



# Strategies for Prevention of Malnutrition Among Adolescent Girls: A Systematic Review of Evidence from Low- and Middle-Income Countries

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## ABSTRACT

Malnutrition among adolescents continues to pose an enduring public health challenge in LMICs and includes problems such as undernutrition, micronutrient deficiencies, and rising levels of overweight and obesity. Intervention among adolescent groups is necessary since it has lasting impacts on future generations in terms of maternal and child health issues. This paper attempts to examine literature related to effective ways of preventing malnutrition among adolescent girls, considering nutritional interventions, behaviors, and policies. The systematic review involved the identification of peer-reviewed articles from the period of 2005 through 2024 using the following online databases: PubMed, Google Scholar, WHO databases, and UNICEF. Key phrases included "adolescent girls," "malnutrition," "nutrition intervention," and "prevention strategy." Articles with intervention strategies and those focusing on adolescent females formed inclusion criteria. After filtering through all the sources, 52 records were found; finally, only 21 articles were selected for analysis using PRISMA guidelines. Multi-component interventions that included micronutrient supplements, nutrition education, food fortification, and school programs proved to be most effective. Iron and folic acid supplement programs led to lower anemia rates, while education programs helped improve diets. Socioeconomic and gender issues were the largest barriers in the process.

**Keywords:** Adolescent girls, Malnutrition, Systematic review, Nutrition interventions, Public health, LMICs



## INTRODUCTION

Malnutrition among adolescent girls remains a pertinent public health issue especially in LMICs, where undernutrition, micronutrient deficiency, and increasing levels of overweight and obesity exist simultaneously. The adolescent age group is marked by fast development, puberty, and heightened nutritional needs, but this stage of life still receives less attention from nutrition-related policies than early childhood and motherhood.

Poor nutritional status among adolescent girls was consistently documented within the reporting period as being responsible for several consequences such as anemia, stunted growth, cognitive impairment, and pregnancy-related complications later on in life. From a global health perspective, adolescence appears to be a risky time for young females because it combines the heightened biological needs of adolescence and various socio-cultural obstacles to achieving optimal health and nutrition.

Many factors in developing countries make the situation even worse. For example, research found that the unequal distribution of foods within households, child marriage, and restrictions in decision-making powers adversely affect adolescent girls' nutritional status. Moreover, the nutrition transition observed today results in an emerging problem known as "dual burden of malnutrition," which refers to undernutrition co-existing alongside overweight and obesity.

Current studies in recent years have also shown that adolescent malnutrition cannot be viewed only from a biological perspective but involves multiple factors, including behavioral, social, and environmental factors. Inequalities in socioeconomic conditions, insufficient health care, and poor implementation of programs have continued to hinder the success of current programs (Bhutta et al., 2013; Black et al., 2013). In addition, behavioral factors, including poor dietary habits and insufficient nutritional knowledge, have been significant contributors to the problem of malnutrition among this group.

Even with the realization of the significance of adolescent nutrition, interventions have largely remained fragmented, where focus has been made on individual aspects of interventions such as micronutrient supplementation without consideration of other factors such as education, gender roles, and food security. Research indicates that fragmented interventions are ineffective unless coupled with behavior-focused and community-based interventions (Salam et al., 2016; Hennegan et al., 2017).

## NEED FOR THE STUDY

The prevalence of malnutrition in adolescents is still a serious public health problem, especially in developing countries where deficiencies occur concurrently with problems of obesity. Adolescence is the period when the body undergoes rapid changes in terms of physical development, but it seems to be less paid attention to in nutrition-related policies and interventions.

In spite of the existence of different initiatives from both the local and international levels designed to enhance the nutrition status, it seems that there are still problems concerning malnutrition and poor nutritional practices among adolescent girls, which signifies the presence of shortcomings in implementing nutrition policies. In addition, previous interventions tend to be based only on specific factors, while other aspects related to socio-economic and behavioral factors have been overlooked.



Intergenerational effects of malnutrition is another major issue that needs to be considered. The effects of poor nutritional status are not just confined to current health outcomes but also have an influence on maternal health and future generations' nutritional status. Hence, it becomes imperative to tackle malnutrition among adolescent girls in order to stop the perpetuation of malnutrition.

Further, the fast nutrition transition witnessed in several developing nations is contributing towards dual burdens of malnutrition, wherein undernutrition persists along with obesity. This adds complexity to intervention initiatives and necessitates a broader strategy.

