



Improving School Children's Health through Nutritional Food Intervention Distributions: A Scoping Review

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Abstract

Purpose: Nutrition has a direct and substantial effect on the agenda of the Sustainable Development Goals (SDGs). Recognizing the importance of adequate diet in strengthening school children's health, the relevant parties should take the initiative to introduce effective nutrition intervention programs. Malnutrition, in all conditions, hinders children's potential to survive and thrive. It has been challenging to demonstrate that enhancing nutrition and sustainability instruction in schools leads to healthier and more sustainable eating patterns. This scoping review is to discover the important drivers and emerging themes in nutritional health intervention distributions at schools toward the attainment of SDGs for school children's health. **Data and methodology:** A scoping review of the literature was conducted between 2007 and 2022 using the Web of Science (WoS) and Scopus databases. A total of 25 journal articles were identified for a full review. **Results:** Five themes were found from the literature relevant to the scenario surrounding pupils and food intake in schools. The data implied that nutrition intervention distributions, including food literacy, food consumption, good governance, and food entrepreneurship, might have a prominent impact on the behavioral and health outcomes of school children. **Conclusions:** Findings have emerged on the usefulness of nutrition intervention distributions at school in encouraging healthy diet intake among school children and consequently meeting the Sustainable Development Goals.

Keywords: Health Improvement, Nutritional Health Intervention Distribution, School Children, Scoping Review, Sustainable Development Goals

JEL Classification Code: C12, C13, J24, L74, M00

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1. Introduction

Nutrition has a direct and significant impact on the Sustainable Development Goals (SDGs) agenda. The 2030 Agenda for Sustainable Development, which comprises 17 SDGs to combat poverty, protect the natural environment, and improve people's lives and prospects, was endorsed by all 193 United Nations Member States, recognising the need for healthy nutrition for optimal growth, prosperous development, and a satisfactory level of well-being (United Nation, 2015). To accomplish the set of these goals (SDGs), effective nutrition intervention distribution programmes must be made feasible for those who need them.

School children are among those who need an adequate supply of nutrition for their lives. School meal programmes or other school food intervention distribution are especially important for promoting a healthy diet not only for school children but also for the general public as the programmes are targeted at children from all socioeconomic backgrounds. Over the course of a decade, children's eating habits have been proven to be more flexible than adults. A school meal is described as a free breakfast or lunch which provides up to 40 percent of the daily calories provided by the school and contains nutritious items such as milk, vegetables, or fruit (Briefel et al., 2009). Malnutrition, in all conditions, hinders children's potential to survive and thrive. Most school meal programs in developing and developed countries are aimed to ensure that school children are receiving sufficient nutrition for their self-development (Oostindjer et al., 2017).

According to the Food Secure Canada Report, school meal programs can be a very relevant and direct strategy for achieving 9 SDGs and 14 other associated targets. The strategy can help the remaining eight goals indirectly but significantly (Food Secure Canada, 2021). Healthy diets are frequently far more difficult to create in isolation, and school platforms should be used to raise awareness about their relevance. Existing delivery channels like school food programs should be employed to bring out new nutrition innovations and to promote updates and referrals to existing nutrition services (de Romaña et al., 2021).

Due to a lack of research on the effects of school meals on health-related behaviors and sustainability, the complexity of the school meal programme may permit significant modifications which benefit all stakeholders. More research is required to establish the optimal method for incorporating lessons about healthy and sustainable behaviors into the school foods programme. It has been challenging to demonstrate that enhancing nutrition and sustainability instruction in schools leads to healthier and more sustainable eating patterns. Multiple elements, such as classroom instruction, nutrient availability, hands-on training, and family involvement, have been identified as crucial to the success of educational efforts. Consequently,

instructional activities can be time-consuming and costly (Harris et al., 2012).

Regardless of the significance of numerous aspects of schoolchildren's health and well-being and the substantial cost of implementing programmes, a comprehensive preliminary evaluation is required. This evaluation will enable researchers to gather information on implemented tractable designs which have the potential to transform society, health, and the food environment. In light of this, the purpose of this scoping review is to examine existing scientific studies on the benefits of school food intervention distribution on nutritional health capacities, as well as their effects on school children's knowledge, behavior, health status, food entrepreneurship, and governance.

Based on this in-depth examination, a map of emerging research trends has been created which shows the practical aspects and extended benefits of various therapies for enhancing the wellness and sustainability of school children's diet and food consumption. The following discussion will provide information about earlier studies that have been graded in terms of the amount and character of study effort on a specific subject by visualising major concepts, themes, primary sources, and types of evidence available for a specific field of knowledge.

