.8% in Asia (12). The different studies have been conducted on the prevalence of malnutrition in Iran, but

most of these studies are at the provincial level, and studies at the national level are limited. However, the estimated prevalence of these studies are different. For example, the study by Houshiar Rad et al. showed that the prevalence of stunting, underweight and wasting in Iranian children under-five years are 13.1, 7.6, and 4.5%, respectively (13). Another study in Fars Province (Iran) showed that the rates of stunting, underweight, and wasting are 9.53%, 9.66%, and 8.19%, respectively (14). Study of Esfarjani F et al. showed that the prevalence of stunting is 3.7% among children in Tehran (15).

Therefore, given that the different prevalence estimated at the provincial and national studies and also the importance of the nutritional status of children under 5 years old as an important health indicator, the aim of this study was to determine the prevalence of stunting in Iranian children under-five years.

## Methods

### Search Strategy

All original articles were searched from international databases including Medline (PubMed), Web of sciences, Google Scholar, Scopus, CINAHL and the Iranian databases consist of SID (Scientific Information Database, www.sid.ir), Irandoc (Iranian Research Institute for Information Science and Technology, Irandoc.ac.ir), Iranmedex (www.iranmedex.com), and Magiran (www.magiran.com) by complex search syntax. We searched in these motor engines and gray literatures without language and time limitation from January 1989 to August 2017. The search performed based on six keywords in English and Persian phrase included Malnutrition, PEM (Protein Energy Malnutrition), Stunting, Growth Disorder, Stunted Growth, Children under 5 years, and children (Table 1).

Table 1. Characteristics of the studies that included in the meta-analysis

Authors	Year	Sample size	Type of study	Measurements	City	Gender	Prevalence of Stunting (%)	Study quality
Hoshiarzadeh et al.	2008	1417	Cross sectional	NCHS	Iran	Male Female Total	14.2 11.8 13.1	Moderate
Emamian et al.	2011	1395	Cross sectional	NCHS	Semnan	Male Female Total	---- ---- 10.3	Moderate
Eslamlo et al.	2012	3341	Cross sectional	NCHS	West Azerbaijan	Male Female Total	10 7.3 8.7	Moderate
Shikholeslam et al.	2008	34200	Cross sectional	NCHS	Iran	Male Female Total	5 4.4 4.7	Moderate
Naderi Bani et al.	2012	384	Cross sectional	NCHS	Isfahan	Male Female Total	21.8 15.7 37	Moderate
Mohammadi et al.	2010	370	Cross sectional	NCHS	Sistan and Baluchestan	Male Female Total	10.2 4.5 7.8	Low
Rimaz et al.	2002	1243	Cross sectional	NCHS	Alborz	Male Female	8.1 12.1	Moderate

Table 1. Cntd

Authors	Year	Sample size	Type of study	Measurements	City	Gender	Prevalence of Stunting (%)	Study quality
Saiedlo et al.	2013	902	Cross sectional	NCHS	Isfahan	Male Female Total	9.5 9.2 ----	Moderate
Davodi et al.	2015	1257	Cross sectional	NCHS	Hamedan	Male Female Total	5.2 6.3 6	Low
Feshrkinia et al.	2008	1303	Cross sectional	NCHS	South Khorasan	Male Female Total	9.4 9.5 9.4	Moderate
Yarparvar et al.	2008	500	Cross sectional	NCHS	Kerman	Male Female Total	3.8 4.8 8	Moderate
Asfarjani et al.	2009	137	Cross sectional	NCHS	Tehran	Male Female Total	5.7 13.4 9.5	Moderate
Feshrkinia et al.	2013	480	Cross sectional	NCHS	South Khorasan	Male Female Total	11.2 8.4 7.7	Moderate
Sheikhi et al.	2011	514	Cross sectional	NCHS	Zahedan	Male Female Total	28.2 22.9 25.5	Moderate
Hoshiazadeh et al.	2008	1417	Cross sectional	NCHS	Iran	Male Female Total	14.2 11.8 13.1	Moderate
Emamian et al.	2011	1395	Cross sectional	NCHS	Semnan	Male Female Total	---- ---- 10.3	Moderate
Eslamlo et al.	2012	3341	Cross sectional	NCHS	West Azerbaijan	Male Female Total	10 7.3 8.7	Moderate
Shikholeslam et al.	2008	34200	Cross sectional	NCHS	Iran	Male Female Total	5 4.4 4.7	Moderate
Naderi Bani et al.	2012	384	Cross sectional	NCHS	Isfahan	Male Female Total	21.8 15.7 37	Moderate
Mohammadi et al.	2010	370	Cross sectional	NCHS	Sistan and Baluchestan	Male Female Total	10.2 4.5 7.8	Low
Rimaz et al.	2002	1243	Cross sectional	NCHS	Alborz	Male Female Total	8.1 12.1 ----	Moderate
Saiedlo et al.	2013	902	Cross sectional	NCHS	West Azerbaijan	Male Female Total	5.4 6.4 ----	Moderate
Saiedlo et al.	2013	902	Cross sectional	NCHS	Kermanshah	Male Female Total	2.7 3.3 ----	Low
Saiedlo et al.	2013	902	Cross sectional	NCHS	Isfahan	Male Female Total	9.5 9.2 ----	Moderate

