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Review

Food and Nutrition Education against Overweight and Obesity in School-age Children: A Scoping Review of progress in Spanish-speaking Countries

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Abstract: School-aged children may benefit from education interventions focused on healthy eating and physical activity to improve their quality of life. This article aims to review scientific evidence on food and nutrition education (FNE) in Spanish-speaking countries for the prevention of overweight and obesity in school-aged children (6-12 y). Articles were searched between April and August 2021. The searches were conducted using MEDLINE, Google Scholar, and SciELO. The primary search for articles focused on the experience of FNE interventions in Spanish-speaking countries. Overall, 518 articles were found and 33 studies were eligible for data extraction. Forty-two percent of the studies had a focus on FNE and 64% were focused on describing the eating habits of schoolchildren. Nutritional assessments (anthropometric) were found frequently with 91% and 30% of the studies focused on physical activity. All interventions focused on preventing or reducing overweight and obesity in school-age children. Educational, cognitive, dietary, and physical activity practices were described, whit being educational the most frequent intervention. Interventions reported positive effects of FNE interventions to improve knowledge and practices of healthy lifestyles in school-age children.

Keywords: Education; effectiveness; intervention; food and nutrition education; knowledge; schoolchildren

1. Introduction

The terms overweight and obesity are used to refer to an excessive increase in body fat that poses health risks [1]. The increase in overweight and obesity in school-age children (6-12 years) is worrying, due to its increase in recent years both in emerging and developing economies [2]. Globally, 340 million children and adolescents are overweight [1]. Latin America and the Caribbean and other Spanish-speaking countries face serious challenges to reducing overweight in schoolchildren, where the problem reaches up to 40 percent of school-age children [2]. The prevalence of overweight and obesity in school-age children in some Spanish-speaking countries ranges from 20 to 40%, being 32% in Mexico [3], 36.7% in Panama [4], 24.4% in Colombia [5], and 23.3% in Spain [6].

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Many countries are moving through the nutrition transition with increased urbanization, a growing economy, and changing food environments [7–9]. As a result, negative changes in eating habits and a predominantly sedentary lifestyle are becoming the primary causes of overweight in the population [10]. Furthermore, the changing food environment, contaminated by advertising, promotion, and sponsorship of ultra-processed products and sugary drinks, directly influences the adoption of inappropriate food practices [11]. Latin America and the Caribbean countries are implementing policies to tackle overweight and obesity, such as in front of the package nutritional warning labels that is implemented in Argentina, Chile, Colombia, Bolivia, Ecuador, Mexico, Peru, Uruguay, and Venezuela. Therefore, it will be key to have harmonized interventions for these policies to be effective, including the FNE in schools.

Customized food and nutrition education (FNE) is one intervention modality that may benefit for school-age children to learn about proper eating habits and healthy lifestyles [12]. School-age children may benefit from educational interventions on health and nutrition to change and improve lifestyles [13,14]. In school settings, children are a captive audience ready to gain new information and skills that they may not be able to learn at home or in their communities. Children must acquire knowledge of healthy eating at an early age to give them the cognitive tools needed to prevent or treat overweight and obesity [15]. Therefore, it is necessary to involve all actors at all levels, i.e. school, community, and home. Thus, teachers are important agents to promote health and nutrition habits among school-age children so that they can transfer competencies and skills on healthy eating habits when they leave the school setting and enter adulthood [16,17].

The literature suggests that a lack of knowledge, together with an unfavorable attitude about healthy eating habits and an obesogenic environment, among other factors, affects the dietary habits of school-age children with health consequences [18,19]. It is during childhood that most people solidify their nutrition behaviors and lifestyle habits [20]. Children may grow up with inadequate eating habits if they never learned them at an early age [2].

Therefore, understanding how effective the implementation of FNE in schools has been important for developing future interventions aiming to improve the healthy eating habits and lifestyles of school-aged children [21]. Likewise, understanding how the participation of parents, teachers, and the entire educational community may influence child diets may inform future interventions, in consideration of physical environments where dietary practices are carried out [22–24]. Given the rising number of interventions targeting overweight and obesity among school-aged children, we conducted this review to summarize evidence of FNE in Spanish-speaking countries for the prevention of overweight in school-age children (6-12 years of age). We sought to answer the following two research questions during this review:

Research question 1: What are the types of FNE intervention approaches being used to improve nutrition outcomes among school-aged children?

Research question 2: What are the types of outcomes measured in FNE interventions aimed at school-aged children 6-12 years old?

2. Materials and Methods

This article presents findings from a scoping review of progress in Spanish-speaking countries on FNE interventions at schools to prevent overweight and obesity among school-age children. A comprehensive search for studies was carried out between April and August 2021. Articles related to FNE programs or that had in their title some of the descriptors of interest were selected. The study was carried out by the Nutrition and Dietetic School of the University of Panama.

2.1. Inclusion and exclusion criteria

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Articles published in Spanish-speaking countries between 2015 and 2021 related to FNE programs aimed at primary school-age children (6 to 12 years old) were included. Community-level or clinical studies were excluded.