2. Data and Methodology

This scoping review methodology was based on Arksey and O'Malley's (2005) study, with revisions by Levac et al. (2010). This strategy allows different sorts of study to be incorporated and provides a spectrum, rather than the complexity of information (Davis et al., 2009). Scoping reviews are a sort of cognition synthesis which examines the degree and direction of rational inquiry on a given issue by outlining key ideas, themes, sources, and types of evidence (Rumrill et al., 2010). This option of study will be useful for complex subjects (Hamel et al., 2021). Scoping reviews may not necessarily assess the quality of studies that match inclusion criteria, but they can help evaluate a comprehensive systematic review (Arksey & O'Malley, 2005; Ramdan et al., 2021) and track research evidence and knowledge gaps for decision-makers. The stages for this scope review process are fully listed. There are five stages involved in a scoping review.

Stage one: Identification of research questions. The goal of this study is to accomplish sustainability objectives through nutritional health interventions in school settings. This study offered two primary questions to guide the search in order to guarantee that a wide range of literature pertaining to the topic of interest was gathered. First, what is the current scientific research on the advantages of school food interventions on nutritional health capacities? Second, what

are the emerging themes of sustainable development through nutritional health interventions in the context of studies in schools?

Stage two: Identification of relevant studies. Academic journals were found using two major databases: Web of Science (WoS) and Scopus. A complete search string of keywords relevant to sustainable development through nutritional health interventions in the context of studies in schools-based research was used in the search approach (for details of scoping review search terms, see Table 1).

Stage three: Screening to remove redundant articles. The selected papers for analysis fulfilled the inclusion/exclusion criteria. During the preliminary screening, only research papers were selected. The systematic review papers, review articles, meta-analysis articles, meta-synthesis articles, book series, novels, and book chapters that did not satisfy the inclusion criteria were excluded. Regarding language and

publication year, only articles published in English between 2007 and 2022 were assessed. Publications in computer science, decision sciences, engineering, psychology, energy, and medicine were also selected in order to avoid extraneous work.

Stage four: Data charting and collation. Each article was summarised in terms of the reference, year, themes, proposed method, benefit, and limitation. To be more specific, this study would use Microsoft Excel to summarise the data obtained (see Table 2) in order to aid in thematic and comparative analysis.

Stage five: Summarising and reporting findings. Finally, we collated common themes and findings from the publications in order to better understand sustainable development through nutritional health interventions in the context of school-based research, as well as the range of new concerns explored in this field.

Table 1: The search strings

Database search string	
WoS	All fields (("school feeding" OR "school meal standard" OR "school food environment" OR "school-based food" OR "healthful foods" OR "hygiene foods" OR "healthy foods" OR "food safety education" OR "food safety knowledge" OR "nutrition food knowledge" OR "nutrient food knowledge") AND ("Students" OR "pupils" OR "schoolchild" OR "children") AND ("Canteen" OR "cafeteria" OR "food service" OR "food provider" OR "schools" OR "primary school" OR "secondary school") AND ("Consumption" OR "intake" OR "availability" OR "offers" OR "provide") AND ("Poisoning" OR "hypertension" OR "diabetes" OR "obesity" OR "overweight" OR "body mass index" OR "cholesterol" OR "high of calories"))
Scopus	TITLE-ABS-KEY(("school feeding" OR "school meal standard" OR "school food environment" OR "school-based food" OR "healthful foods" OR "hygiene foods" OR "healthy foods" OR "food safety education" OR "food safety knowledge" OR "nutrition food knowledge" OR "nutrient food knowledge") AND ("Students" OR "pupils" OR "schoolchild" OR "children") AND ("Canteen" OR "cafeteria" OR "food service" OR "food provider" OR "schools" OR "primary school" OR "secondary school") AND ("Consumption" OR "intake" OR "availability" OR "offers" OR "provide") AND ("Poisoning" OR "hypertension" OR "diabetes" OR "obesity" OR "overweight" OR "body mass index" OR "cholesterol" OR "high of calories"))