### Inclusion/Exclusion Criteria

We reviewed the search results, and then excluded some studies after reviewing the titles. The evaluation of searched studies was done based on inclusion and exclusion criteria by two reviewers individually (MY, MK). The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement was used as a guide to enhance the quality of reporting in this review. In this study, inclusion criteria were 1) cross-sectional design of the study, 2) report of estimated prevalence of Stunting, Growth Disorder, Stunted Growth, Stunting's and PEM in the paper, 3) study on populations younger than 5 years; exclusion criteria were 1) interventional studies and other types of studies except for cross-sectional, 2) animal studies, 3) studies on populations older than 5 years.

### Data extraction and Quality assessment

The qualities of all studies were assessed by Modified Newcastle-Ottawa Scale for cross-sectional studies(16, 17) and PRISMA checklist (7, 18-21) by two reviewer independently(MY, MH). Under supervision by the reviewing team, checklist including the following factors were filled :1) name of first author, 2) date of publication, 3) date of study, 4) total sample size, 5) sampling method, 6) study design, 7) number of female and male cases, 8) type of questionnaire, 9) score of appraisal tool, 10) main variable, 11) prevalence of malnutrition, stunting, growth disorder, stunted growth, stunting and PEM based on their questionnaire, 12) inclusion criteria. Additional information on study results was extracted with respect to the type of instruments.

**Statistical Analysis**

We employed random effect model to generate a pooled prevalence. The reported prevalence is presented as percent and 95% confidence interval (CI). The heterogeneity between the included studies will be assessed using the I<sup>2</sup> heterogeneity statistic, reported as percentage (%), to determine the extent of variation between the studies. Forest plot also was used to present result of meta-analysis schematically. Subgroup analysis was conducted on the gender, and geographical region, and meta-regression was performed to examine the impact of year of publication on prevalence.

**Results**

Our primary search yielded 242 papers. After reviewing the titles, 132 papers excluded due to duplicating or unrelated papers. From the remained 32 papers, based on the developed checklist articles were excluded (Fig. 1, Table 1). The included papers were categorized in two groups according to their study design (descriptive or analytical cross-sectional studies).

**Assessment of Pooled Prevalence**

Finally, 16 studies from different settings remained for meta-analysis. Prevalence of total stunting was 12% (95%

