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# Adolescent Nutrition in Boarding Schools: A Narrative Review of Food Systems, Nutritional Status, Food Determinants and Pathways towards the Sustainable Development Goals

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## Abstract
This narrative review emphasizes the school food system, multilevel determinants, intervention strategies, and health outcomes affecting adolescents in boarding schools. Boarding schools across the globe have distinct structural and cultural elements that influence dietary intake. These schools follow strict timing, a central food distribution, shared eating practices, and dietary norms. A structured literature search identified 28 eligible studies published across PubMed, Scopus, Web of Science, and Google Scholar. The evidence was thematically synthesized across the individual, institutional, and sociocultural levels, specifically for boarding school food systems characterized by repetitive food menus. Limited food diversity and autonomy in food selection were associated with inadequate micronutrient and protein intake, and undernutrition, although some boarding school settings showed overweight and obesity. Additionally, multilevel and multicomponent interventions that combine school meals, nutrition education, micronutrient strategies, and hygiene promotion produced more effective and consistent improvements in dietary education, hemoglobin levels, and anemia prevalence, as well as in meal quality, micronutrient supplementation, nutrition education, and hygiene promotion. Despite this, the anthropometric outcomes of adolescent growth were reflected in the relatively less consistent impact on anthropometric indicators, such as body mass index, with a minor magnitude. In general, the effective strategies improved dietary quality, food diversity, and the institutional food environment, thereby addressing individual, Institutional, and sociocultural determinants.

***Keywords:*** Boarding school, Food systems, Adolescent nutrition, School-based interventions, Nutritional status, Dietary diversity, SDGs

***JEL Classification:*** *I10, I12, I15, E31, O47*

## 1. Introduction
Adolescence is an important period in an adolescent's life where their body, mental abilities, and psychosocial development grow fast. Adolescence is the period from ages 10-19; during this period, they need adequate nutrition for optimal growth and good health (Kapur, 2015). This period of their lives is vulnerable to both overnutrition and undernutrition, which increase nutrient intake, and shift food choices and habits (Kyere et al., 2020). Adolescents can be effectively targeted in educational institutions, where the large adolescent population presents with health and nutrition initiatives. School-based interventions for adolescents have been widely recognized as an effective platform to address their dietary concerns (O'Brien et al., 2021). The efficacy of nutrition programs is available in the normal schooling system rather than in boarding schools. Boarding schools are limited in number and have different religious, social, and dietary settings in which teenagers live and eat (Rimbawan et al., 2023). Boarding schools have controlled environments, meal preparation, food composition, and eating schedules. This can affect both nutritional risk factors and responses to intervention efforts (Black et al., 2020).

There is evidence that meal plans, nutrition education, and multicomponent nutrition therapies can improve adolescents' eating habits, nutritional knowledge, and other health outcomes. For example, systematic

evaluations have shown that school-based nutrition education generally improves teens' eating habits and increases fruit and vegetable consumption, especially when combined with broader educational and environmental components. Additionally, successful results have been achieved by integrating nutrition and hygiene education initiatives, emphasizing the potential advantages of multimodal interventions, even in resource-constrained settings (Kilanowski, 2017; UNICEF, 2003; Iqbal et al., 2021).

However, data on dietary treatment specifically implemented in boarding schools are scarce. Existing studies show a high prevalence of stunting, undernutrition, and low nutrition awareness, which demonstrate significant deficiencies in nutrition behaviors, nutrition status, and knowledge among boarding school adolescents. There are fewer interventional studies in these settings, but those done have shown encouraging results: school lunch programs with nutrition education are associated with increased nutrition knowledge, a more positive attitude to nutrition, and a significant reduction in the prevalence of anemia among children. These results suggest that school-based treatments tailored to the specific circumstances of boarding schools could lead to noticeable improvements in adolescents' nutritional status (Rah et al., 2017).

The review determines residential school food systems, including institutional meals, food diversification, and the food environment, in relation to dietary intake and micronutrient outcomes. The studies are conducted in boarding school settings and reported separately. The evidence is derived from conventional day-school interventions. The findings and results from conventional day school settings are used only for comparison and understanding rather than to present evidence for the boarding school adolescents.

## 2. Methods (Literature Search Strategy)

The search was conducted by exploring searches in four databases: PubMed, Web of Science, Scopus, and Google Scholar from 2000 to 2026 with the keywords: adolescent, boarding schools, dietary intake, food system in Pakistan, conventional schools vs boarding schools, Islamic boarding schools, Global to national level, with different string options. A total of 128 papers were identified across 4 databases, including PubMed, Scopus, Web of Science, and Google Scholar. 37 were excluded; either duplicate, non-English, or not relevant to other boarding school systems. 94 research articles remained, and 63 were excluded at the full-text assessment stage, and only 28 were included, as shown in Fig. 1, the PRISMA 2020 flow diagram (study identification, screening, inclusion, and exclusion).

Studies were included if they: (1) focused on adolescents between the ages of 10 and 19, regardless of the sex and the male sex specific finding reported where applicable; (2) were carried out in residential, religious, or other boarding schools; (3) examined components of the boarding school food system (such as food provision, meal structure, dietary environment), dietary behaviors, nutritional status, or nutrition-related interventions; (4) reported measurable health or nutrition outcomes, such as anthropometric indicators, hemoglobin levels, micronutrient status, or dietary intake; and Studies were ruled out if they: (1) only looked at non-residential or day-school settings; (2) included non-adolescent populations without disaggregated data; (3) lacked primary empirical data (such as editorials or commentaries); or (4) did not report pertinent nutrition-related outcomes. The title and abstract were used to screen each record, and then the full text was checked against predetermined eligibility criteria. Before screening, duplicate entries were removed. The study selection process consisted of identification, screening, eligibility assessment, and inclusion.

The important points from the studies were taken, including study designs, geographic settings, structures of the adolescents' boarding school nutrition system, types of nutritional interventions and its outcome where relevant. A narrative review was used for the differences in study design and outcome measurement. The studies were selected across different study designs, and the outcome only depends on the included studies. The analytical framework outlines the different levels of interaction among schools, environment, sociocultural factors, and the outcomes of these factors on dietary behaviors. A large number of articles were irrelevant, such

as non-English articles, day scholar students, and not fully accessible. A total of 28 research articles remained, and these articles were finally analyzed.