2.2. Search strategy

The search strategy included all studies that were observational, descriptive, analytical, cross-sectional, cohort studies, cases and controls studies, pre-post-interventions, quasi-experimental intervention designs, with or without a control group, and randomized and double-blind trials. For the selection of studies, a search was conducted using MEDLINE PubMed, Web of Science, Google Scholar, and SciELO. Descriptive MeSH keywords such as: "food and nutrition education", "nutrition education", "knowledge", "loss weight", "school age", "behavior", "eating habits", "physical activity", and "cognitive" were used.

Titles and abstracts of initially identified articles were screened. Eligible studies were reviewed in full text and each article was checked for inclusion criteria to be selected for data extraction. The information that was extracted included: authors, year of publication, place of execution of the study, objectives, sample size, description of the intervention, summary of results, and conclusions.

3. Results

Table 1 shows the summary of evidence from the selected studies on FNE against overweight and obesity in school-age children in Spanish-speaking countries. Five hundred and eighteen studies were initially identified being 402 articles excluded because they were not related to the research objectives, leaving 116 articles. Seventy-one studies were excluded due to duplication. We excluded twelve articles because were carried out in non-Spanish-speaking countries. A total of 33 studies were included for the final extraction of information (**Figure 1**).

3.1. Types of intervention approaches used FNE studies

Most of the FNE studies intervened through evaluations of eating habits (63%), followed by educational programs (42%). Nutritional assessments (anthropometric) were included in 91% and 30% of the studies included physical activity as an outcome. The identified FNE interventions were focused on both physical activity programs and educational activities for school-age children. Compared to other study designs, the intervention studies had a focus on preventing and reducing overweight and obesity in participants.

In the transformation of healthy schools, the FNE intervention was carried out with the school-age children, teachers, parents, and administrative personnel of the schools to achieve changes at the level of the physical structure and the environment, to support the measures of prevention of overweight. In these, they managed to improve the school environment through illustrative posters with health messages or advice throughout the school. In others, they painted the stairs and corridors of the schools to promote physical activity among students. They also focused on improving school canteens, that is, having better options in the food supply, above all suspending the sales of processed foods and sugary drinks, and thus providing and encouraging students to prefer healthy foods, as also reported elsewhere [25,26].

On the other hand, concerning counseling on physical activity and nutrition after school, the interventions consisted of motivating students, parents, or people responsible for children to lead healthy lifestyles after finishing the school day or on holidays. The main focus of this strategy was motivation to stimulate the will for a healthy lifestyle change. Organized educational sessions were reported to provide support to parents in terms of healthy eating, self-efficacy to change specific behaviors, and taking care of the

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practice of physical activity. Games were also played to overcome different barriers that children could present and thus remain constantly active, avoiding a sedentary lifestyle in school-age children, as also reported by Annesi et al., (2016) [27].

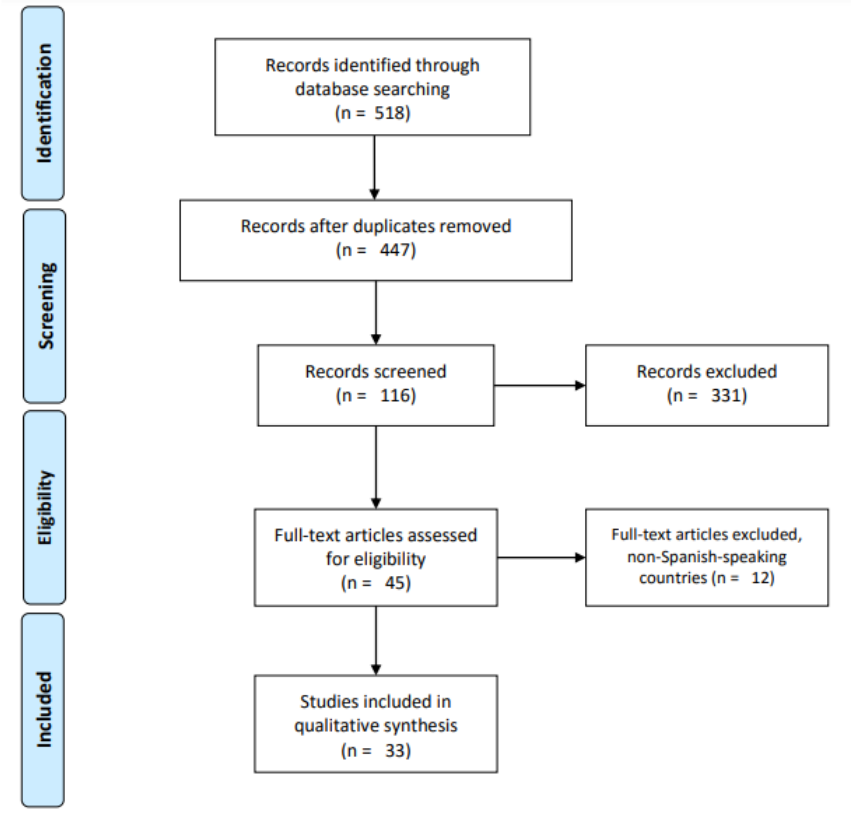

Figure 1. PRISMA flow diagram.

