



Prevalence and Risk Factors of Malnutrition among Primary School Children in Iran: A Systematic Review

Saeed Mohammadi¹, Molood Bolourian¹, Mohaddeseh Badpeyma², Mona Nasiri³, *Anahita Alizadeh Ghamsari⁴, Samaneh Movahedinia⁵

¹Pediatrician, Department of Pediatrics, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran. ²Student Research Committee, Tabriz University of Medical Sciences, Tabriz, Iran. ³Assistant Professor of Pediatrics, Department of Pediatrics, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran. ⁴Associate Professor, Fellowship of Clinical Toxicology, Department of Clinical Toxicology, MTRC Medical Toxicology Research Centre, Mashhad University of Medical Sciences, Mashhad, Iran. ⁵Kerman University of Medical Sciences, Kerman, Iran.

Abstract

Background: Malnutrition poses a significant threat to children's health and remains the leading cause of childhood mortality in the World Health Organization (WHO) Eastern Mediterranean Region. This study aims to assess the prevalence of malnutrition and identify its associated risk factors among primary school children in Iran.

Materials and Methods: In this systematic review, a systematic search of online databases (MEDLINE, EMBASE, Scopus, Web of Science, Cochrane Library, CIVILICA, SID, and Google Scholar) was conducted for related studies with no time limit up to June 2022. Two reviewers evaluated the quality of eligible studies and carried out the selection procedure.

Results: Twelve related studies were selected. The prevalence of malnutrition based on weight-for-age, height-for-age, and weight-for-height was 24.9% (underweight, 3.2-46.6%), 19.9% (stunting, 3-36.9%), and 28.5% (wasting, 3.7-53.3%), respectively. Logistic regression analyses showed that the risk of malnutrition in rural areas was 1.34 times that of urban areas, in girls 1.17 times that of boys, in the Sistani ethnic group 1.82 times that of the Fars ethnic group, and in low-income families 2.01 times that of high-income families. Thinness was significantly higher in public schools than in private schools. A statistically significant relationship was observed between the consumption of snacks and wasting in schoolchildren. Birth weight, parental education, father's height, father's job, family income, and maternal age were significant contributing factors to malnutrition in schoolchildren ($p < 0.05$).

Conclusion: The prevalence of malnutrition among Iranian schoolchildren in Sistan and Balochistan, Kerman, and Kurdistan provinces was relatively high in terms of wasting, stunting, and being underweight. The risk of malnutrition was higher in rural areas, girls from the Sistani ethnic group, and low-income families.

Key Words: Iran, School Children, Malnutrition, Prevalence, Primary School

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*Corresponding Author:

Anahita Alizadeh Ghamsari, MD, Fellowship of Clinical Toxicology, Department of Clinical Toxicology, MTRC Medical Toxicology Research Centre, Mashhad University of Medical Sciences, Mashhad, Iran.

Email: alizadehan@mums.ac.ir

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1- INTRODUCTION

Children are the main assets of any society, and their health forms the foundation for future community well-being. Evidence shows that delayed growth in school-aged children can impair learning, intelligence, and academic achievement (1). Therefore, assessing growth is a crucial component of healthcare for children and adolescents (2). Child growth is widely recognized as a key indicator of nutritional status and overall health. Indicators such as stunting, wasting, underweight, and overweight are commonly used to describe the magnitude and patterns of under- and overnutrition (3).

Malnutrition encompasses various conditions, including undernutrition (wasting, stunting, and underweight), micronutrient deficiencies, overweight, obesity, and diet-related noncommunicable diseases (4, 5). Globally, nearly one in three people suffers from at least one form of malnutrition (6). Undernutrition remains more common in developing countries (7), and research suggests that stunting is often more prevalent in urban slums than in rural areas (8). In 2020, an estimated 149.2 million children under five were stunted, 45.4 million were wasted, and 38.9 million were overweight. While the prevalence of stunting has declined across most regions, it continues to rise in Africa. More than half of all children affected by wasting live in Southern Asia, and Asia accounts for over three-quarters of those with severe wasting (9).