Table 2: Charting form

Source	Underpinning Theory/Model/Guideline	Method, Samples and Limitation	Main Findings	Themes
1. Nosi et. al (2021)	The 4 Ps of the Marketing Mix	Mixed-method research. The pilot project carried out in four Italian towns and 16 elementary schools	Social marketing education programs may be excellent methods for increasing children's understanding of healthy food and lifestyle. Nutritious eating is a strategy for improving family eating habits.	Food literacy and behavior
2. Levasseur (2021)	The Intergenerational transmission of The Economic Status Model.	Quantitative method.	Innutritious drinks and foods lead to health problems due to their availability. As predicted, the effects are more pronounced among non-poor students. Whereas overall healthy food intakes are adversely correlated.	Health condition
3. Kwok et. al (2020)	The Socio-Ecological Model	Quantitative method. The perspectives of policymakers and policy researchers were excluded. Does not take into account the cost of adoption. Some policy recommendations use examples from foreign contexts and cultures.	Hong Kong's secondary school education programs are unlikely to benefit. Hong Kong's food environment must change so young adults can easily apply their nutrition knowledge.	health condition
4. Yüksel and Çengel-	Bourdieu's theory and the social-ecological model.	Qualitative method.	The ramifications of school policy are influenced by consumer society attributes.	Governance

Source	Underpinning Theory/Model/Guideline	Method, Samples and Limitation	Main Findings	Themes
Schoville (2020)			Introduction of mandatory nutritious foods in school canteens policy, still unable to hinder access for unhealthy meals. Policy decisions are inextricably linked to school circumstances, as well as the profiles of parents, classmates, and teachers.	
5. Wang et. al (2020)	The model of risk factors.	Quantitative method. Since it was chosen from four provinces in northwest China, it is not generalizable to the population.	Malnutrition rates among sample pupils have not decreased three years after the School Feeding Programs (SFP) was implemented, in fact, the required daily intake of micronutrients fell well short of national standards. There are no statistically strong effects on anemia or BMI, but because of an increasing number of students under height for their age Z scores.	Health condition
6. Martinez-Ospina et. al (2019)	The Socio-Ecological Model.	Quantitative method.	Excessively unhealthy diets, overweight, and obese students were identified in schools with a store or restaurants. They also discovered that viewing television for more than 3 hours per school day increased the likelihood of being overweight or obese.	Health condition
7. Diplock et. al (2019)	N/A	Qualitative method. Only ten schools were included in the study, all of which were poor to moderate-income earners.	There are four strategic action areas for student food safety learning: how to handle food appropriately, how to keep themselves and their kitchens safe and sanitary, how germs form and how they may cause food contamination, and how to keep food out of the "line of fire." The results emphasize children's requirements for using kitchen tools, preparing meals, and engaging in physical activities.	Food literacy and behavior
8. Pham et. al (2017)	The Socio-Ecological Model.	Quantitative method. Experts determined students' food safety education standards without student or parent input.	Unhealthy food marketing to children was blamed for increased childhood obesity rates. University nutrition professors knew the least about food marketing, obesity, and nutrition transition challenges and their causes.	Food literacy and behavior
9. Asada et. al. (2017)	Grounded Theory and The Dietary Guidelines for Americans.	Qualitative method. Vietnam suffers from a lack of suitable sample frames.	Food Service Directors (FSDs) are hopeful about improving school meal practices and their anticipated repercussions, as well as greater fruit and vegetable consumption, despite early challenges with wastage, whole grain procurement, and fast-paced salt targets. Students' acceptance of these changes developed with time and in-service training, making implementation difficult and ongoing.	Governance
10. Larsen et. al. (2017)	The RE-AIM (reach, efficacy, adoption, implementation, and maintenance) framework.	Quantitative method.	There are differences in awareness, knowledge, and implementation of healthy food selection between conventional, intervention students and their parents. Healthy foods are more consumed and fewer unhealthy foods are being selected. About 41% of kindergartners' teachers apply the majority of the lesson content in California public schools.	Food literacy and behavior
11. Song et. al. (2016)	The Social Cognitive Theory.	Quantitative method. Timely selection of control and intervention groups	Several characteristics, including eating behaviors, frequency of vegetables and fruits intake, and self-efficacy in meal preparation, showed substantial gains in the comprehensive group when compared to the control restaurant groups. In the cafeteria and/or comprehensive groups, several healthy food preferences improved considerably.	Health condition
12. Pehlke et. al. (2015)	The Grounded Theory.	Qualitative method.	The existing school food program, the overall school food environment (SFE), and the	Governance