Hence, the need of the hour is to conduct a systematic review of existing literature related to preventive measures of malnutrition among adolescent girls.

## REVIEW OF LITERATURE

The studies concerning adolescent nutrition have undergone a considerable transformation during the last two decades. They progressed from describing nutrition problems towards adopting a more systematic and intervention-oriented approach. Thus, a key contribution made by Black et al. (2013) revealed a profound association between undernutrition of adolescents and maternal undernutrition, noting that these issues are related to structural determinants like poverty, food insecurity, and insufficient dietary consumption. As such, this seminal study stressed that malnutrition is not only a health-related problem but also a rather complex and multifaceted issue that requires a comprehensive approach for solving it.

At the same time, Bhutta et al. (2013) made another important contribution by developing the list of cost-effective and evidence-based nutrition interventions, which included micronutrient supplementation and fortification of foods. These studies confirmed that any technical interventions can produce positive results if implemented in the context of effective delivery and health policy, which makes them critical for solving adolescent malnutrition problem.

An increasing trend towards intervention-specific research is well illustrated in the work of Salam et al. (2016). These researchers conducted a systematic review which proved that the use of iron and folic acid supplementation effectively decreased anemia rates among adolescent girls. Nonetheless, this research pointed out one important problem – namely, that standalone intervention programs were hardly sustainable unless behavioral change was also addressed.

The question of delivery mechanisms was explored by Phillips-Howard et al. (2016). These authors provided robust evidence for school-based interventions. The researchers found that incorporation of nutrition and health services into school systems not only increased adolescents' nutrition level but also improved their school attendance. This suggests that schools may serve as powerful and scalable platforms for adolescent health program implementation.

Finally, regarding a broader discussion around adolescent health, Patton et al. (2016) stressed that adolescence was an extremely important period for health investment. According to these authors, investments in adolescence paid off in terms of health and development of individuals. More precisely, they noted improved reproductive health, reduced risk of diseases, and increased productivity as some of these effects.



The importance of behavioral and socio-cultural factors was also brought into focus in Hennegan et al.'s work (2017). The researchers found out that the knowledge, attitudes, and practices play a significant role when it comes to health behaviors among adolescent girls. Their results prove that mere knowledge is not enough because deep-rooted socio-cultural norms, stigma, and gender inequalities have to be tackled too to see tangible improvements in nutrition status.

The recent regional findings by Sethi et al. (2025) emphasize the problem of a double burden of malnutrition in South Asia. According to the researchers, the increasing rates of overweight and obesity were observed among people at the same time when undernutrition continued to prevail due to urbanization and the shift towards new lifestyles and diets.

The importance of nutrition-sensitive interventions has been proven by Escher et al. (2024), whose study showed that educational, sanitation, and empowerment interventions can be more successful than simple supplementation measures.

Some new innovations are mentioned in recent literatures on digital and community-based interventions for adolescent nutrition. Some of these interventions are e-health and behavior change communication intervention. The above-mentioned approaches have exhibited potentials in enhancing eating habits and knowledge about dieting amongst adolescents. Nevertheless, recent research studies indicate the need for further evaluation of these interventions.

There is a gap in recent studies on this topic area; there is a lack of longitudinal studies assessing the sustainability of the interventions used. Secondly, multi-sectorial approaches were not well incorporated within these studies. Thirdly, the importance of incorporating gender sensitivity and culturally-based strategies in designing intervention programs was not well addressed by these studies.



## METHODOLOGY

### Study Design and Reporting Framework

This study adopted the systematic review approach guided by PRISMA 2020 protocol for conducting and reporting systematic reviews. The objective was to enhance transparency, replicability, and methodological soundness in reviewing the available literature on the topic of preventing malnutrition in adolescent girls.

### Inclusion and Exclusion Criteria

#### Inclusion Criteria

- Research studies targeting adolescent girls aged between 10 and 19 years
- Research interventions (nutrition, education, policies)
- Systematic reviews and meta-analyses
- Research with measurable nutritional indicators (BMI, anemia, dietary diversity)

#### Exclusion Criteria

- Research targeting children below 10 years and adults
- Unreviewed opinion articles
- Research lacking intervention outcomes

### Study Selection Process

The process of selecting research studies entailed four major steps:

1. Identifying records (n = 52)
2. Title and abstract screening (n = 38)
3. Eligibility check of full text articles (n = 25)
4. Including articles (n = 21)

Screening and selection were done independently

### Data Extraction and Synthesis

Data were extracted for:

- Design of the study
- Description of the participants
- Type of intervention
- Measures of outcomes
- Primary results



Narrative data synthesis was employed because of the inconsistency between study designs and interventions. Narrative data synthesis is suitable for differentiating between various types of interventions in recent times

### **Quality Assessment and Risk of Bias**

The quality of the included articles was evaluated according to:

- Strength of study design
- Size of sample
- Validity of outcome measures

Recent systematic reviews highlight that variability in reporting and methodological quality remains a challenge in adolescent nutrition research.