Anthropometric indicators such as weight and height are essential for evaluating nutritional status across all age groups. Studies on malnutrition have examined various population groups—infants, children under five, school-aged children, adolescents, pregnant women, adults, and the elderly—using different growth references. These include the National Center for Health Statistics (NCHS)

growth charts, WHO references (1995 and 2007), the Centers for Disease Control and Prevention (CDC) growth charts, the National Health and Nutrition Examination Survey (NHANES), the Obesity Task Force (IOTF) criteria, and the Indian Academy of Pediatrics (IAP) growth charts (10).

Globally, around 795 million people were undernourished in 2015—roughly one in ten of the world's population (11). By 2020, the number had increased to about 820 million, or one in nine individuals worldwide. These increases are partly attributed to the COVID-19 pandemic, which exposed major weaknesses in food and health systems. It was estimated that by late 2020, the pandemic could double the number of people facing acute hunger, and raise the prevalence of moderate and severe wasting by 14% (13, 14).

In Iran, multiple studies have assessed the height and weight of children and adolescents across different regions, revealing that both indicators are generally below NCHS reference standards in several cities, including Mashhad, Tehran, Shiraz, Kashan, Zahedan, Chababar, Malayer, and Rasht (15–21). Nearly half of Iran's population is under 18 years old (12), representing a highly vulnerable demographic. The middle childhood period (ages 7–12) is marked by rapid growth and the beginning of puberty, which further emphasizes the importance of adequate nutrition during this stage (22).

Evaluations of the nutritional status of primary school children conducted both globally and in Iran have identified issues ranging from stunting and thinness to overweight and obesity (23–27). Primary school children represent one of the most vulnerable groups, and their health strongly influences their learning capacity and educational success (28, 29). Monitoring their growth provides a foundation for evidence-based public

health planning (30). Therefore, the present study aimed to determine the prevalence and associated risk factors of malnutrition among Iranian primary school children.

2- MATERIALS AND METHODS

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist was used as a template for this review (31). Based on the World Health Organization's (WHO) definition, malnutrition in children is diagnosed when weight-for-age, height-for-age (HAZ), or weight-for-height (WHZ) z-scores are below two standard deviations (-2 SD) compared to the international reference median value (32).

2-1. Eligibility criteria

The Participants, Interventions, Comparators, and Outcomes (PICO) framework was used to formulate the review objective and inclusion criteria.

- **Participants:** Iranian primary school students aged 7-12 years.
- **Interventions:** The included studies were non-interventional; therefore, no intervention group existed.
- **Comparison:** The study did not have a comparison group.
- **Outcome:** Malnutrition indicators such as wasting, stunting, and underweight.

2-2. Included studies

The review included studies that contained any form of quantitative assessment, measurement, and evaluation of malnutrition in primary school children in Iran. The inclusion criteria were as follows: focusing on malnutrition (undernutrition) among primary school students only, published up to June 2022, written in English or Persian, participants aged 7-12 years (since they are primary school students), and classification of

malnutrition according to the National Center for Health Statistics (NCHS)/WHO criteria (33).

2-3. Exclusion criteria

The exclusion criteria included abstracts without full articles, studies on high school students, reports using percentiles or percent of median to define malnutrition (not based on the WHO definition), articles not written in English or Persian, review articles, meta-analyses, letters to the editor, editorials, short reports, case reports, and briefs.

2-4. Information sources

A systematic search of electronic databases—Medline, EMBASE, Scopus, Web of Science, Cochrane Library, CIVILICA, SID, Magiran—and Google Scholar was conducted. The search was performed independently by two reviewers in duplicate; any disagreements between them were resolved by a supervisor.

2-5. Search

Keywords were obtained from MeSH and also extracted from related articles. The search terms were a combination of (Students OR Primary school children OR Elementary students OR Children) AND (Malnutrition OR Undernutrition OR Wasting OR Stunting OR Underweight) AND (Prevalence) AND (Iran).