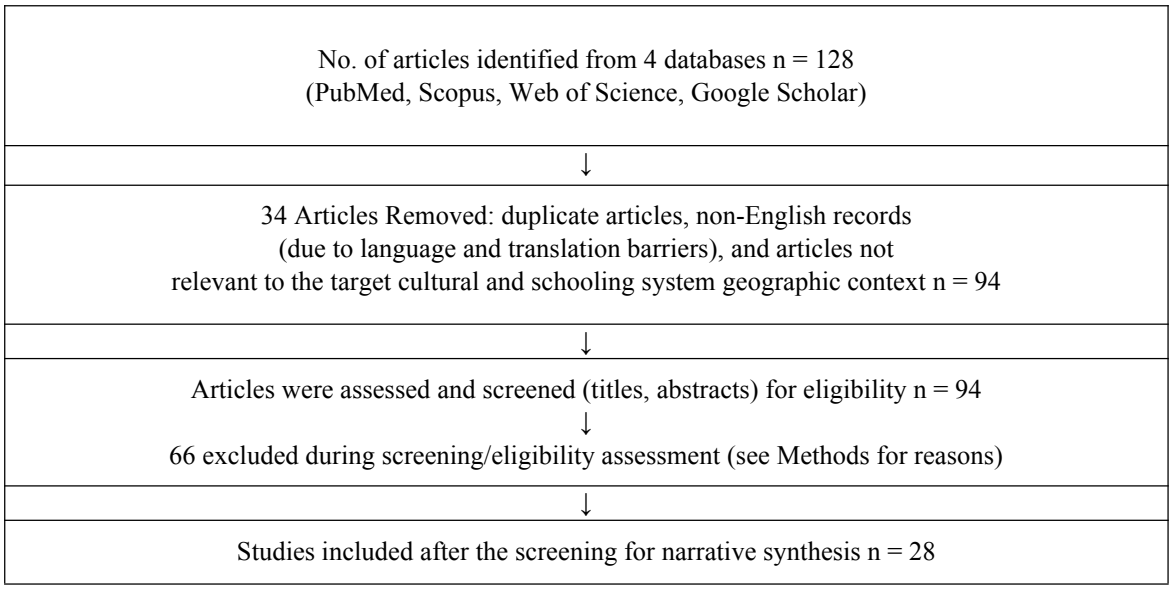


***Figure 1. PRISMA Flowchart***

**Note:** Mapping of each reference to its probable source database, such as PubMed, Scopus, Web of Science, or Google Scholar, is provided

## 3. Conceptual Framework

### 3.1 Overview of Conceptual Framework

This conceptual framework guides adolescent nutrition within the broader nutrition system, which serves as the primary narrative synthesis. The framework focuses on how the institutional food environment, a multilevel determinant, and targeted interventions jointly produce nutritional outcomes. It links adolescents' daily food intake and health outcomes with broader structural and organizational factors, such as the food purchasing system, menu planning, and school nutrition policies. The framework also draws on the Social Ecological Model and the UNICEF conceptual framework of malnutrition to highlight that malnutrition does not result from a single factor, but from multiple interconnected influences operating at different levels. According to the UNICEF framework, malnutrition arises from factors operating at three different levels. The immediate causes include limited food security, inadequate care practices, and unhealthy living conditions. At the broader level, basic causes are linked to socioeconomic and structural conditions that influence access to food, healthcare, and other essential resources (Heslin & McNulty, 2023; Rah et al., 2017). At the same time, the Social Ecological Model explains that adolescent nutrition is influenced by multiple interacting factors, including individual behaviors, family and peer relationships, school environment, community influences, and broader policies (Bell et al., 2013).

### 3.2 Nutrition, Growth, in relation to Adolescent Health

Adolescence is a crucial time for sexual maturation, changes in body composition, and physical growth, all of which significantly raise nutritional needs. According to studies by Rah et al. and Heslin et al.(Heslin & McNulty, 2023; Rah et al., 2010), during this period, adequate intake of energy, protein, and micronutrients to maintain immune system function, bone mineralization, cognitive development, and linear growth. While

excessive or unbalanced intake may lead to overweight, obesity, and the early onset of risk factors for non-communicable diseases, inadequate nutrition throughout adolescence may cause stunting, delayed puberty, anemia, poor academic performance, and increased susceptibility to infections (Das et al., 2017; Meiklejohn et al., 2016).

The study by Bell et al. discussed how, due to their rapid gains in lean body mass and energy expenditure, male adolescents are particularly susceptible to nutritional deficiencies in settings with low food diversity, quantity, or quality. Similarly, a study by Das. (Das et al., 2017) underscores the significance of targeted dietary strategies at this developmental stage, noting that nutritional status during adolescence has long-term effects on adult productivity and illness risk in addition to immediate health results (Adedoyin, 2023; Nicholaus et al., 2020). These considerations underscore the importance of examining how boarding school food systems meet or fail to meet the specific needs of adolescents.

**3.3 Boarding School Food Systems and Nutritional Interventions**

The connection between food provision practices, dietary intake, nutritional adequacy, and student health outcomes forms the basis of the conceptual framework for boarding school food systems and nutritional interventions. Because students rely heavily on school-provided meals to meet their daily nutritional needs, boarding schools play a crucial role in shaping their eating habits (Kola-Raji et al., 2017; Luo et al., 2009). As a result, the nutritional status, growth, academic performance, and overall well-being of students at boarding schools are directly impacted by the variety, quality, frequency, and nutrient content of meals (Chen et al., 2018; Ogechi et al., 2007).

According to research conducted in various countries, boarding school food systems frequently feature routine diets dominated by carbohydrate-rich foods and lack fruits, vegetables, and animal-source protein. Despite consuming a lot of carbohydrates, boarding school students in China had insufficient intakes of protein, fats, and micronutrients, according to research by Luo and Chen (Chen et al., 2018; Luo et al., 2009). In a similar vein, female students in Nigeria were found to have higher rates of malnutrition and insufficient protein intake in studies conducted by Ogechi and colleagues (Yunianto et al., 2026).

Additionally, deficiencies in essential micronutrients like calcium, iron, zinc, vitamin C, and B-complex vitamins were found in studies conducted in Kenya and Croatia (Bennett, 2020; Rutherford et al., 2020). These deficiencies were primarily the result of a lack of dietary variety and poor menu planning. It is noted that food systems are also affected by the budget allocated for food, menu planning, food availability, related policies, and kitchen management (Bennett, 2020; Rutherford et al., 2020; Serrem et al., 2020; Yunianto et al., 2026).

The primary sources of protein and energy come from legumes and starchy foods, while fruits, vegetables, milk, and animal proteins are not adequately provided (Gajdoš Kljusurić & Colić Barić, 2004; Luo et al., 2009). This lack leads to various micronutrient deficiencies, causing undernutrition, anemia, weakened immunity resulting in adolescents, and decreased academic performance. As a result, nutritional interventions are necessary to boost the efficiency of boarding school food systems. Expanding access to nutrient-dense foods like milk, eggs, fish, and meat, as well as increasing dietary diversity, can significantly improve boarding school students' nutrient adequacy, according to the reviewed studies.

