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Efforts Undertaken by Several ASEAN Countries to Address Childhood and Adolescent Obesity in School-Based Programs: A Systematic Review

Upaya yang Dilakukan Beberapa Negara ASEAN untuk Mengatasi Obesitas Anak dan Remaja dalam Program Berbasis Sekolah: Tinjauan Sistematis

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ABSTRACT

Background: Childhood and adolescent obesity is on the rise in Southeast Asia. Necessitating stronger actions from ASEAN governments to address this issue, because the significant financial and social welfare implications. Schools provide an effective platform for targeted interventions among children and adolescent groups.
Objectives: This study provides an overview of school-based nutrition interventions implemented in ASEAN countries to address childhood and adolescent obesity.
Methods: A literature review was conducted by searching multiple databases (Google Scholar, PubMed, ProQuest, ScienceDirect, and Web of Science) between April 1 and May 1, 2023. The search included computer-based searches and manual search in relevant journals. The articles considered were limited to publications from the past 10 years.
Discussion: School-based nutrition interventions in ASEAN countries require further development, with attention to key factors such as intervention duration, sample size, and family involvement.
Conclusions: Urgent large-scale research is needed to evaluate the effectiveness of existing school-based nutrition programs. Integrated and effective programs require support and collaboration from families, the private sector, and the government.

INTRODUCTION

Despite the numerous positive impacts brought about by rapid technological advancements in the present era, negative consequences are inevitably present. In the field of health, economic and technological development not only leads to the creation of beneficial health innovations but also simultaneously triggers shifts and changes in unfavorable lifestyle trends within society[1]. One prominent observed lifestyle trend is the prevalence of unhealthy eating patterns and the rise in sedentary activities, both of which are contributing factors to obesity[2,3].

Over the past two decades, the rapid growth in the Asian region has been accompanied by an increase in obesity rates. Recent statistics indicate that more than 40.9% of adults in the region are currently classified as overweight, in comparison to 34.6% in the year 1990[4]. This indicates a 38% increase in obesity rates in Southeast Asia, which is higher than the average increase across Asia as a whole. Although Southeast Asia has relatively lower rates of childhood obesity compared to other regions, projections suggest that by 2030, nearly 20 million children aged 5-9 and over 25 million children aged 10-19 in the region will be affected by obesity[5]. Risky behaviors such as poor dietary patterns and lack of physical activity often emerge during childhood and adolescence, persist into adulthood, and become entrenched habits that are difficult to rectify, leading to inevitable clinical manifestations[6].

Diseases associated with obesity as a risk factor are chronic conditions that require extensive and costly management[7–9]. This, in turn, has a negative impact on the financial condition of a country. In a study conducted in 2019, the economic impact of obesity was estimated using a cost-to-illness approach in eight countries (Australia, Brazil, Mexico, Spain, Saudi Arabia, South

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Africa, India, and Thailand)[10]. The study revealed that a 5% reduction in the projected prevalence of obesity or maintaining it at the same level as in 2019 would result in an average annual reduction in economic costs of 5.2% and 13.2% by the year 2060.

In recent years, numerous research studies have focused on the treatment of chronic diseases resulting from obesity. However, nutrition has rarely played a significant role and, if considered, it is often viewed as an adjunctive therapy rather than a primary component of a curative approach[11]. Investment in programs aiming to modify comprehensive lifestyle behaviors is crucial in addressing the challenges associated with childhood and adolescent obesity[12,13].

The main factors contributing to childhood overweight and obesity are related to an imbalance between calorie intake and expenditure. Since children spend a significant portion of their day at school and consume a considerable portion of their daily calories in that environment, schools are seen as an optimal setting for implementing interventions to address obesity. As a result, schools have been recognized as relatively effective platforms for addressing obesity among a large number of children[14,15].

Considering the aforementioned facts and projection figures, it is imperative for governments, including those within the Association of Southeast Asian Nations (ASEAN), to enhance the urgency and prioritize aggressive implementation of obesity management or intervention programs targeting children and adolescents. This is warranted by the magnitude and severity of the consequences associated with the issue. This study object to present a comprehensive overview of nutrition intervention programs based in schools, which have been implemented or are currently underway in various ASEAN countries. These programs are specifically designed to tackle the problem of obesity among children and adolescents.