2-6. Study selection

A database search was conducted for possible studies. Abstracts were screened to identify eligible studies, full-text articles were obtained and assessed, and a final list of included studies was compiled. In addition to primary articles, their references were also searched for additional studies. This process was performed independently by two reviewers in duplicate; any disagreements were resolved by a third reviewer. References were organized and managed using EndNote software (version X8).

2-7. Data collection process

A data extraction form was developed and used for each study. Two reviewers collected the data independently. The following data were extracted for all studies: first author, year of study, study location, sample size, age group, gender, and the prevalence of malnutrition. The collected data were combined and compared for accuracy; any discrepancies were resolved by a third reviewer.

2-8. Risk of bias in individual studies

The quality of studies was assessed using the Quality Assessment Checklist for Prevalence Studies (34). The total score from this checklist was categorized into three subgroups: low risk of bias (0–3), moderate risk of bias (4–6), and high risk of bias (7–9). Only studies with a low risk of bias were included in this systematic review.

2-9. Synthesis of results

Due to variations in study designs, age groups, sample sizes, and malnutrition

indicators across diverse geographic locations, a meta-analysis was not feasible.

2-10. Ethics considerations

Approval from a research ethics committee was not necessary, as the study analyzed only publicly available articles. The research adhered to ethical standards by respecting copyright laws and ensuring transparency in its methods and sources.

3- RESULTS

Based on the initial search conducted in national and international databases, 12 relevant articles were selected (**Figure 1**). The prevalence of malnutrition among boys and girls in primary schools across the provinces of Sistan and Balochistan, Kerman, and Kurdistan was relatively high, with rates of 24.9% for weight-for-age, 19.9% for height-for-age, and 28.5% for weight-for-height indicators. The general specifications and data of the selected articles are presented in **Table 1** and subsequent sections.

Table-1: General characteristics of included studies (n=12).

Author, (Reference)	Study location	Study design	Sample size	Age group	Gender	Prevalence of malnutrition
Malekzadeh et al. (35)	Boirahmad	Cross-sectional	544	6-12	girl-boy	Stunting: 15.7%, Underweight: 12.5%, Wasting: 3.6%
Gholami et al. (36)	Kerman	Cross-sectional	1056	7-12	girl-boy	Stunting: 26.04%, Underweight: 24.43%, Wasting: 24.90%
Darvishi et al. (37)	Kurdistan province	Descriptive-Analytical	1100	7-12	girl-boy	Underweight (Weight-for-age): 27.5%, Wasting (Weight-for-height): 32.3%, Stunting (Height-for-age): 36.9%
Hajian et al. (38)	Babol	Cross-sectional	1000	7-12	girl-boy	Underweight: 13.5%, Overweight: 12.3%, Obesity: 5.8%
Karajibani et al. (39)	Iranshahr	Cross-sectional	1000	6-14	girl-boy	Stunting: 50.2%, Underweight: 46.6%, Wasting: 18.1%
Esfarjani et al. (40)	Tehran	Case-Control	3147	7	girl-boy	Stunting: 3.7%
Pasdar et al. (41)	Kermanshah	Cross-sectional	704	7-12	girl-boy	Wasting: 16.7%, Overweight: 13.2%, Obesity: 4.3%

Dehghan et al. (42)	Larestan	Descriptive-Analytical	876	7-12	girl-boy	Stunting: 6.5%, Underweight: 7.3%, Wasting: 9.8%
Nowrozi et al. (43)	Golpaygan	Descriptive-Analytical	1062	7-12	girl-boy	Stunting: 3%, Underweight: 5.4%
Delvarianzadeh et al. (44)	Villages of Shahrood	Cross-sectional	890	6-12	girl-boy	Stunting: 15.3%, Underweight: 14.7%, Wasting: 11.6%
Karajibani et al. (45)	Zahedan	Randomized Systemic Method Study	2067	7-11	girl	Underweight: 15.6%, Wasting: 9%, Stunting: 15%
Veghari et al. (46)	North of Iran	Cross-sectional	5698	7-12	girl-boy	Underweight: 3.20%, Stunting: 4.93%, Wasting: 5.13%