**3.4 Pathways Linking Boarding Environments to Nutritional Outcomes**

Adolescents' nutrition is affected by multiple interrelated factors within the boarding school food system. These factors at the school level include meal menu planning, food supply, portion size of nutrition and amount of food and calories consumed. A recent study of boarding schools by Serrem (Serrem et al., 2020) shows that the same or similar menus do not provide a balanced amount of food or sufficient calories (Bennett, 2020). On the other hand, Yuniato (Yunianto et al., 2026) organized the food environment and system to provide good

dietary quality and better growth of boarding school adolescents (Amalia et al., 2023). This research highlights the impact of good food supply and services on the long-term health of boarding students.

The boarding school setting and environment play an important role in adolescents' dietary habits, including the availability and quality of food, sanitation and hygiene, nutritional intake, balanced food, and health. In residential schools, limited food variety, inadequate balanced nutrients, the same routine and poor quality of food are associated with poor health among students (Amalia et al., 2023; Humphrey, 2009). Similarly, Nicholaus (Nicholaus et al., 2020) highlight that Tanzanian boarding schools also provide repetitive food, especially cereal and legume based meal. The vegetables and fruits were very limited in their meal menu which was a major source of micronutrient deficiency among adolescents (Luo et al., 2009).

Similarly, research conducted in Indonesian Islamic boarding schools showed that the school food environment plays a major role in shaping adolescents' dietary quality and nutritional outcomes (Mosby & Galloway, 2017; Zamzam et al., 2024). According to Yunianto (Yunianto et al., 2026), factors such as school type, food management systems, and nutrition-related practices significantly affect the dietary quality of adolescents living in boarding schools (Amalia et al., 2023). These findings highlight the significance of strong school-based nutrition policies and healthy meal environments. Another study by Indriasari and colleagues found that poor dietary habits and limited nutrition awareness among students were associated with higher levels of undernutrition and unhealthy nutrition practices (Yang et al., 2023).

Along with food access and meal composition, hygiene and sanitation conditions also play an important role in nutrient utilization and overall health outcomes. Poor environmental conditions can contribute to environmental enteropathy, also known as environmental enteric dysfunction, a subclinical intestinal condition that affects nutrient absorption and increases the risk of stunting and undernutrition. Humphrey (Humphrey, 2009) introduced that poor sanitation, inadequate hygiene, and repeated exposure to enteric pathogens contribute to this condition (Li et al., 2023). Further research has shown that children and adolescents in institutions and low-resource settings can suffer from intestinal inflammation, malnutrition, and malabsorption as a result of prolonged exposure to contaminated environments and unsafe food conditions (Nor et al., 2021; Sodik et al., 2018).

Eating habits and dietary intake may also be influenced by the meal setting itself. Yang (Yang et al., 2023) observed that different boarding-school management systems influenced adolescents' snacking behavior and nutrient intake patterns, suggesting that institutional eating environments can affect both food choices and nutritional adequacy (Anwar et al., 2019). Collectively, these findings suggest that nutritional outcomes among adolescents in boarding schools are influenced not only by the nutritional quality of meals, but also by the wider environmental conditions that shape health and nutrition.

**Table 1: Conceptual Framework for Adolescent Nutrition in Boarding Schools**

| Conceptual Domain | Key Factors | Nutritional Implications in Boarding Schools | Citations |
|---|---|---|---|
| Immediate determinants | Dietary intake, disease, nutrient adequacy | Directly affects growth, immunity, cognition, and health outcomes | (Black et al., 2020; UNICEF, 2003) |
| Underlying determinants | Food security, sanitation, care practices, and meal environment | Influences food access, nutrient absorption, and infection risk | (Black et al., 2020; Kilanowski, 2017; UNICEF, 2003; Zamzam et al., 2024) (Mosby & Galloway, 2017; Yang et al., 2023) |
| Adolescent nutritional | Rapid growth, sexual maturation, and increased | Higher risk of anemia, stunting, and poor academic performance | (Bell et al., 2013; Das et al., 2017; Heslin & McNulty, |

| | | | |
|---|---|---|---|
| needs | nutrient demands | if diets are inadequate | 2023; Meiklejohn et al., 2016) |
| Boarding school food systems | Menu composition, meal frequency, procurement, portion sizes | Shapes dietary diversity and nutrient adequacy | (Adedoyin, 2023; Chen et al., 2018; Kola-Raji et al., 2017; Luo et al., 2009; Nicholaus et al., 2020) |
| Common dietary patterns | High-carbohydrate, low fruit, vegetable, and animal-source food intake | Leads to micronutrient deficiencies and undernutrition | (Bennett, 2020; Gajdoš Kljusurić & Colić Barić, 2004; Ogechi et al., 2007; Serrem et al., 2020; Yunianto et al., 2026) |
| Institutional food environment | Rigid meal schedules, centralized food decisions, structured eating settings | Limits dietary variety and influences eating behavior | (Bennett, 2020; Gajdoš Kljusurić & Colić Barić, 2004; Yang et al., 2023) |
| Hygiene and food safety | Poor sanitation, unsafe food handling, contaminated environments | Impairs nutrient utilization and increases infection-related malnutrition | (Li et al., 2023; Nor et al., 2021; Yang et al., 2023) |
| Nutritional interventions | Dietary diversification, nutrient-dense foods, policy support, and monitoring | Improves diet quality, nutritional status, and academic performance | (Adedoyin, 2023; Gajdoš Kljusurić & Colić Barić, 2004; Ogechi et al., 2007; Serrem et al., 2020; Yunianto et al., 2026) |

Table 1 indicates that the conceptual framework highlights that the food system and meal menu in boarding schools are strictly controlled by school administration, which affects students' dietary habits. During adolescence, students need a high-calorie diet for growth, but limited food choices and poor food quality distort their growth and health. Therefore, boarding school settings should be sites for implementing multi-level nutrition interventions, and nutrition-related interventions should be implemented to enhance health and well-being.

## 4. Characteristics of Boarding School Food Systems

This section operationalizes the conceptual framework by examining the schools, environmental, sociocultural, and individual determinants within boarding school food systems that shape adolescents' dietary practices.

### 4.1 Institutional Food System Structures and Living Arrangements

The studies show that food system and living conditions significantly influence adolescents living in boarding schools. The students of these schools mostly receive repetitive meals given by the authorities, such as cereal and legumes. The students' boarding schools in China consume adequate carbohydrates in their daily routine, but essential food diversification remains insufficient, such as protein, energy, fat, and other micronutrients (Gajdoš Kljusurić & Colić Barić, 2004; Serrem et al., 2020; Woodruff & Hanning, 2009). Nigerian studies also show that protein, fat and essential micronutrients are not provided in sufficiently amounts for boarding students (Yunianto et al., 2026).