Source	Underpinning Theory/Model/Guideline	Method, Samples and Limitation	Main Findings	Themes
			roles/opinions of vendors and principals demonstrate continuous worry about undernutrition and a lack of concern about overweight/obesity.	
13. Andersen et. al. (2015)	The Dietary Guidelines.	Quantitative method.	60% of participants ate salads (SBs). Non-African-American and health-food-desiring students were more likely to use the SB than African-American pupils. Students who promoted healthy eating were more likely to utilize the SB.	Food consumption
14. Callaghan et. al. (2015)	The Health Promoting Schools (HPS) Framework.	Quantitative method. All of the data is cross-sectional and self-reported, which is prone to bias. Only looked at self-reported SB usage and did not look at real fruit and vegetable intake.	Moreover, half of the schools had a canteen or small food shop, and 37.1% had vending machines. 32.7 percent of schools serve chips, while 44.2% sell energy-dense, nutrient-poor meals. 1.95 to 6.7% of firms within 1 km of post-primary schools sold unhealthy meals. Fruit and vegetable merchants are just 0.73 percent concentrated.	Food entrepreneurship
15. Muilenburg-Trevino et. al. (2014)	The Social Learning Theory.	Quantitative method. Only Irish school workers answered the questionnaire.	Post-test results of nutrition program participants were substantially different from control group pupils. In matched groups, intervention students improved on four of five components, whereas control students did not.	Governance
16. Vargas et. al. (2013)	The Secretariat of Health Guideline.	Quantitative method. Midwestern, United States at-risk elementary schools	None of the lunch packs (LP) from the elementary school (ES) were deemed healthy, and only 1% were deemed adequate. Preschool children (PS) were classified as healthy in 21% of cases and adequate in 6% of cases. Half of the students identified the brand of elevated, strong, and increased goods on and off premises. Most ES and PS LP and school lunches were unhealthy and inadequate.	Food entrepreneurship
17. Wijesinha-Bettoni et. al. (2013)	The Dietary Guidelines.	Quantitative method. Scope to a handy region of a border city between Mexico and the United States, and which occurred at a specified time period	Few countries have fruit and vegetable programs; price and storage space are obstacles. 11 of 18 countries have nutrient-based criteria and school meal recommendations, however fruits, and vegetables are often underspecified.	Governance
18. Ohri-Vachaspati et. al. (2013)	The Dietary Guidelines for Americans.	Quantitative method.	Schools in the south, remote regions, and provinces with better dietary regulatory frameworks had a higher engagement in Team Nutrition. Participation in the program was larger in schools with a preponderance of low-income children and a nutritionist on staff. Throughout lunchtime, participating schools were more likely to offer healthy selections and less likely to supply harmful options.	Governance
19. Lee (2012)	N/A	Quantitative method. The analyses are based on cross-sectional data and are based on school administrators' reports of Team Nutrition involvement.	In this sample of primary school-aged youngsters, differential food outlet exposure did not explain weight growth over time. Socioeconomic or racial/ethnic disparities are not explained by variations in the availability of home food outlets.	Food entrepreneurship
20. Prelip et. al. (2012)	The 2005 Dietary Guidelines and MyPyramid Food Guidance System.	Quantitative method. Food quality and establishment diversity data are limited.	The treatment led to a better shift in knowledge, attitudes, and beliefs regarding vegetables and teacher effect on students' fruit and vegetable preferences	Food literacy and behavior
21. Krukowski et. al. (2011)	The School Cafeteria Nutrition Assessment (SCNA).	Quantitative method. More focused on big district urban schools	Except for sides and chips, all meal categories evaluated demonstrated high inter-rater reliability. The School Cafeteria Nutrition Assessment (SCNA) ratings covered most of	Governance

Source	Underpinning Theory/Model/Guideline	Method, Samples and Limitation	Main Findings	Themes
			the potential values, suggesting the measure's capacity to identify healthier alternatives.	
22. Katz et al. (2011)	The Social Ecological Theory.	Quantitative method. Inter-rater reliability was low in the side dish and chip categories, suggesting the difficulty of classifying a multi-component meal as an entrée. Few schools studied.	In intervention schools, pupils' understanding of nutrition labels improved significantly. The third-grade students made the most progress. Guardians of intervention students improved at reading nutrition labels. The total calorie, salt, and sugar intake of the intervention group did not change appreciably. Despite the trial's short duration, BMI did not change.	Governance
23. Power et al. (2010)	Bioecological Systems Theory and Self-determination Theory.	Qualitative method. The food label quiz was made for the show and never validated. This short-term study didn't find consequences on downstream variables in the obesity logic model, such as dietary habits and weight.	Despite their lack of understanding of what constituted appropriate eating, early teenagers demonstrated a great understanding of the link between their behavior and their health. Participants reported a desire for a range of healthier diets and physical activities, but they also mentioned various hurdles to participation. The basic attribution error was represented in the fundamental distinction between students, parents, and teachers, with early adolescents attributing their bad behavior to their surroundings, instructors blaming parents, and parents blaming their children.	Food literacy and behavior
24. Brouse et al. (2009)	The National School Lunch Program Guidelines.	Quantitative method. The group's target audiences were European American and the middle class.	The majority of food service directors (FSDs) stated that even a lack of nutrition education for parents (80%) and pressure to provide children's favorite meals rather than wholesome foods (75%) were likely or certainly impediments to enhancing the school food environment. According to the majority of respondents, encouraging healthy food taste testing and expanding the availability of fresh fruit would likely have a favorable or very positive influence on the school food environment.	Food literacy and behavior
25. O'toole et al. (2007)	The Dietary Guidelines for Americans.	Quantitative method.	Few states compelled schools to limit the availability of deep-fried meals, prohibit the sale of low-nutrient-density goods in particular contexts, or supply healthy liquids when beverages were given. While many schools promoted nutritious meals and beverages outside of the school nutrition services program, many also sold high-fat, strong, and elevated goods.	Governance