1. A cross-sectional study involving 544 schoolchildren aimed to determine the prevalence of protein-energy malnutrition among rural schoolchildren in Boirahmad. The results indicated that, based on the -2 SD cutoff point, 15.7% (95% CI = 12.6-18.8), 12.5% (95% CI = 9.9-15.5), and 3.6% (95% CI = 2-5.2) of children suffered from stunting, being underweight, and wasting, respectively. Additionally, girls exhibited better height-for-age than boys. The education level of parents and the father's occupation were significantly associated with height-for-age (35).

2. A cross-sectional study involving 1,056 students aimed to determine the prevalence of malnutrition among schoolchildren in Kerman. The results showed that the prevalence of malnutrition based on weight-for-age, height-for-age, and weight-for-height was 6.06%, 5.58%, and 75.9%, respectively. The average prevalence of malnutrition for these indicators was 24.43%, 26.04%, and 24.90%. Furthermore, a comparison of weight-for-age and weight-for-height indices revealed a higher prevalence of malnutrition in girls than in boys ($p < 0.05$) (36).

3. A descriptive-analytical study involving 1,100 students investigated the level of malnutrition and its related factors among elementary school students in the

Kurdistan province. The results indicated that the prevalence of malnutrition, based on weight-for-age, weight-for-height, and height-for-age indicators, was 27.5%, 32.3%, and 36.9%, respectively. There was a statistically significant relationship between mothers' occupation and chronic malnutrition (height-for-age) as well as weight-for-height in students. Additionally, a statistically significant relationship was found between parents' education level and both height-for-age and weight-for-height indices. Furthermore, significant relationships were observed between weekly consumption of meat, soft drinks, cheese, and milk, and chronic malnutrition, as well as between the consumption of junk snacks and weight-for-height in students (37).

4. A cross-sectional study involving 1,000 primary school children aged 7 to 12 aimed to determine the prevalence of obesity, overweight, and underweight among primary school children in Babol. The results showed that the overall rates of underweight, overweight, and obesity were 13.5%, 12.3%, and 5.8%, respectively. The prevalence of underweight was more common in public schools (38).

5. A cross-sectional study of 1,000 primary school children aged 6 to 14 aimed to evaluate the anthropometric indices of children in Iranshahr, located in the center

of Sistan and Baluchestan province. The results indicated that thinness was significantly more prevalent in public schools than in private schools (18.1% vs. 1%; $p < 0.0001$). The stunting rates were 50.2% in public schools versus 53.3% in private schools ($p = 0.11$), while underweight rates were 46.6% versus 35% ($p < 0.0001$), respectively. These findings suggest that although the nutritional status was better in private schools, malnutrition remains a public health problem in this area (39).

6. A case-control study of 3,147 schoolchildren aimed to investigate the determinants of stunting among first-grade primary school children in Tehran in 2007. The results showed that the prevalence of stunting was 3.7%. Birth weight, father's height, and maternal age were the main contributing factors to stunting in the studied population (40).

7. A cross-sectional study of 704 primary school children aimed to determine the relationship between dietary habits and educational achievement among children in the suburbs of Kermanshah. The results indicated that, based on body mass index (BMI) percentiles, the prevalence of wasting, overweight, and obesity was 16.7%, 13.2%, and 4.3%, respectively. Additionally, 3.3% of children attended school without having breakfast, and 17.3% reported irregular breakfast consumption (41).