METHODS

After establishing the objectives of this study, the author conducted review by searching for relevant articles through various databases such as Google Scholar, PubMed, ProQuest, ScienceDirect, and Web of Scopus. The keywords used for this study are “obesity”, “overweight”, “malnutrition”, “children”, “adolescent”, “youth”, “school-age”, “peer”, “intervention”, “nutrition”, “school-based program”, “ASEAN”, “Brunei”, “Cambodia”, “Indonesia”, “Laos”, “Malaysia”, “Myanmar”, “Philippines”, “Singapore”, “Thailand”, “Timor Leste”, and “Vietnam”. For this study, inclusion criteria were established to ensure the selection of relevant articles addressing school-based nutrition interventions in ASEAN countries to combat childhood and adolescent obesity. The inclusion criteria were articles focusing on any of the ASEAN member states were eligible for inclusion. These include Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Timor Leste, and Vietnam. Articles published within the past 10 years, between April 1, 2013, and April 1, 2023, were considered for inclusion. Articles that specifically addressed school-based nutrition interventions and their impact on childhood and adolescent obesity were included. These interventions encompassed dietary programs, physical activity initiatives, educational campaigns, or any approach aimed at improving the nutritional habits and overall health of students within the school setting. To ensure the selection of high-quality and relevant studies, the following exclusion criteria were applied. Articles published in languages other than English were excluded, which might have led to the omission of potentially valuable studies published in local languages. This exclusion criterion may have limited the representation of non-English language research in the study. Studies that did not directly address school-based nutrition interventions or their impact on childhood and adolescent obesity were excluded.

A systematic approach was employed for data extraction. Relevant data, including study characteristics, methodologies, sample size, intervention details, and conclusions, were extracted from each selected articles. The data extraction process aimed to provide a comprehensive overview of the various school-based nutrition interventions implemented in ASEAN countries and their outcomes. To evaluate the quality of the included studies, the Jadad score was employed for randomized controlled trials (RCTs) and experimental designs. Two reviewers independently assessed the methodological quality of each study. Any discrepancies in quality assessment were resolved through discussion and consensus. Only medium to high quality study included to this review. Data analysis was performed in a descriptive manner. Findings from the selected studies were synthesized to provide an overview of school-based nutrition interventions in ASEAN countries. The analysis focused on key factors such as intervention duration, sample size, and the extent of family involvement. It also sought to identify gaps and limitations in the existing literature, highlighting areas where further research is needed. The study did not involve quantitative meta-analysis due to the heterogeneity of the included studies and the focus on descriptive synthesis.

DISCUSSION

The study selection resulted in seven articles that met the study criteria. The selected articles can be found in Table 1. Among the 11 ASEAN countries, articles from seven countries were identified that met the inclusion and exclusion criteria. These included two descriptive studies (Singapore, Brunei Darussalam), four experimental studies with pre-post designs (Malaysia, Indonesia, Thailand, Philippines), and one cluster randomized control trial (cRCT) study (Vietnam).