3. Results

A repository search yielded 786 results for this scoping review. Thirty of these articles were removed from the first hit due to similarity. The titles and abstracts of 672 systematic review articles, review articles, meta-analysis studies, etc. were eventually deleted. 59 of the remaining 84 publications were found unrelated to the aims of the scoping research after a comprehensive analysis. Based on preferred reporting elements for systematic review (PRISMA; Moher et al., 2015), only 25 papers were found relevant and

satisfied the study's objectives after a comprehensive screening (see Figure 1).

The selection of publications was limited to quantitative, qualitative, and mixed empirical research from journal articles published according to a few criteria. Specifically, conventional assessments, which were most likely influenced by the author's subjectivity, led to the removal of conference proceedings due to a lack of systematisation and transparency as a result of conventional evaluations (Hodgkinson & Ford, 2014; Razak et al., 2022; Yahaya et al., 2022).

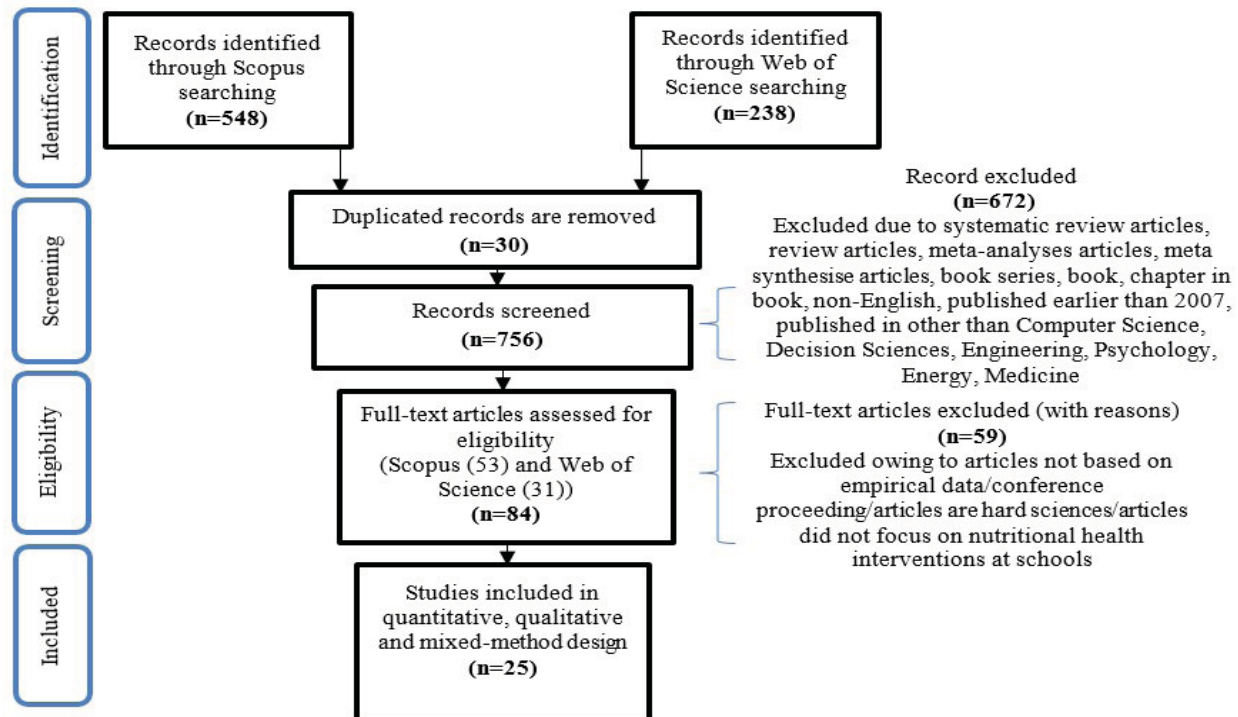


Figure 1: Flow diagram of the study selection process using the Preferred Reporting Items for Systematic Reviews (PRISMA) (adapted from Moher et al., 2015)