8. A descriptive-analytical study involving 876 elementary school students aimed to investigate the prevalence of malnutrition among elementary students in Larestan County. The results revealed that the prevalence rates of malnutrition based on weight-for-age, height-for-age, and weight-for-height were 7.3%, 6.5%, and 9.8%, respectively. Weight-for-age and weight-for-height malnutrition were more prevalent in female students ($p < 0.05$) (42).

9. A descriptive-analytical study of 1,062 primary school students aimed to investigate the rates of underweight and stunting among students in rural and urban areas of Golpaygan. According to the mean malnutrition indices in the studied population, the prevalence of underweight (weight-for-age Z-score, or WAZ) was 5.4%, and the prevalence of stunting (height-for-age Z-score, or HAZ) was 3%. Malnutrition was less prevalent in girls than in boys (43).

10. A cross-sectional study of 890 elementary school students aimed to investigate the prevalence of protein-energy malnutrition and its associated factors among students aged 6–12 years in the villages of Shahrood. The results indicated that the prevalence rates of malnutrition, based on weight-for-age, height-for-age, and weight-for-height, were 14.7%, 15.3%, and 11.6%, respectively. Chronic malnutrition had the highest prevalence (44).

11. A randomized systematic study involving 2067 girls aged 7-11 years aimed to determine the prevalence of obesity and wasting among primary school girls in Zahedan. The results indicated that, according to the weight-for-age, weight-for-height, and height-for-age indicators, 15.6% were underweight, 9% had wasting, and 15% had stunting. Based on percentiles of weight-for-height, 11.2% of students in lower grades and 14.2% in higher grades exhibited wasting. According to body mass index, 33% of students were classified as thin (45).

12. A cross-sectional study involving 5698 primary students (2505 Fars, 2154 Turkmen, and 1039 Sistani) aimed to assess malnutrition and related socioeconomic factors among three ethnic groups of primary school children in northern Iran. The results revealed malnutrition prevalence rates of 3.20% for underweight, 4.93% for stunting, and 5.13% for wasting. Malnutrition was more

common in girls than in boys and among Sistanis compared to other ethnic groups. The correlation between malnutrition (underweightness, stunting) and ethnicity was statistically significant ($p = 0.001$). Logistic regression analysis showed that the risk of malnutrition in rural areas was

1.34 times higher than in urban areas, in girls it was 1.17 times higher than in boys, in the Sistani ethnic group it was 1.82 times higher than in Fars individuals, and in low-income families it was 2.01 times higher than in high-income families (46).