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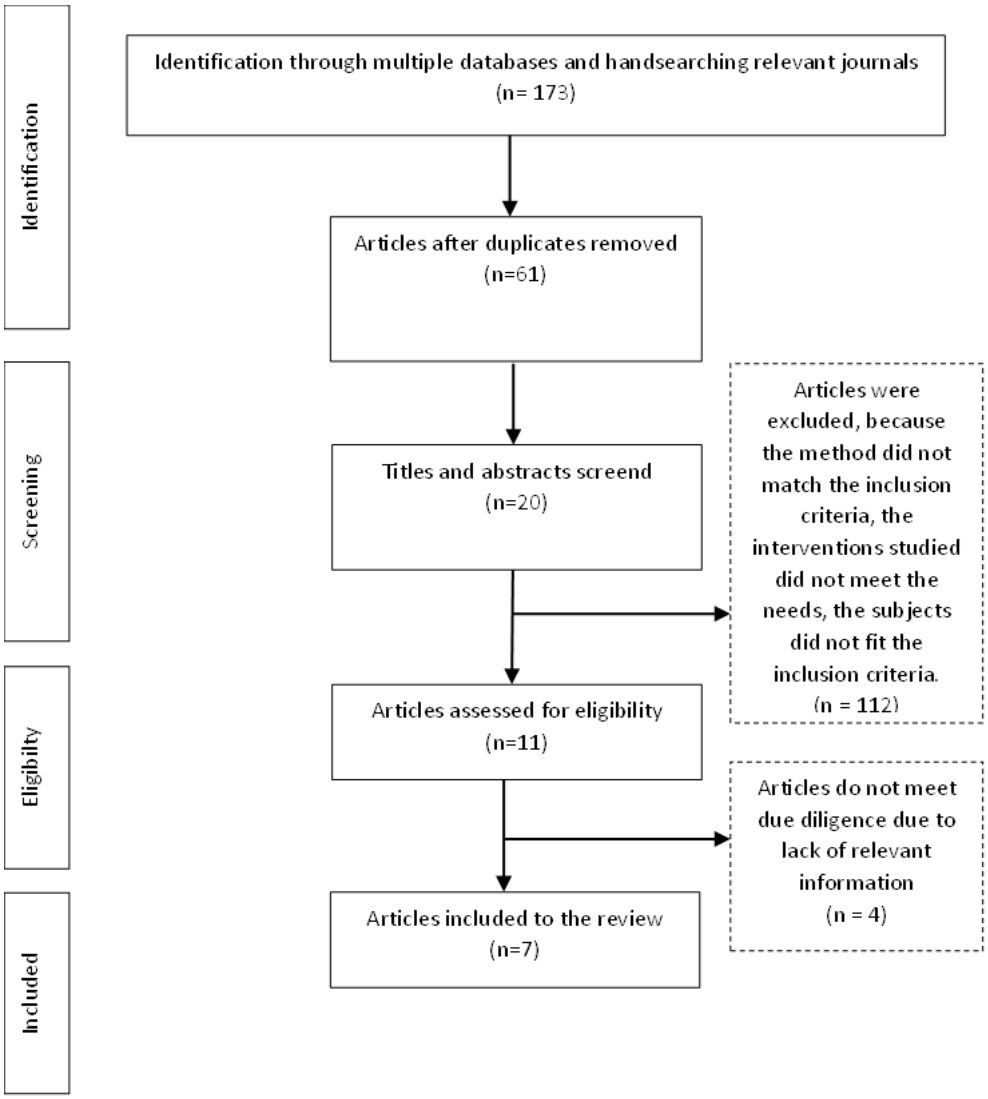

Figure 1. Study Selection Flowchart

Most ASEAN countries are classified as low-middle income nations. Drawing lessons from the success of developed countries in addressing obesity through school-based nutrition programs[15], it is evident that this concept is relatively new and requires further development in low-middle income countries. The four experimental studies[16–19] conducted in ASEAN countries yielded similar results, indicating that nutrition education interventions over a specific period effectively improved nutrition-related knowledge scores. However, an increase in knowledge does not always correlate directly with changes in attitudes, motivation, and behavior. Nutrition education programs that concentrate solely on imparting factual knowledge without addressing the cultivation of positive attitudes towards food and nutrition may not be effective enough in promoting healthy eating behaviors among students[20]. The duration of the program is also a crucial factor to consider; three of the mentioned programs lasted approximately 4-6 months, with face-to-face sessions held only once a week. Behavioral changes require a minimum of six months to observe effectiveness[21]. Even a longer-duration study conducted in Indonesia[18] for 15 months failed to significantly improve dietary variety among the sample, although it did significantly enhance vegetable and fruit consumption and physical activity.

The study conducted in Malaysia[16] utilized peer educators as a method of delivering nutrition education, aiming to enhance student receptiveness to the materials. Although this approach yielded positive results in terms of knowledge improvement, it did not lead to significant behavior change. The peer educator method has limitations as the effectiveness of program delivery by peer educators may vary. Peer educators tend to possess different abilities in terms of presentation skills, participant engagement levels, and personal characteristics that influence their delivery of the materials. Reasons why nutrition education may not translate into behavior change include insufficient parental involvement, absence of standardized implementation strategies, insufficient duration of interventions, and a lack of appropriate activities for children or adolescent related to age[22]. Therefore, stronger enabling factors are needed to induce behavior change in individuals. To facilitate sustainability and success, nutrition programs need to be integrated into

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the long-term curriculum and school policies, with ongoing support from school administrators and staff[23].