The living arrangements within boarding institutions also influence eating patterns and food behaviors. The fixed meal schedules, centralized food decisions, and limited autonomy over food selection may restrict students' ability to meet individual nutritional needs (Khusun et al., 2025; Ronitawati et al., 2020; Terry-McElrath et al., 2009). A study by Woodruff and Hanning found that meal environments and food settings were strongly associated with overall diet quality among adolescents, particularly when meals were consumed in structured institutional settings (Ihsan et al., 2021).

The larger school food environment further influenced the dietary outcome. Food availability, nutrition policies, and institutional food practices all significantly affect adolescents' eating habits and body weight outcomes, according to studies of school nutrition environments. A Canadian study by Mâsse et al. found that adolescents were more likely to have unhealthy eating habits and obesity when their school food environments were unhealthy, and nutrition guidelines were weak or poorly implemented (Helen, 2016). Similarly, Terry-McElrath et al. found that secondary school students were more likely to be obese when schools provided easy access to high-calorie but low-nutrient foods (Bariroh & Alam, 2025).

**4.2 Sociocultural and Disciplinary Influences on Dietary Practices**

The meals depend on what is served; adolescents adjust their eating in accordance with rules, routines, and shared expectations woven into daily life. What gets eaten often follows a timetable set by staff, leaving little room for personal preference or change. Social patterns matter in these conditions; what peers do can quietly shift choices at breakfast, lunch, or dinner. Control over portions comes from serving methods, not student decisions, which shape intake whether intended or not. Behaviors around food emerge through repetition, habit, and subtle resistance within tightly scheduled days (NisaMairo et al., 2024; Stea et al., 2015; Würbach et al., 2009).

A research project led by Helen in 2016 at Opoku Ware Senior High School in Ghana found school meals included core food categories. Yet learners expressed concern about portion sizes and overall taste. Because of this, several pupils added items such as kenkey, banku, rice, and beans that were bought outside the cafeteria. Funding shortfalls stemming from weak state support restricted what the institution could offer in terms of balanced, appealing dishes. Social views shared among classmates, along with personal eating habits, played a role in shaping how often meals were skipped or seen as unsatisfactory (Ali & Abizari, 2018).

Consistent with earlier findings, research by Bariroh and Alam (2025) examined how diet and food safety play out in pesantren along Indonesia’s coast. Instead of sticking strictly to providing meals, many students turned to ready-made snacks - shaped less by preference than by repetition in daily menus. Institutional habits, shared mealtimes, and strict routines quietly shaped what teens chose to eat. Even when food was available, its limited variety pushed learners toward easier options. Behind kitchen doors, cleanliness rules varied widely; some staff skipped basic steps without realizing risks. Nutrition lessons rarely reached classrooms, leaving gaps in understanding. Teachers and cooks alike showed uneven awareness about safe handling and balanced intake. These limitations were observed by Sta et al. (2024) in the Norwegian population, and Ali and Abizari (2015) in Ghanaian adolescents. These issues are related to adolescents’ health. These include fatigue longer than expected, disruption of menstrual cycles and emotional imbalance among women. These issues become harder without guidance (Boateng, 2013; Ene-Obong & Akosa, 1993; Kljusurić et al., 2016; Ramadhani et al., 2026; Shatila et al., 2021).

The boarding students in Islamic countries can support the idea of what their students eat. This suggests that students are strongly affected by food access and daily routine. The data indicates that nutrition consumption is influenced not only by their own habits but also by their meal access system. The literature also suggests that the types of food consumed by adolescents daily is strongly related to their overall health. Therefore, mealtime with these institutions was important because students’ nutrition was shaped by both the structure of the dining environment and their own choices (JUNITA et al., 2024; Otuneye et al., 2017).

**4.3 Meal Patterns and Dietary Restrictions**

The structured mealtimes in boarding schools usually come from set timetables and shared dining operations, creating predictable but often repeated eating habits. These settings commonly follow a three-meal plan - morning, midday, and afternoon - which directly affects how students spread their calorie intake through

the day. Yet research shows inflexible formats might lead to uneven eating behaviors, like missing meals, especially breakfast, along with increased snacking later if cafeteria offerings feel dull or unfulfilling (Maslahat & Khaq, 2023; Said et al., 2023; Shinde et al., 2021).

Most adolescents at boarding schools adjust what they eat because of strict routines. Food choices at boarding schools face constraints due to policies, faith-based customs, or rigid meal systems. Though fixed menus ease kitchen work and lower expenses in numerous cases, variety tends to shrink, leaving little room for health requirements, sensitivities, or taste differences. Research examining meals served in educational settings shows preset plans may streamline logistics yet undermine eating freedom and nutritional value if better options remain scarce (Chouraqui et al., 2021; Eliasi & Dwyer, 2002; Muttaqin et al., 2024; Priestner et al., 2024).

Fasting traditions tied to faith sometimes shape when students eat at boarding schools. Across many Muslim residential settings, skipping food during daylight hours is normal - shifting when meals happen, along with how much energy people take in. Research shows that these routines, even when freely chosen and rooted in culture, can delay mealtimes or result in missed morning nutrition. Without careful scheduling by the institution, overall nourishment across the day might fall short (Nor et al., 2021).

Support shows best not through rules but through a small room to choose. Successful change relies on listening rather than enforcing (Leng & Dayimu, 2025; Mander et al., 2015; Salim et al., 2024; Tang et al., 2020; Zhong et al., 2024).

**4.4 Individual-Level Influences**

Leng et al. (2025) found that boarding school students' adjustment varies with age, mental growth, mental health, emotional resilience, growth and development, and family background. These characteristics affect the overall wellbeing within the boarding school environment. Some students at the boarding school better shape their character. Past experiences sometimes weigh more heavily than current support systems. Not every challenge shows up at once; timing plays a hidden role. Responses vary widely, even among peers raised similarly. What helps one learner thrive may overwhelm another nearby (Martin et al., 2014).

The study by Jia, Li, and Xie (2024) also elaborates on how, though less visible, adolescents' ability to manage emotions often shapes their boarding school experience. Secure bonds formed early in life help some adapt smoothly, even when their parents are far away. When connection feels uncertain, though, distance can deepen feelings of isolation. Emotional steadiness shows up more often in students who trusted that care was available before. Without that base, stress may build quietly - spilling into sleepless nights or quiet withdrawal (Kidane, 2012).

Studies by Tang et al. and Mander et al. indicate that adolescents often feel a stronger sense of social belonging, shaping how they adapt. At that point, losing close support networks can hit harder emotionally. Entry during these years might weigh more heavily compared to joining later, when self-reliance grows. Identity begins taking clearer shape just as students face new environments. By mid-adolescence, relationships outside the family tend to stabilize, softening such shifts (Romadhon et al., 2025; Wang et al., 2015).