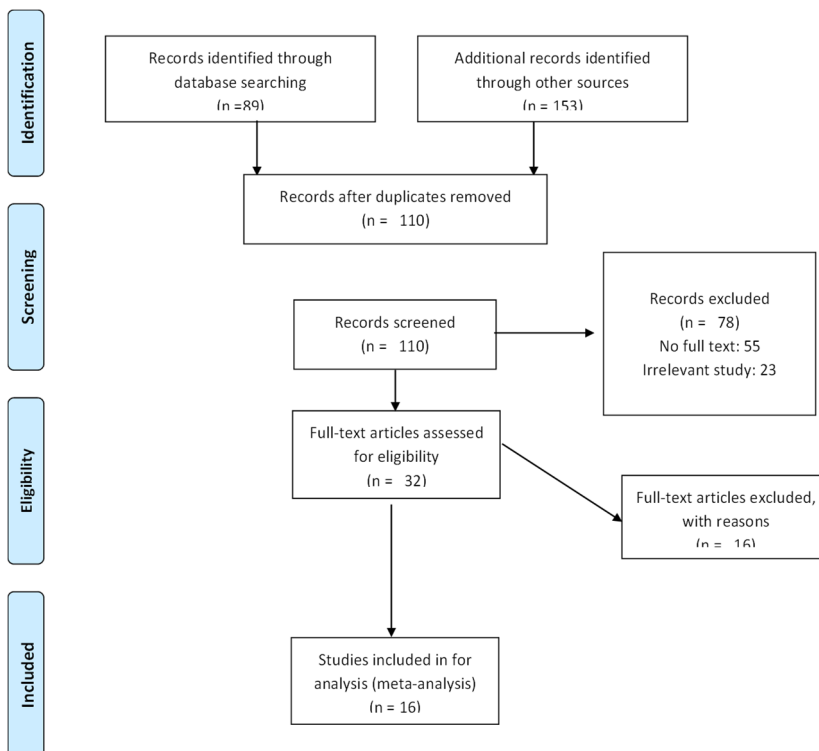


Fig. 1. Flow diagram of the literature search and study selection

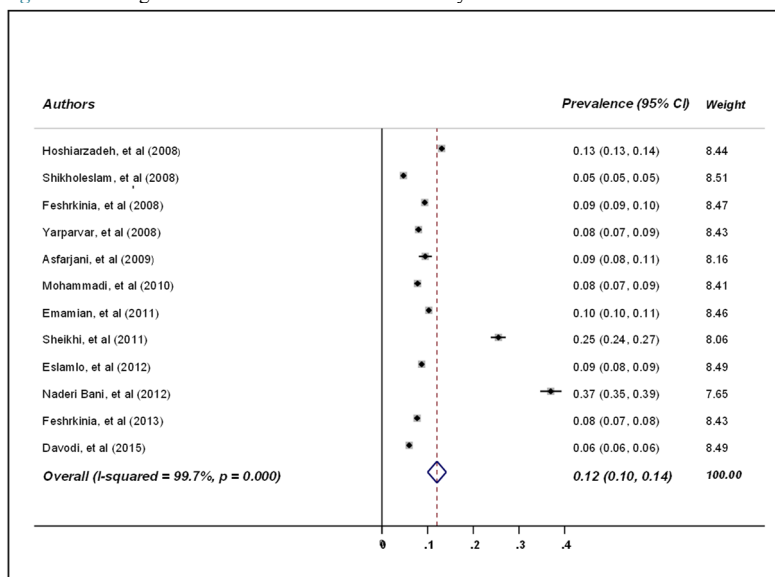


Fig. 2. Meta-analysis of the pooled prevalence of stunting in Iranian children

CI: 10-14) (Fig. 2). Subgroup analysis for gender showed that the prevalence of stunting in both boys and girls were equal to 10% (95% CI: 8-11) and 9% (95%CI: 8-10), respectively (Fig. 3). Also, the estimate of pooled prevalence of stunting based on the subgroup analysis for province in Iran showed that the prevalence in central was 15% (95%CI: 10-21) and in south was equal to 17% (95% CI: 1-34) (Fig. 4).

### Discussion

The present study was a meta-analysis study which was designed and implemented to determine the prevalence of

stunting in Iranian children under-five years. The results of this study showed that the pooled prevalence of stunting in Iranian children under-five years is 12% (95% CI: 10%–14%), regardless of gender. While the subgroup analysis for gender showed that the prevalence of stunting in boys and girls are similar and equal to 12% (95%CI: 10–14). Also, the estimate of pooled prevalence of stunting based on the subgroup analysis for different regions of Iran showed that the prevalence of stunting in western, eastern, southern and central regions are 9% (95%CI: 8%–10%), 8% (95%CI: 7%–8%), 17% (95%CI: 1%–34%) and 15% (95%CI: 10%–21%), respectively.