Parental involvement is a crucial factor that can contribute to the success of a child nutrition program. Despite children spending a significant amount of their time at school, their eating behaviors are greatly influenced by parenting styles, cultural factors, and values taught and practiced within their respective families. Among the studies reviewed, only Thailandappeared to include home visits as one of the research variables, although it was not extensively analyzed[17]. The objective of this approach was to promote awareness and facilitate changes in behavior through the support of families. However, effective communication between schools and families often poses a challenge. Therefore, in the future, there is a need for tools or innovations to overcome barriers and improve communication between schools and families. For instance, online platforms such as Facebook have been suggested as a means to address time constraints faced by parents in accessing nutrition education[24]. In Singapore, a workshop was organized for parents with the purpose of improving their comprehension and appreciation of the program's goals. Through this approach, parents actively engaged as collaborative partners in the educational process[25].

Active parental involvement can be observed in Singapore, where the intervention program for addressing obesity in children and adolescents focuses on increasing physical activity. Physical education classes, held several times a week for >45 minutes each session, are supported by advanced monitoring devices. This transforms the learning experience of physical activity from a compulsory and coercive obligation into personalized, self-directed learning for each child. Parents are actively involved and participate in the same activities, enabling them to acquire and understand the concepts of healthy and active living alongside their children. Moreover, multiple studies have indicated the influence of parental education on children's dietary behaviors, underscoring the importance of parental involvement in such program[26,27].

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Table 1. Results of School-Based Nutrition Intervention Articles

Title, Author	Country	Research Design	Sample	Intervention	Research Findings
Effectiveness of A School-Based Intervention on Knowledge, Attitude and Practice on Healthy Lifestyle and Body Composition in Malaysian Adolescents (Ishak et al, 2020)[16]	Malaysia	Quasi Experimental	44 youth from 2 schools (randomly selected from Hulu Langat district in the state of Selangor)	The EPal* program consists of providing eight material topics regarding knowledge and skills in adopting a healthy lifestyle, which are delivered by peer educators over eight sessions in 8 meetings.	The intervention group reported significantly higher knowledge scores compared to the control group in the post-intervention period ($p < 0.05$) Throughout the study duration, both groups did not demonstrate significant alterations in BMI* scores or the percentage of body fat.
Effectiveness of modified health belief model-based intervention to reduce body mass index for age in overweight junior high school students in Thailand (Khumros et al, 2019)[17]	Thailand	Quasi Experimental	479 obese adolescents from 2 schools that met the criteria	The program comprises five core activities based on the HBM* theory, along with a total of 11 meetings conducted over a six-month timeframe. These meetings consist of nine student visits, one visit by the school director, and one home visit. Each contact session lasts for 50 minutes. The program employs a range of behavior change techniques to enhance student motivation towards adopting lifestyle modifications.	After the intervention, notable disparities were noted between the HBM group and the control group regarding BMI, health knowledge scores, and health behavior scores.
Evidence-Based Nutrition Interventions Improved Adolescents' Knowledge and Behaviors in Indonesia (Oddo, 2022)[18]	Indonesia	Pre-Post Design	514 were selected from several secondary schools in West Lombok and Klaten districts	The program encompasses three nutrition-specific interventions. These interventions involve providing breakfast and weekly iron-folate supplementation for girls to manage and prevent anemia, incorporating a nutrition education program into the school curriculum, and implementing a SBCC* strategy. The SBCC strategy includes mobilizing schools, enhancing the capacity of key stakeholders (such as youth peer support groups, health and non-health service providers), and conducting media campaigns.	Following the intervention, there was a notable increase in knowledge scores regarding healthy eating patterns, physical activity, and anemia. There was a significant increase in fruit and vegetable consumption, physical activity, and consumption of iron-folate supplements in female adolescents.
School and Community-Based Physical Education and Healthy	Singapore	Descriptive	-	This article provides a description of a program that focuses on increasing	Physical education classes are conducted thrice a week, with each session lasting 50 minutes. The