Resilience matters as much as teens' ability to handle stress. Studies show that young people who use effective strategies, such as tackling issues head-on or managing their feelings well, often adjust better to boarding school routines. When support networks are strong, reaching out becomes easier too. On the flip side, shutting down or escaping problems tends to deepen mental strain. Facing challenges directly usually leads to steadier outcomes (Mahmood & Shaikh, 2026; Raut et al., 2024).

Some learners adjust better because they believe in their academic abilities. When challenges appear, confidence can turn pressure into drive. Others, unsure of themselves, might feel overwhelmed by expectations. Doubt grows easily in strict environments. Stress builds when mistakes seem dangerous. Fear of failing is

closely related to anxious thoughts. A shaky sense of competence leaves room for emotional strain (Ajie & Chapman-Novakofski, 2014). The factors influencing the boarding school nutritional outcomes, as shown in figure 2


***Figure 2: Factors influencing nutritional outcomes in boarding school settings***

## 5. Nutritional Status of Boarding Adolescents

Understanding the nutritional status of adolescents in boarding schools is important for assessing how well institutional food systems function. These schools play a major role in deciding what food students can access and consume. As a result, students' nutritional status reflects the combined influence of school food provision, the surrounding environment, culture and social practices, and individual eating habits. Studies commonly assess this through indicators such as BMI-for-age, height-for-age, micronutrient status (especially hemoglobin level), and overall dietary quality.

### 5.1 Double Burden of Malnutrition in Boarding Schools

The nutritional status variations are not linked to one country alone; in our findings, it was noted that across varied regions, signs point to adolescents in boarding schools facing two forms of poor nutrition at once: too little food, too much unhealthy intake, alongside missing key vitamins and minerals - sometimes even among peers in one setting (Bennett, 2020; Gajdoš Kljusurić & Colić Barić, 2004; Hidayanti et al., 2025; Yunianto et al., 2026).

A single snapshot of boarding students in Tanzanian secondary schools revealed repetitive meals that lacked essential micronutrients like iron, calcium, zinc, and vitamin C. Among these youth, nearly one-quarter showed signs of anemia, a similar share carried excess weight, while more than six percent met criteria for obesity - clear signs of uneven nutrition even within standardized meal systems. Boys ate somewhat more protein and carbs than girls did; however, their overall eating patterns still lacked critical nutrients. Quality gaps persisted across genders, suggesting that the sheer volume of food does little to fix poor variety (Luo et al., 2009; Priestner et al., 2024).

### 5.2 Undernutrition Affecting Growth and differences among institutions

One out of every four teens at a religious boarding school in Indonesia showed signs of poor nutrition, based on body measurements revealing low weight and short stature. These findings point to long-term gaps in diet quality in schools with limited resources. Surprisingly, boys faced greater risks than girls, likely due to their faster growth rates or differences in how meals are shared across the institution. Evidence suggests that food access in such settings may not evenly meet student needs. About a quarter of the youth studied fell below standard growth markers, highlighting persistent challenges in feeding adolescent populations adequately (Mosby & Galloway, 2017; UNICEF, 2003; Zamzam et al., 2024).

Over time, poor nutrient intake often stems from narrow food variety, small servings, or dependence on basic staples - patterns previously tied to structural factors. Although earlier research pointed to systemic influences, observed outcomes closely match those conditions (Anwar et al., 2019; Sodik et al., 2018). Among

boarding-school adolescents, nutrition differs noticeably even when they live under one roof. One look at boys living in dorms showed most had average weight for their age. Still, some were underweight, and three per cent fell into the thin category. Overweight was more common, affecting eight out of every hundred. Obesity sat at three per cent. These numbers highlight clear differences within a single group (Chouraqui et al., 2021).

One reason outcomes differ lies in how personal traits like metabolism or daily movement respond to common dining settings. Where people eat the same meals yet show varied health results, it reveals a mismatch between supply and biological uptake. Differences in past diet patterns shape present responses, even under identical conditions. When routines collide with physiology, effects scatter rather than align. Uniform access still permits uneven benefit, since bodies absorb and utilize nutrients in distinct ways (Chouraqui et al., 2021; Eliasi & Dwyer, 2002; Priestner et al., 2024).

**5.3 Nutrient Adequacy**

Looking at what students eat in boarding schools helps explain their nutrition levels. Research shows meals often centre on repetitive grains, lacking enough meat, produce, and dairy (Eliasi & Dwyer, 2002; Luo et al., 2009). Because of this, key nutrients like iron, zinc, and certain vitamins fall short, leading to poor absorption and health issues such as anemia.

Though meals look simple on the surface, behind them sit rigid rules around buying, spending, and organizing food within organizations. Where supplies come from, how much space exists to keep ingredients, also shapes what gets served. Shared dining settings often mean people eat whatever is provided, even when it lacks balance. Without personal control over selections, habits form that repeat across days regardless of nutritional value. Even when research overlooks gender differences, signs point to boys in residential schools dealing with layered dietary issues, low levels of essential vitamins, low body weight, and also rising cases of excess weight. Because teens need more fuel and nutrients, rigid meal plans in dormitories often fall short, leaving them prone to shortages or poor balance (Chouraqui et al., 2021; Eliasi & Dwyer, 2002; Priestner et al., 2024).

**Table 2: Summary of Nutritional Status**

| Subsection | Key Theme | Main Findings | Supporting Evidence |
|---|---|---|---|
| 5. Nutritional Status of Boarding Adolescents | Overall nutritional assessment | Nutritional status reflects the combined effects of institutional food provision, environmental conditions, sociocultural practices, and individual behaviors. Standard indicators include BMI-for-age, height-for-age, hemoglobin levels, and dietary quality. | Conceptual framework-based synthesis |
| 5.1 Double Burden of Malnutrition | Coexistence of under- and overnutrition | Adolescents in boarding schools experience both undernutrition and overnutrition simultaneously. Studies showed that around 25% had anemia, approximately 25% were overweight, and nearly 6% were obese. Studies also showed that diets were repetitive, with micronutrient content and insufficient energy intake. | Adedoyin.,(2023); Ogechi et al., (2007); Serrem et al., (2020); Gajdos et al., (2004); Shinde et al. (2021) |
| 5.2 Undernutrition and Growth Differences | Stunting, thinness, and intra-school variation | Around one out of four adolescents were stunted or underweight, especially in resource-limited boarding schools. Boys were often more affected because of higher growth needs. Even in the same school, nutrition outcomes differed due to biological and behavioral factors. | Rimbawan et al., (2023); Amalia et al., (2023); Indriasari et al., (2020); Li et al., (2023); Nor et al., (2021); Otuneye et al., (2017); Said et |

| | | | |
|---|---|---|---|
| | | | al., (2023); Eliasi et al (2002) |
| 5.3 Nutrient Adequacy and Dietary Gaps | Poor dietary diversity and micronutrient deficiency | Adolescents' diets were mainly focused on cereal, legumes, with limited dairy products, fruits and vegetables. Students' limited access to important nutrients increases the risk of anemia and poor health. The boarding school system restricts the food diversification and students' choice. | Adedoyin., (2023); Said et al., (2023); Shinde et al. (2021) |

## 6. Nutritional Interventions Implemented

The conceptual framework aims to improve dietary intake by addressing essential nutrients, the food system and supply, living conditions, social practices, and eating behaviors by enhancing consistent dietary intake and long-term nutritional health in boarding schools. The anthropometric status improved slightly over a short nine-month intervention period. The broader school settings support the fortified meals, dietary education, and multicomponent intervention, but these findings are contextually interpreted as school-specific.