## **RESULTS**

### **Overview of Evidence**

These included:

- 8 systematic reviews
- 5 randomized/quasi-experimental studies
- 8 observational studies

Large scale recent reviews (2024–2026) have established the multifactorial nature of adolescent malnutrition, citing various factors such as socioeconomic status, diet diversity, gender roles, and health access.

### **Determinants of Malnutrition**

#### **Socioeconomic Determinants**

Household poverty, hunger, and parents' education level showed significant correlation with poor nutrition.

Research done recently points out that socio-economic disparities continue to be one of the biggest predictors of malnutrition for adolescent females.

#### **Dietary and Behavioral Factors**

A lack of food variety, poor protein intake, and greater reliance on processed foods were common observations.

Other new developments in dieting include the benefits of digital and behavioral methods for improving dietary choices in adolescents.



## **Gender and Cultural Norms**

Food distribution and early marriages based on gender discrimination result in malnutrition.

The latest South Asian literature suggests that structural gender discrimination remains a significant barrier to obtaining proper nutrition.

## **Health System and Policy Gaps**

Lack of healthcare access and poor implementation of nutritional interventions are considered two main obstacles.

The recent BMJ analysis reveals systemic hurdles in implementing programs in South Asia.

## **Effectiveness of Prevention Strategies**

### **Micronutrient Supplementation**

- Effective decrease in anemia levels
- Highly efficient in the school environment

### **School-Based Integrated Interventions**

Recent quasi-experiments indicate that joint educational and health initiatives lead to better results than education interventions alone.

### **Nutrition-Sensitive Interventions**

Interventions related to food safety, sanitation, and educational components have a broader scope of influence.

The 2024 global literature review indicates that behavioral and school-based interventions are more productive than single supplementation interventions.

### **Emerging Strategies**

- Digital health (eHealth) interventions
- Community-based behavioral models
- Gender-transformative programs

These approaches are increasingly recognized as essential for long-term impact.

## **DISCUSSION**

This review provides a comprehensive synthesis of evidence on strategies for preventing malnutrition among adolescent girls, highlighting the complexity of the issue and the need for integrated solutions.

One of the major conclusions of the literature is that malnutrition is not solely due to poor dietary practices, but rather a consequence of interrelated biological, behavioral and socioeconomic conditions.

Recent systematic reviews confirm that poverty, gender inequalities, and lack of health care, among other nutritional determinants, are interlinked.



## Effectiveness of Interventions

Micronutrient supplementation, while effective, fails to make a difference when applied in isolation.

It has been shown that the effectiveness of interventions increases dramatically when several components, including education, supplementation, and participation of the community, are included.

As a way of reaching many individuals at once, school-based programs are an efficient strategy.

However, they can only succeed through program quality, coverage, and adherence.

## The Double Burden of Malnutrition

Another recent trend is the problem of co-existing under-nutrition and obesity, especially in cities growing fast in developing countries.

The evidence presented by recent global reviews suggests that the risk of obesity increases because of poor nutrition programs in some cases.

## Structural and Policy Barriers

Though there are ways to prevent malnutrition efficiently, the implementation of these methods is still weak and faces many problems, namely:

- Inadequate funding
- Poor program monitoring
- Lack of coordination across sectors

Recent UNICEF reports indicate that many countries lack comprehensive policies covering all essential adolescent nutrition interventions.

## Future Directions

Future research and policy should focus on:

- Longitudinal studies assessing long-term impact
- Integration of digital health technologies
- Gender-sensitive interventions
- Strengthening health systems

Additionally, there is growing interest in using data-driven and predictive approaches to identify high-risk populations, although this area remains underexplored.

## CONCLUSION

Poor nutrition in young females is still a big problem today. There is evidence that an integrated approach will be more successful in tackling the issue.

This can be achieved through Enhancing current programs, Behavior change, Economic factors and Monitoring and evaluation



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