3.1. Main Findings

Table 2 (Appendix I) lists the twenty-five studies that were examined in accordance with the selection criteria: There are nineteen quantitative studies (Lvasseur, 2021; Kwok et al., 2020; Wang et al., 2020; Martinez-Ospina et al., 2019; Pham et al., 2017; Larsen et al., 2017; Song et al., 2016; Andersen et al., 2015; Callaghan et al., 2015; Muilenburg-Trevino et al., 2014; Vargas et al., 2013; Wijesinha-Bettoni et al., 2013; Ohri-Vachaspati et al., 2013; Lee, 2012; Prelip et al., 2012; Krukowski et al., 2011; Katz et al., 2011; Brouse et al., 2009; O'toole et al., 2007), five qualitative studies (Yüksel & Çengel-Schoville, 2020; Diplock et al., 2019; Asada et al., 2017; Pehlke et al., 2015; Power et al., 2010), and one mixed studies (Nosi et al., 2021). Most of the studies (n=13) were conducted in United State (Asada et al., 2017); Larsen et al., 2017; Song et al., 2016; Andersen et al., 2015; Muilenburg-Trevino et al., 2014); Wijesinha-Bettoni et al., 2013; Ohri-Vachaspati et al., 2013; Lee, 2012; Prelip et al., 2012; Krukowski et al., 2011; Katz et al., 2011; Brouse et al., 2009; O'toole et al., 2007) and followed by Mexico (n=2) (Pehlke et al., 2015; Vargas et al. (2013). In addition, just one study on sustainable development through nutritional health interventions in the

context of studies in schools (n=1) had been conducted in Italy (Nosi et al., 2021), Brazilian (Lvasseur, 2021), Hong Kong (Kwok et al., 2020), Turkish (Yüksel & Çengel-Schoville, 2020), China (Wang et al., 2020), Colombia (Martinez-Ospina et al., 2019), Canada (Diplock et al., 2019), Vietnam (Pham et al., 2017), Ireland (Callaghan et al., 2015) and African (Power et al., 2010). Furthermore, the scoping identified five major themes. The major headings were food literacy and behavior, health condition, governance, food consumption, and food entrepreneurship.

4. Discussion

A recent debate on nutritional health issues at the school level globally includes several aspects related to students' knowledge, behavior, health status, and governance. This scoping study provided an overview of the literature on nutritional health interventions at schools and the analysis done has revealed five themes to explain the scenario concerning students and food intake in schools. The themes are food literacy and behavior, health condition, governance, food consumption, and food entrepreneurship.

4.1. Food Literacy and Behavior

The lack of knowledge about the importance of nutritional food has led to several negative health impacts among school students. Food providers are among this group. Food nutrition experts believed that a lack of nutrition education for parents and therefore, pressure to deliver meals that children like rather than nutritious foods are the main factors causing them not to improve the school food environment. The food providers (or preparers) agreed that encouraging healthy food taste testing and providing fresh fruit will have a favorable or very good impact on the school food environment (Brouse et al., 2009). Although school students showed limited awareness of what defines healthy eating, they had a strong understanding of the link between their healthy eating behavior and their health. They prefer a variety of healthy meals and physical activities but expressed various barriers to participation. The barriers include financial (healthier food is costly), and lack of healthy selection in food supplies in schools. And their ill behaviors to environmental circumstances. On top of it, instructors would blame the parents, and the parents put blame on their children for these negative behaviors (Power et al., 2010). However, there is previous research that found that teacher influence on students would result in a positive change in knowledge, attitudes, and beliefs toward vegetables (Preliip et al., 2012).