The results of this study showed that the pooled

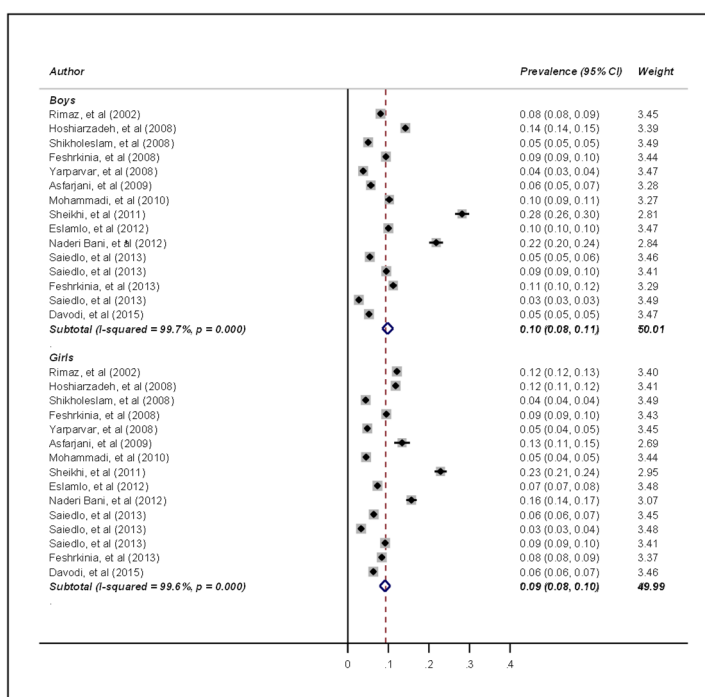


Fig. 3. Meta-analysis of the prevalence of stunting in Iranian children by gender

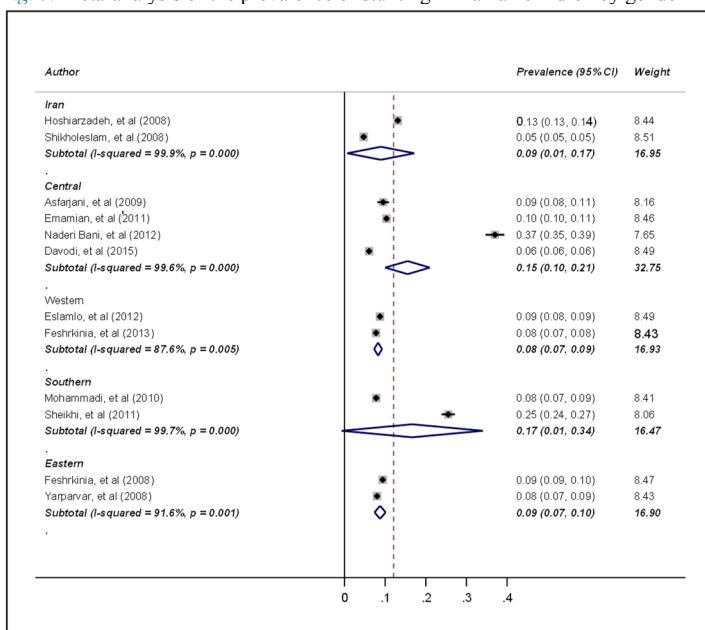


Fig. 4. Meta-analysis of the prevalence of stunting in Iranian children by province



prevalence of stunting in Iranian children under-five years is 12% (95%CI: 10–14), regardless of gender. In general, studies are very limited at the national level, and most of the studies in Iran are at provincial and city level. For example, in a national study by Houshiar Rad et al. to determine the prevalence of stunting, underweight, wasting and overweight among Iranian children under five years (2000-2002), a number of 7158 households were selected using systematic sampling from 28 provinces of Iran and, generally, 2562 children were examined. Their results showed that the prevalence of stunting for children under 5 years was 13.1% (95%CI: 11.8%–14.4%) (13). As it is seen, the results of this study are not consistent with our study, and the prevalence in our study is almost two times lower; but other studies are more consistent with the results of this study. For example, the data extracted from “Iranian National Study of Malnutrition Prevalence” has showed that prevalence of stunting is 4.7% in Iranian children in 2008 (22). In another study conducted to investigate the determinants of stunting in first grade primary school children of Tehran, the results showed that the prevalence of stunting is 3.7% in the study population in 2013 (23). In fact, it can be said that, we are seeing a decrease in the prevalence of stunting in Iran, of course, the decreasing trend of stunting has been reported in South East Asia and world (24, 25). This can be explained by improved primary health care during pregnancy and early childhood, breastfeeding and growth monitoring.