This indicates that many interventions were implemented to improve nutritional and dietary intake as well as to increase monitoring and nutritional habits in boarding school settings. School meals stand out in the research because they reshape core elements such as which foods are served, how balanced each dish is, and whether portions meet needs. A closer look comes from Indonesia: in a nine-month period at an Islamic boarding school, 319 youths received both daily meals and lessons on diet. Results were better hemoglobin readings, along with higher consumption of protein, iron, and vitamin C. Even though physical growth markers shifted little during those months, anemia rates dropped sharply-from 42.6% down to 21.7% among students who started underfed. Their grasp of healthy choices grew stronger, too, reflected in better scores on knowledge, attitude, and practice assessments. Such results echo wider findings: feeding programs work best against low nutrient levels and blood deficiency when menus include richer or enhanced ingredients (Najdah et al., 2026). Methodological quality was assessed for each design using the appropriate assessment tool [INSERT tool, e.g., Newcastle-Ottawa Scale/ RoB2/AMSTAR-2], as shown in Table 3.

**Table 3: Nutritional Interventions in Boarding Schools**

| Year | Country- [Population] | Study design | Study Quality (Indicative) –Sample Size | Outcomes | Citation |
|---|---|---|---|---|---|
| 2018 – 2021 | Indonesia (Sodik); Multi country protocol(Shinde)- [Islamic boarding school adolescents (Indonesia)] | Quasi-experimental (boarding school setting) | Moderate – pre-post design, no control group; Shinde et al. is a review *protocol*, not completed results- [9-month school feeding program + nutrition education- {n =319} | ↑ Hemoglobin; ↑ protein, iron, vitamin C intake; ↓ anemia prevalence (42.6% → 21.7%); improved KAP; no major anthropometric change | Sodik et al. 2018, Shinde et al, 2021 |
| 2018 | Global- Multi country [School-aged children & adolescents (multi-country)] | Review/synthesis of school feeding evidence | Moderate–High – authoritative multi-country synthesis, but not primary data- [ School feeding programs with fortified/diversified menus]- {Not Specified) | Improved micronutrient status; reduced anemia; improved dietary intake | Bundy et al., 2018 |

| | | | | | |
|---|---|---|---|---|---|
| 2020 | Multi-country (LMICs)-[School-aged populations] | Evidence synthesis (fortification studies) | High – Campbell Collaboration systematic review methodology-[Food fortification (iron-fortified staples, biofortified crops)]-{Multiple Studies} | Reduced micronutrient deficiencies; improved iron status | Salam et al., 2020 |
| 2019 | Ghana-[ LMIC school systems] | Program evaluation/policy analysis | High-Cluster RCT-[ Local procurement school feeding models]-{Multiple Sites} | Improved diet quality, sustainability, and local food access | Gelli et al., 2019 |
| 2015 | China-[ Rural Chinese adolescents] | Quasi-experimental | Moderate – single-arm pre-post, no control group- [Nutrition education program (6 months)]-{Not Specified} | ↑ Knowledge, attitudes, dietary behaviour; limited biomarker change | Wang et al., 2015 |
| 2025 | Indonesia-[ boarding school adolescents (girls)] | Peer-led intervention study | Low–Moderate – design and comparison group not clearly reported-[ Peer education on healthy snacking]-{Not Specified} | Improved snacking behaviour and dietary awareness | Romadhon et al., 2025 |
| 2014 – 2025 | Pakistan (Mahmood); Nepal (Raut); Multi Country (Ajie)-[ Religious boarding schools] | Quasi-experimental, Systematic Review-Multi-study intervention reports | Mixed – Mahmood is a study *protocol* (no results yet); Raut is quasi-experimental; Ajie is a systematic review-[Structured health education & outreach sessions]-{Not Specified} | Improved knowledge of balanced diet and healthy lifestyles | Mahmood et al., 2025; Raut et al., 2024; Ajje et al., 2014 |
| 2025 | Pakistan- School adolescents (Pakistan) | Randomized controlled trial, Intervention +Evaluation + | High – RCT with defined sample size-[Nutrition education + WASH + micronutrient-related intervention]-{n=603} | Prevented BMI decline; improved health indicators; modest biomarker changes | Perveen et al., 2025 |
| 2022 | Indonesia-[ School adolescents] | Integrated adolescent nutrition programs (reviewed evidence) | Moderate – not RCTs; Soekarjo is qualitative policy analysis, not an outcomes study- [School meals + IFA supplementation + SBCC]-{Multi Study} | ↑ Dietary diversity; ↑ micronutrient intake; improved behaviours | Oddo et al., 2022; Soekarjo et al., 2018 |
| 2022 | Multi-Country-[Adolescents (LMIC schools)] | Integrated nutrition program synthesis | High – systematic review with meta-analysis-[Multicomponent nutrition + health interventions]-{Multi Study} | Improved diet quality and health behaviours | Medeiros et al., 2022 |
| 2012- | Muti-country- | School | Moderate – Haldar/Gitau | ↑ Haemoglobin; ↓ | Medeiros eta |

| | | | | | |
|---|---|---|---|---|---|
| 2022 | India (Halder); Kenya (Gitau) [Adolescents] | feeding + fortified food studies | are single-site observational/quasi-experimental; Medeiros is high-quality SR (see row above)-[ Fortified school meals]-{Mutiple Studies} | anemia prevalence | al, 2022; Haldar et al., 2012, Gitau et al., 2016 |
| 2026 | South Korea-[ School/boarding adolescents] | Dietary intervention studies | Low–Moderate – underlying study designs not specified in source-[Dietary improvement programs]-{Multiple Studies} | ↑ Protein, iron, and vitamin intake; improved dietary diversity | Kang et al., 2026 |
| 2022-2025 | Indonesia (Salim, Hidayanti); Türkiye (Özoruç)-[Adolescents] | Short- and medium-term interventions | Low–Moderate – descriptive/observational ; comparison groups not consistently reported-[ School nutrition programs]-{Multiple Studies} | Modest and inconsistent anthropometric changes | Salim et al., 2022; Hidayanti et al., 2025; Ozoruc et al., 2025 |

Local sources of food fortification with nutrient-dense foods improve nutrient intake. Nutrition education can improve dietary choices for selected foods, but the changes in anthropometric outcomes when the food is repetitive remain inconsistent. The multicomponent integrated intervention combines nutrition education with school meals, WASH, food diversity, health monitoring, and micronutrient strategies relevant to the boarding schools. These approaches may be sustainable when tailored to the local culture and resources and integrated into the routine schooling system. The evidence suggests that nutrition education becomes more effective within the institutional food environment. Nutritional knowledge and behavior may increase with education, whereas anemia, micronutrient status, and growth need adequate dietary intake, food quality, nutrient density, and sustained support from schools.