From the side of health experts, they put blame food marketers for the rising prevalence of childhood obesity. As a consequence, more health professionals disapproved of the marketing of less healthful foods to children. It is more apparent when most of the food products introduced are packed with sugar and contain various unhealthy content such as food coloring, MSG, and starch. Similarly, university nutrition lecturers are said to be the least knowledgeable about food marketing and the danger of obesity. Therefore, university nutrition lecturers are the least accurate in making judgments about nutrition transition difficulties and their potential causes (Pham et al., 2017). In previous research, students who are exposed to a portion of healthy food, during the intervention had better knowledge and understanding of food categories and healthy breakfast/snack alternatives than control students (Larsen et al., 2017). The students seem to replicate their parents' behavior in selecting and consuming food. The parents of the intervention group children read food labels more often, and the intervention group children ate more fruits and vegetables and less unhealthy food items. In other research four priority action areas for food safety education aimed at students have been suggested: safe food handling; maintaining cleanliness and safety in kitchens; understanding how germs grow and diseases caused by it, and ensuring food are always safe for consumption (Diplock

et al., 2019). The findings suggested that children require clear instruction in handling food and kitchen utilities during school activities. All these may be achieved through programs such as social marketing education (Nosi et al., 2021).

4.2. Health Condition

Students with a strong liking for nutritious eating are more likely to consume veggies, research revealed. These pupils urge others to eat veggies more than those who do not (Andersen et al., 2015). Song et al. (2016) found that the comprehensive group (experimental group) increased the number of days they ate vegetables and fruits and their self-efficacy in cooking fruit and vegetables at home. Some said cafeteria and/or comprehensive groups increased nutritional choices including oatmeal, whole-grain noodles, and veggies. At schools, canteen operators served too many harmful meals (Martinez-Ospina et al., 2019). This made students fat.

The result is contradicted in Hong Kong as nutrition-related information has been provided at the secondary school level. Therefore, the food environment program in Hong Kong has allowed young adults to transfer their nutrition knowledge into choosing good food choices (Kwok et al., 2020). Another piece of evidence is shown by the malnutrition rates among sample pupils have not decreased three years after the School Feeding Programs (SFP) was implemented (Wang et al., 2020). This is consistent with other findings such as Levasseur (2021), where unhealthy foods and drinks at school increase the likelihood of being overweight. The effects are less pronounced among the well-to-do students with healthier meals.

4.3. Governance

In earlier research by O'toole et al. (2007), schools in a few states were instructed to limit the sale of unhealthy food which are low-nutrient-density. The study found that many schools sold healthy meals and beverages outside of the school nutrition services program while many also sold high-fat, high-sodium, and high-added-sugar products. This brings the need for a stricter program to ensure more schools comply with the requirement for healthy food selection for students. This is consistent with Krukowski et al. (2011) that concluded that all food categories tested showed high inter-rater reliability scores using the School Cafeteria Nutrition Assessment (SCNA) among the public school cafeterias during the lunch period. In another study, the nutrition label literacy among students in intervention schools increased significantly as equal to parents for nutrition label reading (Katz et al., 2011).

Few countries have health programs focusing on fruit and vegetable consumption (Wijesinha-Bettoni et al., 2013). Such programs were expensive and lacked storage space. Eleven of 18 countries have nutrient-based school meal standards. These countries don't eat enough fruits and vegetables. Southern, rural, and states with better nutrition regulations had higher Team Nutrition participation rates (Ohri-Vachaspati et al., 2013). Participation was higher in low-income schools. Participating schools offered healthier food. All these prove the need for a healthy school food policy.

Muilenburg-Trevino et al. (2014) analyzed nutrition education in primary schools and found that pupils who participated had a considerably positive influence over those in the control group. The intervention group improved, while the control group didn't. In Guatemala, a school food environment (SFE) was set up due to undernutrition and a lack of overweight/obesity concerns (Pehlke et al., 2015). Elementary students' main worry is malnutrition. The SFE includes food from school kiosks, home or street vendors, and the school. School kiosks, street vendors, and parents offer high-calorie food and drinks. The school food program, SFE, suppliers, and principals are concerned about undernutrition and greater responsiveness to overweight and obesity. In short, elementary school kids' nutrition is a concern. SFE should promote diet to thwart childhood overweight and obesity.

Gaining insight into school meal standards is crucial. Therefore, the Food Service Directors (FSDs) were interviewed in Asada et al.'s (2017) research. The findings reported overall positive perceptions and their potential impacts. However, the implementation was regarded as a challenging, continuing process and student acceptance of these modifications increased with time and in-service training. In a newer study, the ramifications of school policy are influenced by consumer society attributes. Even though local and national policies require nutritious food at school canteens, kids still pick bad options. To conclude, policy decisions are inseparable from school circumstances, parents' involvement, classmates, and teachers (Yüksel & Çengel-Schoville, 2020).