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Title, Author	Country	Research Design	Sample	Intervention	Research Findings
Active Living Programs: Holistic Practices in Hong Kong, Singapore, and the United States (Chin et al, 2019)[25]				physical activity and healthy food consumption in schools through collaboration and partnership with parents, and the vendors involved.	optimal physical education program aims to foster enjoyment in physical activity, encourage independent learning, enhance self-confidence, promote collaboration, and instill a sense of social responsibility within a dynamic and engaging learning environment. Students are motivated to make independent decisions, exhibit sportsmanship, engage in critical thinking, and monitor their own progress through the utilization of a heart rate monitor. Additionally, parents are scheduled to participate in physical activities at school twice a week, fostering their involvement in their children's physical education.
Assessing school-lunch feeding and nutrition education strategy for healthier kids in selected Philippine public schools (Dorado, 2020)[19]	Philiphine	Quasi Experimental	385	The nutrition intervention involved the provision of school lunches and the integration of nutrition education sessions within the regular school curriculum for the students.	At the conclusion of the study, the mean scores for knowledge, attitudes, and behaviors of school children in the intervention group exhibited a significant increase ($p<0.05$). It was observed that children and households met their protein requirements to a greater extent than their energy needs. A substantial portion of the children (25.3%) who achieved a normal nutritional status after the intervention were part of the complete school lunch and nutrition education intervention group.
Testing methods to increase consumption of healthy foods evidence from a school-based field experiment in Viet Nam (Nguyen, 2021)[28]	Vietnam	Cluster Randomized Control Trial	197 children from 12 schools in the suburbs Hanoi	Treatment 1: Nutrition education Treatment 2: Provision of healthy food	Nutrition lessons have a notable impact on enhancing children's knowledge; however, they do not effectively influence attitudes and motivation towards adopting healthier eating habits.
Nutrition Education at Schools in Brunei Darussalam: Current Status and Challenges (Hosoda et al, 2015)[29]	Brunei Darussalam	Descriptive-comparative	-	This paper assesses the current situation and challenges of nutrition education in primary schools in Brunei Darussalam, taking a comparative perspective with nutrition education in Japan.	The Food Traffic Light System determines the recommended foods and drinks that should be sold in school canteens to promote healthy eating habits among children. The guidelines employ a system of three distinct color codes (yellow, green, and red) to simplify the categorization of

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Title, Author	Country	Research Design	Sample	Intervention	Research Findings
					foods and beverages that are permissible or not permissible for sale in the school canteen, depending on the nutritional content of each item.

*) EpaL (Eat Right, Be Positive About Your Body and Live Actively), BMI (Body Mass Index), HBM (Health Belief Model), SBCC (Social Behavior Change Communication)

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In Brunei Darussalam a school lunch system is not in place as seen in other developed countries. Instead, students only have snacks during break time. Students can either bring pre-packed meals provide by their parents or purchase them from the school canteen, which operates commercially under government licenses[29]. Every school has a committee dedicated to managing the canteen, to monitor the sale of food and beverages. A system known as the "Food Traffic Light System" has been implemented in schools in Brunei Darussalam. However, the outcomes of implementing this guideline have been reported to exhibit varied reactions. Interviewed individuals have provided positive feedback, stating that this approach is an advantageous way to acquaint healthy food concept to children, such as steamed potatoes instead of fried ones, and to raise their awareness of what constitutes "healthy food." However, some find its implementation somewhat challenging, due to the apprehension of certain canteen operators, there is resistance towards offering "healthy" snacks that may not be preferred by children, also the guideline itself lacks stronger enforcement measures. The concept and implementation of providing subsidized school lunches to meet daily nutritional needs remain quite challenging in ASEAN. Even in the United States, the primary school lunch provision program, known as the "National School Lunch Program (NSLP)" has experienced turbulence due to the COVID-19 pandemic, posing a threat to food security for 33% of households with children, including 40% of Black and Hispanic households[30].