Iron-rich staple foods, along with crops enhanced through breeding, contribute to better vitamin and mineral levels in teens, reducing shortfalls often seen in youth groups (Salam et al., 2020). Adolescents' school programs can improve dietary habits by incorporating locally sourced food, sustainable practices, and the integration of local food systems and communities (Gelli et al., 2019). Despite aiming at personal choices, classroom-focused nutrition efforts often ripple into shared teenage social patterns. A half-year program in rural Chinese schools boosted teens' grasp of basic dietary principles and shifted some eating habits, yet blood measurements showed little shift (Indriasari et al., 2020). In group settings like Islamic dormitory schools, student-run activities nudged snack selections toward healthier options - proof that peers can steer each other's daily decisions (Nicholaus et al., 2020). When similar lessons were delivered across faith-based residential schools, learners gained clearer ideas about meal balance and wellness routines after organized teaching blocks (Ajie & Chapman-Novakofski, 2014; Mahmood & Shaikh, 2026; Raut et al., 2024). Even so, better insight and claimed habit shifts rarely translate into measurable physical gains unless food access itself improves alongside learning.

Recent studies point to broader efforts tackling several aspects at once, rather than isolated actions. One experiment in Pakistan applied lessons on healthy eating alongside clean water measures and added nutrient support, which helped teens maintain better body mass and overall nourishment (Perveen et al., 2025). In much the same way, projects that brought together school-based food programs, supplements such as iron and folic

acid, and messaging aimed at encouraging healthier choices led to wider food variety and improved daily habits in various regions (Oddo et al., 2022; Soekarjo et al., 2018). Boarding schools create conditions where surroundings, rules, peer influences, and personal decisions blend tightly - making them fitting places for complex solutions. Working on many layers all at once allows methods to stick longer while covering more ground in shaping how young people eat and feel day to day. The meal environment is a determinant of dietary diversity, adequacy, and planned menus, including dietary diversity and nutrient density. It is directly associated with increased dietary intake and hemoglobin levels and reduced anemia prevalence. Conversely, similar or repetitive foods meet total energy intake requirements but remain inadequate in micronutrient and macronutrient content (Haldar et al., 2012) .

Environmental conditions influence sanitation, food safety, water availability, and additional food options. Integrated interventions improve dietary intake, WASH, and health, reduce illnesses and nutrient deficiencies, and support improvement in nutritional outcomes. Similarly, sociocultural factors, including teachers' and peers' influence, shared routines, and religious practices, help shape food acceptance and dietary behavior(Gitau et al., 2016). Culturally acceptable meal planning can improve acceptability and adherence, while individual factors such as age, nutritional knowledge, physical activity, and food preferences can modify the responses. The reinforcement of multilevel approaches that place responsibility solely on adolescents (Kang et al., 2026).

Though education efforts help boost understanding and habits, bigger gains in nutrition - like lowering anemia and raising vitamin levels - show up more clearly when changes happen right inside the school meal system (Kang et al., 2026). The literature indicates that height, weight, and BMI increase inconsistently, imbalanced food intake, poor diversification, unhealthy living and social factors affect the adolescents' nutrition and growth (Hidayanti et al., 2025; Özoruç et al., 2025; Salim et al., 2024). The boarding school needs an effective environment for healthier meals, nutrition education and a supportive health environment to enhance eating habits.

## 7. Determinants of Nutritional Outcomes

The school adolescents' nutritional outcomes are shaped by individual family background, hygiene, school environment and surrounding factors which are essential for health variation and effective nutritional intervention. Most immediate influence on nutrition comes from the setting where meals are served - specifically, how varied, nutritious, and well-balanced school food options are. When boarding institutions offer planned meal schedules with broader menu choices or added nutrients, overall diet quality improves alongside stronger blood markers, such as hemoglobin, thereby reducing anemia cases (Özoruç et al., 2025). On the flip side, repetitive meals high in calories yet low in essential nutrients tend to maintain poor vitamin and mineral levels, even with adequate energy consumption.

Food habits and nutrition in boarding schools depend heavily on surroundings, not just official policies. What shapes eating patterns includes how meals are scheduled, sanitation standards, availability of extra snacks, cleanliness routines, plus where pupils sleep at night. When health efforts combine clean water projects with balanced diet support, results improve - fewer illnesses mean fewer lost nutrients, and better growth is shown in studies. The layout and daily framework of these schools influence what students eat; control over personal choices may shrink, yet steady oversight allows reliable meal quality. Structure limits freedom, though it opens doors to routine-based wellness.

Young people bring different personal traits into dining halls - what they know about food, how they feel about healthy eating, ways of handling stress, their age, even bodily requirements - all shaping what ends up on their plates. When schools teach nutrition, students often say they eat better afterward; yet actual improvements in diet quality rarely follow unless other changes happen at the same time (Najdah et al., 2026; Oddo et al., 2022; Perveen et al., 2025). Those already attuned to wellness messages tend to make fuller use of

healthier meals offered at school, while others who lack understanding or are stuck in unhelpful routines might miss out, regardless of the help available. Seeing student diets through a lens of layered influences - personal, social, structural - offers clearer insight than blaming any one cause.

## 8. Implementation Challenges

Even with growing evidence that nutrition efforts in schools and boarding settings are effective, real-world implementation often hits roadblocks that weaken long-term success. One of the major issues is that funds are short, especially for residential or boarding schools facing these hurdles. Meals are made with a variety of fortified ingredients, which require consistent funding for food purchasing, food delivery, and facility maintenance. However, meal quality declines, leading to poor implementation when resources are unstable or unevenly distributed.