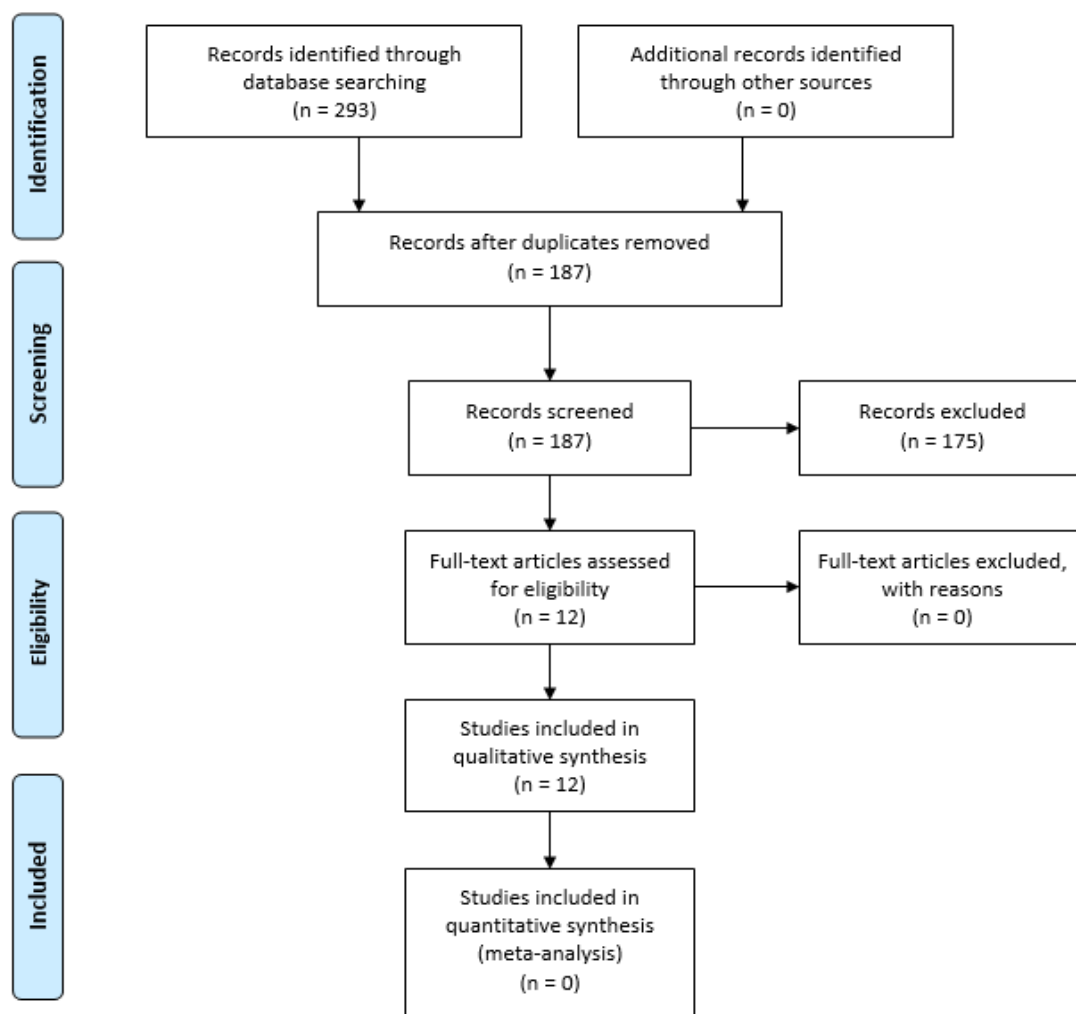


Fig.1: PRISMA flowchart.

4- DISCUSSION

This systematic review aimed to evaluate the prevalence and risk factors of malnutrition among Iranian primary school children. The results indicated that the prevalence of malnutrition in all its forms—including wasting, stunting, and underweight—was 28.5%, 19.9%, and 24.9%, respectively. The prevalence of malnutrition was notably high in the Sistan

and Balochistan, Kerman, and Kurdistan provinces. Logistic regression analysis revealed that the risk of malnutrition in rural areas was 1.34 times higher than in urban areas, and that girls were 1.17 times more likely to be malnourished than boys. Key contributing factors to malnutrition in the studied population included birth weight, parents' education, fathers' height, fathers' occupation, family income, and maternal age ($p < 0.05$).

Malnutrition is the most serious health problem affecting children and is the primary cause of child mortality in the WHO Eastern Mediterranean Region. Nearly one-third of children in the region are either underweight or stunted, and more than 30% suffer from micronutrient deficiencies (47). Malnutrition refers to deficiencies, excesses, or imbalances in a person's intake of energy and nutrients. The term encompasses three broad categories:

- Undernutrition, including wasting (low weight-for-height), stunting (low height-for-age), and underweight (low weight-for-age);
- Micronutrient-related malnutrition, which includes micronutrient deficiency (a lack of important vitamins and minerals) or micronutrient excess; and
- Overweight, obesity, and diet-related non-communicable diseases (e.g., heart disease, stroke, diabetes, and some cancers) (48).

The percentage of children with low height-for-age (stunting) reflects the cumulative effects of undernutrition and infections since birth, and even prenatally. This measure can indicate poor environmental conditions or long-term restriction of a child's growth potential. The percentage of children with low weight-for-age (underweight) can reflect wasting (i.e., low weight-for-height), indicating acute weight loss, stunting, or a combination of both. Thus, underweight is a complex indicator that may be difficult to interpret (3-5).