In our study, the subgroup analysis for gender showed that the prevalence of stunting in boys and girls are similar and equal to 10% (95%CI: 8–11) and 9% (95%CI: 8–10), respectively. The national study by Houshiar Rad et al. to determine the prevalence of stunting, underweight, wasting and overweight among children under five years (2000-2002), showed that the prevalence of stunting in boys and girls were 14.2% (95%CI: 12.2%–16.1%) and 11.8% (95%CI: 10.1%–13.6%), respectively (13). The report of the children's nutritional status in the provinces of Iran showed that the prevalence of stunting in boys and girls were 16.8% and 13.9%, respectively (26). A study by Esfarjani et al. showed that the prevalence of stunting in boys and girls are 2.8 % and 4.4%, respectively (23). Most of the studies carried out in this field show that the prevalence of stunting in girls is higher than boys (27-29). This difference may be due to more attention and care of the families to the boys, which is related to the false beliefs and cultural problems of that society (30). Some studies have also shown no significant difference between the two sexes. The study of Nouri Saeidlou showed that stunting rates in girls higher than boys but differences were not significant (8). A study by Davoodi and colleagues showed that there is no significant statistical difference between boys and girls in Hamadan (31).

In the present study, the estimate of pooled prevalence of stunting based on subgroup analysis for different regions of Iran showed that the prevalence of stunting in the western, eastern, southern and central regions are 9% (95%CI: 8%–10%), 8% (95%CI: 7%–8%), 17% (95%CI: 1%–34%) and 15% (95%CI: 10%–21%); respectively. The study by Karajibani et al. in children under six years in Sistan-and-

Baluchestan province which is located in south-east of Iran showed that the prevalence of stunting is 32.1% (32). The result of a study on the prevalence of malnutrition in children under five years old in Salmas (in west of Iran) showed that the rate of stunting is 7.3% (8). The study of Davoodi et al. showed that the prevalence of stunting in Hamadan (in west of Iran) was 6% (31). Also, the study of Fesharakinia in Birjand city (in east of Iran) in 2011 showed that the prevalence of stunting in under 5-year old children is 9.8% (33). The study of Payandeh with the aim of determination of the prevalence of malnutrition among preschool children in northeast of Iran showed that the rate of stunting was 12.5% (10). Generally, as can be seen the prevalence of stunting in some regions of Iran is higher. Although, in recent years much efforts have been made to address deprivation such as economical, nutritional and social supporting, improvement quality of life, but there are still nutritional problems in these areas of Iran.

Use of various instruments for measurement of outcomes, inadequate sample size in some studies and various methods for sampling might have increased the risk of information bias and might have been a reason for high heterogeneity in the results of the included studies. In other words, these factors should be investigated in future studies.

The studies have shown that there are many different factors that contribute to child stunting, including poor maternal health and nutrition during pregnancy, anemia in women of reproductive age, child's inadequate nutrition (not eating enough or eating foods that lack growth-promoting nutrients), low birth weight, childhood overweight, exclusive breastfeeding, wasting, and recurrent infections or chronic diseases which cause poor nutrient intake, absorption or utilization. Specifically, the maternal nutritional and health status before, during and after pregnancy influence child's early growth and development, beginning in the womb. For example, intrauterine growth restriction due to maternal undernutrition is responsible for 20% of childhood stunting (33, 34). Therefore, for the prevention and control of childhood stunting all these factors must be considered.

## Conclusion

In conclusion, it seems that the stunting indicates long-term malnutrition, and in the following years, with the help of adequate nutrition or greater care, education and improved living conditions it can not be reversed easily. So, growth monitoring and baby nutrition plans should be taken into consideration in order to reduce the prevalence of the stunting in Iran.

## Conflict of Interests

The authors declare that they have no competing interests.

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