A large sample size contributes to the generalizability of research findings. Studies conducted in ASEAN countries regarding school-based nutrition programs largely consist of pilot studies using small samples, making it difficult to draw conclusions and generalize them to the entire population. Broadly speaking, the findings of this study align with a recent comprehensive analysis, known as a systematic review, examined the efficacy of school-based nutrition interventions and environmental food interventions on physical measurements, such as height, weight, and body mass index (BMI), among school-aged children and adolescents in low- and middle-income countries[31]. For instance, in the sub-Saharan Africa region, after reviewing a number of randomized controlled trials (RCTs) aiming to enhance nutritional knowledge and improve nutritional status, the authors concluded that while the interventions were successful in improving nutrition knowledge, they may have limited impact on actual nutritional status without sufficient environmental support and reinforcing facilitation. Four interconnected factors contribute to driving change that play an important role as reinforcement such as multisectoral action, engagement at multiple levels, involvement of multiple stakeholders, diverse program approaches, and social participation and empowerment. Within the nutrition intervention context, reinforcement forces can take the form of school policies, coordinated efforts among local governments, schools, and healthcare facilities, as well as the involvement of local communities or NGOs with shared interests in the field.Therefore, future research needs to consider these aspects to ensure program satisfaction that drives better nutrition behavior change among children and adolescents in schools[32].

Policy Implications

From the discussions above ASEAN governments should establish and fund comprehensive school-based nutrition programs that go beyond merely promoting awareness. These programs should incorporate evidence-based interventions and educational strategies with a strong emphasis on promoting healthy eating habits and physical activity. These initiatives should be embedded within the curriculum, involve teachers, and provide resources for extracurricular activities aimed at improving the nutritional literacy and overall health of students. Governments should ensure that school-based nutrition interventions are not short-term endeavors. They should be designed with long-term sustainability in mind, involving continuous monitoring and evaluation. This includes considering the duration of interventions and their adaptation to changing circumstances and emerging research. Recognizing the importance of family in shaping children's eating habits, policymakers should encourage and facilitate family involvement in school-based nutrition programs. This may involve workshops, awareness campaigns, and resources that help parents and guardians support and reinforce healthy eating and lifestyle choices at home. Governments should seek partnerships with the private sector, including food and beverage companies and fitness organizations, to leverage resources, expertise, and technology for the promotion of healthier lifestyles. This collaboration should be transparent and governed by strict regulations to prevent conflicts of interest and ensure the programs' integrity.

Urgent and substantial investment in research and evaluation of existing school-based nutrition programs is essential. Governments should allocate funds for large-scale, independent studies to assess the effectiveness of these interventions and to identify best practices that can be replicated across the region. ASEAN governments should harmonize policies related to nutrition and obesity prevention across the region to ensure a unified and coordinated approach. This includes setting common goals, standards, and strategies for tackling childhood and adolescent obesity. By implementing these policy implications, ASEAN governments can take proactive steps towards combating childhood and adolescent obesity, mitigating its financial and social welfare implications, and promoting healthier and more resilient future generations in the region.

Limitation of Study

One of the primary limitations of this study is the potential limited generalizability of the findings. The research focused on a specific time frame (publications from the past 10 years) and utilized available data. As a result, the conclusions drawn from this study may not be fully representative of the diverse range of school-based nutrition interventions in all ASEAN member states. Variations in cultural, economic, and educational contexts, as well as differences in the prevalence of childhood and adolescent obesity, may impact the

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effectiveness and implementation of these programs in different countries. Consequently, the findings should be interpreted with caution and may not be directly applicable to every ASEAN nation. A significant limitation of this study is also language barrier that may have restricted access to certain articles and sources. The research primarily relied on English-language databases, which might have omitted valuable studies published in local languages. Further research and data collection in individual countries are necessary to develop more context-specific and tailored interventions.

CONCLUSIONS

The integrated school-based nutrition intervention programs remain a complex model to implement in low- to middle-income ASEAN countries. Existing studies primarily consist of pilot studies and lack national implementation. However, acknowledgement is warranted for the efforts made by these countries to create school environments that prioritize the nutritional well-being of children and adolescents. Large-scale studies and research are necessary to assess the effectiveness of existing programs in the future. Collaboration and support from various stakeholders, including families, the private sector, and the government, are crucial to establish an integrated and effective school-based nutrition program.

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