4.4. Food Consumption

Childhood obesity has been mentioned as one of the factors contributing to obesity in adults. It has been shown that many children do not fulfill the World Health Organization's recommendation of eating at least 400 grams of fruit and vegetables (FV) per day. This condition, which is due to inadequate consumption of FV, put them at risk for many chronic diseases. Research by Andersen et al. (2015), showed that students' intake of FV is different based on ethnic background. In fact, students who enjoy nutritious

eating are more likely to utilize salad bars (SB). The researchers also observed that students who promoted healthy eating were more likely to use the SB. This finding implied that those who currently practice good food intake will do so in other settings.

Development of relevant, effective intervention programs and policies related to healthy food consumption targeting children and adolescents, it is critical to identify the factors which may influence their healthy food consumption. Nevertheless, we have to bear in minds that individual factors play a role in healthy food consumption. These are factors such as food preference, attitudes toward health and nutrition, nutrition knowledge, and interpersonal characteristics on food intakes involving both family and peers.

4.5. Food Entrepreneurship

The contextual factor may have contributed to obesity where food environments are the combination of physical, economic, policy, and socio-cultural surroundings, opportunities, and conditions influencing food choice. However, the risk is based on the supply of food by retailers in residential neighborhoods, whereby the children probably have access to unhealthy forms of food which, in turn, are determinants of weight status. Vargas et al. (2013), inspected elementary school lunches and found none of the recommendable quality and very few adequate. About half of the students knew the brand name of high-fat, high-salt, and high-added-sugar items on and off school grounds. The majority of elementary and preschool lunch packs and school meals were unhealthy and inadequate. Schools have a canteen, small shops, and vending machines. Many schools sell chips in the cafeteria and nutrient-poor meals and drinks in the school store (Callaghan et al., 2015). Lee (2012) investigated if lack of access to healthy food merchants and/or "unhealthy" food providers explains children's risk of overweight and obesity. Different food outlet exposure doesn't explain weight increase over time, the study found. Variations in home food outlets don't explain socioeconomic or racial/ethnic differences.

To foster a more conducive food intake environment, Vargas et al. (2013) recommended new regulations on the foods allowed in schools to be proposed along with a comprehensive program targeting teachers, cafeteria personnel, parents, and children. One of the initiatives organized by the American organization is the evaluation of food outlet kinds and composition as potential remedies to childhood obesity (Lee, 2012). Callaghan et al. (2015) suggested guidelines in relation to the location of food premises in close proximity to schools and policies supporting healthier food environments to be translated into practice in schools and communities.

The above discussion highlights a preference and easy access to unhealthy food choices for the students involved, making it necessary for the schools to have an adequate healthy food program to inculcate healthy food users among the students. And, the public policy office, on the other hand, shall design a practical and not-so-costly program and/or regulation to further enhance the good practices. Based on the discussion of the findings, the study proposed a framework of sustainable development through nutritional health interventions in the context of studies in schools (see Figure 2).

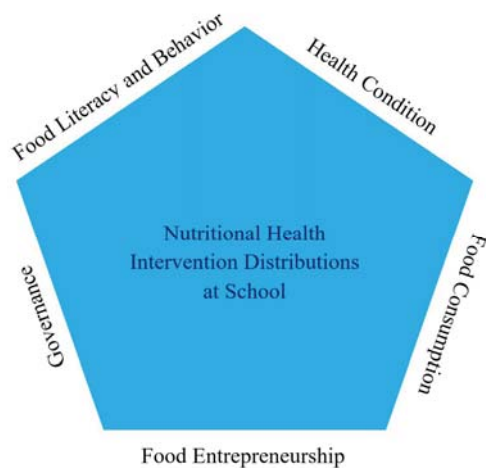


Figure 2: Framework on themes of improving school children's health through nutritional food intervention distributions.

5. Limitations and Recommendations

This study only uses a subset of WoS and Scopus articles. The pattern suggested more future publications. Academics are recently interested in dietary health interventions for schoolchildren. Multiple studies indicate that the issues must be addressed immediately. Therefore, further study is needed to increase school access to healthful foods. Consequently, the current scoping review's findings may assist researchers in future investigations involving the selection study population and nutrition intervention.

6. Conclusion

The scoping review evidenced the intricate link between school children's knowledge, behavior, health status, governance dimensions, food providers, and nutritional health issues at school. A contribution of this review is that it identified several factors such as food literacy, food

consumption, good governance, and food entrepreneurship that have a positive impact on the behavioral and health outcomes of school children. To conclude, in reaching the SDGs targets for nutrition, nutrition interventions at school is effective in promoting a well-balanced diet and positive lifestyle among school children.

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