In 2020, 149.2 million children under five years of age were stunted, 45.4 million were wasted, and 38.9 million were overweight. More than half of all children affected by wasting live in Southern Asia, and Asia as a whole is home to more than three-quarters of all children suffering from severe wasting (48, 49). It is estimated that nearly one in three people

has at least one form of malnutrition, including wasting, stunting, vitamin or mineral deficiency, overweight, obesity, or diet-related non-communicable diseases (6). Undernutrition is more common in developing countries (7). Stunting is more prevalent in urban slums than in rural areas (8). In Asia, India has one of the highest prevalences of wasting, with over 20% of children wasted (50).

Underweight and thinness were more prevalent among children in public schools compared to private schools. Several studies support this, indicating a higher prevalence of underweight specifically in public schools (51, 52). However, Karajibani et al. found a contrasting result: stunting rates were higher among students in private schools (53.3%) compared to public schools (50.2%) (39). This discrepancy in results may stem from differences in study methodologies and reference values. Further research is needed to comprehensively evaluate the nutritional status of children in both public and private schools, considering the various factors contributing to childhood malnutrition (53).

The present study confirms that wasting was more pronounced in children aged 7–11 years compared to underweight and stunting. This aligns with findings from a Nigerian study by Adedeji et al., which reported a prevalence of 11.1% for thinness, 10.7% for underweight, and 10.1% for stunting (54). Similarly, a study in India indicated that underweight was the most common form of malnutrition, followed by wasting (33.3%) and stunting (18.5%) (53).

Our systematic review indicates a higher risk of malnutrition among female students compared to male students, aligning with a study on schoolchildren in urban slums of India that reported significantly higher prevalence among girls (53). Potential explanations include family size, gender bias, greater parental attention toward

boys, and cultural preferences for male children in certain regions. However, several studies report higher malnutrition rates among boys (54–57), while UNICEF data suggest similar underweight prevalence between boys and girls in developing countries (58, 59).

This study found elevated rates of thinness, underweight, and stunting in rural versus urban areas—a pattern consistent with global evidence, including a sub-Saharan Africa meta-analysis (60) and studies across 36 developing countries (61, 62)—likely due to differences in food access, safe water, and sanitation. Key factors identified include parental education, birth weight, father's height and occupation, family income, and maternal age, corroborated by South Asia and sub-Saharan Africa reviews linking these to low income, food shortages, parental illiteracy, and insecurity (63, 64), alongside broader associations with poverty, unsafe water, poor sanitation/hygiene, societal issues, disease, maternal factors, and gender inequities (65). WHO notes that two in five stunted children reside in Southern Asia (66), and in Iran, prevalence is higher in deprived provinces like Kurdistan, Kerman, and Sistan and Baluchestan (35, 37, 56).

4-1. Study Limitations

- Due to insufficient data, this study does not provide a comprehensive review of the prevalence of malnutrition among primary school children in Iran.
- Not all articles provided comprehensive and detailed data on all the elements reviewed.
- Considerable heterogeneity in how studies reported their findings limited the comparisons made in this research.
- The reported results are specific to Iranian society and primary school children and are not generalizable to other populations.

5- CONCLUSION

Malnutrition prevalence varies across Iranian regions, with primary school children aged 7-12 years showing wasting (28.5%; range: 3.7-53.3%), stunting (19.9%; range: 3-36.9%), and underweight (24.9%; range: 3.2-46.6%). Rates are notably high in Sistan and Baluchestan, Kerman, and Kurdistan provinces. Significant factors contributing to stunting include birth weight, parental education, father's height and occupation, and maternal age. Chronic malnutrition correlates significantly with soft drink consumption and reduced frequency of meat and dairy intake ($p < 0.05$). Additionally, weight-for-age and weight-for-height malnutrition are more prevalent among female children ($p < 0.05$).

6- CONFLICT OF INTEREST: None.

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