The boarding school students have limited choices and a fixed supply of food that meets the minimum caloric intake, but essential nutrients remain short. Although food fortification and variety of meal plans can improve nutrient intake, limited and unstable resources minimize the choices of food fortification and meal plan variety (Bundy et al., 2018). These organizational challenges make it difficult for schools to provide stable nutrition in boarding schools. Even when schools aim to improve nutrition, the results depend on supply, delivery, and resource systems beyond their control. Another challenge comes from students' behaviors and cultural expectations. Even when healthy foods are available, adolescents may reject them if they do not match their tastes, home eating habits, or peer preferences. Research suggests that peer-led programs and behavior-focused interventions can help youth to adopt healthier food choices (Romadhon et al., 2025). However, sustaining those shifts requires ongoing support and a school environment that promotes healthy food choices. In many cases, religious or local context influences the meal, which is acceptable, so they plan carefully to meet the context requirements of acceptability (Ajie & Chapman-Novakofski, 2014; Raut et al., 2024).

Another major challenge is coordinating all stakeholders at different levels to successful programs. These initiatives rely on coordination among teachers, healthcare providers, school management and food providers; weak or poor administration creates inconsistencies in balanced nutrition, hygiene and the systematic operation of school meal programs (Medeiros et al., 2022). These school programs have limited scope to enhance adolescents' health without uniform policies, management, locally tailored meal diversification and sustainable funding. This review highlights the importance of recognizing boarding schools and their nutritional policies for adolescents, and that these policies should address food quality, food diversification, macronutrient adequacy, food safety, WASH, and sustainable resources compatible with local culture. The boarding schools should develop minimum standards for balanced meals, dietary diversity, nutrient density, portion adequacy, regular nutritional assessments, and local purchasing, with trained food service staff ensuring food sustainability and food quality. Strict supervision and a reliable food supply chain can improve the nutritional status of adolescents in boarding schools. Nutritional education should be included in the boarding school curricula and be part of the school routine, reinforced by teachers, peers, healthcare workers, and stakeholders. Cultural and religious aspects should be part of the acceptability of the food program and sustainability.

The finding support the SDG 2 (Zero Hunger) with the improvement of access and to the adequate food and food diversity; SDG 3 (Good health and well-being) helps to the prevention of malnutrition and macronutrient deficiency; SDG 4 (food quality) can be improved with nutrition, health education and leaning support; SDG 6 (Clean water and sanitation) with the importance of food safety, environment and WASH; SDG10 (Reduced inequality) can be reduced by highlighting the overlooked Islamic boarding schools which have a large chain of schools. These are the policy implications that support the evidence rather than as direct SDG achievement (Bhandari, 2024; Hameed et al., 2024; Hameed et al., 2023; Hameed & Siddiqui, 2024).

## 9. Conclusions and Implications

Adolescents in boarding schools experience multiple changes in nutrition, including diversification and limited dietary choices. Evidence shows that inadequate and imbalanced nutrition, deficient micronutrients, imbalanced weight and unhygienic and unhealthy eating are major risks in boarding schools. All of these are influenced by the school meal system, friends, individual preferences, food availability and accessibility, daily eating habits, social and environmental factors and a tight schedule in boarding schools.

Better meals help adolescents eat well, learn about a balanced diet, diversify their food choices, and promote health literacy through a meal menu. The success depends on the local food system, the program must match the local community habits, eating behavior, source of funds and the local people who carry the system. Locally tailored solutions reflect local needs, environment, basic needs, cultural adaptation, and a broader system shaped by consistent progress in boarding school dietary requirements. Evidence-based, strong policy, integrated with investment in research and intervention programs, can create a healthy food environment and dietary outcomes among school adolescents.

The long-term benefits can be achieved by improving the food system in boarding schools to support adolescents' health, academic performance, and overall well-being among adolescents. By building more resilient supply networks within these organizations, positive ripple effects may extend into daily functioning and development during critical growth years. The results align with SDG 2 (Zero Hunger) by improving dietary variety; SDG 3 (Good Health and Well-being) by reducing anemia and improving the affordability of micronutrient; SDG 4 (Quality Education) by advancing school participation system; SDG 6 (Clean Water and Sanitation) by providing the facilities and educating about the pros and cons of WASH conditions; and SDG 10 (Reduced Inequalities) by beginning nutritional insufficiencies in underfunded boarding schools.

This review emphasizes that policymakers should give boarding schools proper, urgent attention to their food procurement, food diversity, budget allocation, reliable income-generating mechanisms, accessibility, and the affordability of nutrient-rich food. The system should sustain financing, improve the efficiency of local purchasing, ensure equitable resource allocation for the scale-up of food interventions, and reduce the economic burden on undernutrition programs and activities. The role of boarding school settings and the need for balanced nutrition in shaping adolescents' eating habits should be prioritized, and nutrition-sensitive policies should be prioritized to improve teens' health and well-being.

When shaping national health plans, boarding schools should be prominently featured within adolescent nutrition initiatives. Clear rules should be defined for nutrition standards, with sustainable resource allocation, food quality and diversification, including essential, balanced micronutrient intake, accessibility of local food, meal consistency, and promotion of long-term nutritional outcomes. The available research evidence about the boarding school food system is limited compared to the conventional schooling system, but the research on religious boarding schools' food and food diversity is scarce, and it is difficult to determine the nutritional intake, nutritional risks, locally developed food interventions, and segregated responses of boys and girls. The boarding school system needs more attention, including integration between all stakeholders.

***Limited context-specific research:***

The research evidence focuses on non-resident adolescents, but there is limited information about boarding schools and few conclusions regarding sustainable effects on growth, macronutrient status, and health status. Even available data does not provide separate data for boarding girls' and boys' schools in low-income countries.

***Lack of longitudinal and intervention studies:***

Most of the existing evidence comes from cross-sectional or short-term studies on individual dietary behavior rather than on the school food system, so the reported effects are short-term. Several long-term studies

examine day scholars, but boarding schools, especially Islamic boarding schools, should be included in research on food procurement, budgeting under limited resources, food planning, food safety, food accessibility, meal timing, and management at the individual and institutional level.

***Insufficient focus on food systems approaches:***

The current studies focus on individual and domestic audiences, but pay very little attention to boarding schools, which face many challenges and lack regular income, proper meal planning, or support from government authorities. Future studies can be more helpful in understanding the complex existing food system, enabling better, more practical interventions for the boarding schools' environment.

***Measurement and evaluation limitations:***

The boarding schools, especially religious schools that operate without a proper source of income, have limited choices for food diversification and balanced diet planning. The adolescents in these schools have limited dietary options and unbalanced and inadequate nutrition with low essential macronutrients and high carbs. Consequently, a major proportion of adolescents face underweight or obesity, and they should be treated differently with good, balanced food composition because conventional school students have many food options.

The local interventions encompass psychosocial, cultural, resource availability, institutional capacity, and sustainable food procurement, monitoring, hygiene, nutrition, and health services. A coordinated food system strategy may help boarding schools support healthier growth during adolescence. Longitudinal research studies are needed to determine the combinations of food diversity, nutrition education, and hygiene that sustainably improve adolescent dietary outcomes.

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**Ethical Approval**

This research article has not violated any ethical standards.

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