3.2. Typical outcomes measured in FNE interventions

The FNE interventions were beneficial in improving knowledge and lifestyle practices in school-age children. However, very few achieved positive changes in nutritional status [28,29]. This was regardless of the type of intervention and the time duration of the interventions. The educational interventions to promote healthy eating were carried out to increase knowledge on healthy eating habits in which FNE sessions were constructed using different didactic materials such as talks, workshops, visits to the food market, videos, games, etc.

A study in Mexico in 2015, on the impact of an educational intervention program, conducted educational sessions for parents of 10 obese school-age children aged 7 to 11 years [29]. Different didactic tools were used in the interventions to improve knowledge about healthy lifestyle practices. The results of the evaluation identified that the educational intervention program caused a significant change in the attitude of the responsible adult about school obesity. In this article, Díaz et al., (2015) reported that the knowledge of parents about healthy eating and the importance of preventing overweight and obesity was improved by choosing better food offers [29].

In Mexico, a study developed by Ríos-Pérez et al., (2015) with 920 overweight or obese school-age children performed an educational intervention through training on healthy lifestyles, for a year [30]. At the end of the intervention, the students were able to increase their knowledge of healthy eating and physical activity in a higher proportion than children who were classified with normal nutritional status. They were evaluated using instruments designed for each topic to assess the level of learning acquired from

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healthy eating and physical activity after the intervention. The authors showed that FNE has a significant effect on improving healthy behaviors in school-age children.

Martínez & Trescastro (2016) in Spain evaluated 28 school-age children in the context of an FNE intervention [31]. Their results were positive responses in the students since more than 70% acquired knowledge of healthy eating and healthy lifestyle practices. After two years, the consumption of industrialized products was reduced and fruits were the most consumed food. They concluded that the FNE intervention produces significant changes, improving knowledge and increasing the consumption of healthy foods [31].

Regarding eating habits, the identified FNE interventions applied different tools to describe the eating behaviors in school children, they used food frequency questionnaires, 24-hour dietary recalls, child-eating behavior questionnaires, and facial hedonic scales to evaluate the acceptance of the school meals. Some characteristics that could be observed in the eating behaviors of school-age children are that the diet is usually varied and this depends on the sociodemographic characteristics. For example, children from rural areas tend to consume traditional foods typical of their culture, and children from urban areas have access to processed and ultra-processed products, sugary drinks, or fast food. It should be noted that the evaluated dietary patterns included assessing the habit of having breakfast, lunch, dinner, and snacks [32,33].

González-González et al., (2016) in a study carried out in Spain with 1142 school-age children, aimed to assess the eating patterns in elementary school, a questionnaire was applied to investigate and fully understand the schoolchild's diet [33]. The result was that food preference is an important factor in children when choosing a specific food. In addition, it was found that cereals were the most consumed food group (92.8%), and vegetable consumption was low (35.4%) [33].

Regarding the nutritional evaluations, weight, height, body mass index (BMI), waist index, hip index, and skinfolds were measured in several interventions. The nutritional status of the participants was determined to classify them as having overweight, obese, or normal nutritional status according to the child growth standards of the World Health Organization [34]. Nutritional assessments are included as an important dimension of the evaluation of FNE interventions.

Several articles report the results of improving knowledge in nutrition, as well as food intake and nutritional status in the FNE interventions in schools. One of them is the study carried out by Aparco et al., (2017) in Peru [35]. The objective of the intervention was to determine the impact of an FNE program in school-age children from first to fourth grade on BMI, knowledge of nutrition, and eating patterns. The results revealed a positive impact on the improvement of knowledge in nutrition; the implementation also improved the eating pattern in all food groups except vegetables. However, this intervention failed to reduce the BMI Z-score [35].

Another study carried out in Mexico aimed to know the effect that an FNE program in schools has on the eating habits and nutritional status of school-age children [36]. The intervention was carried out with 35 children for nine months. The results showed that children improved positively their eating patterns; especially the reduction of sugary drinks consumption. However, in the anthropometric variables, an increase in height, body weight, and waist circumference was observed, and the BMI was maintained during the intervention [36].

An FNE program was carried out in Spain with 79 school-age children aged 6 to 8 years intending to improve their nutritional status and eating habits. The intervention did not show statistically significant associations. However, improved the BMI categories for normal nutritional status and reduction in overweight and obesity. Concerning eating

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habits, the need to improve the diet in school-age children was demonstrated, since an impoverished consumption of food groups was found [37].

Table 1. The characteristics of the articles in which FNE focused in the prevention of overweight and obesity among school-age children in Spanish-speaking countries.

Author, year	Country	Objective	Sample size
1. Almeida et al., 2019 [38]	Mexico	To determine differences in eating patterns, obesity, and overweight in schoolchildren from public and private sectors in the Zacatecas-Guadalupe Metropolitan Area of Mexico.	372
2. Altamirano & Nazar, 2020 [39]	Chile	To evaluate associations between caregivers' infant feeding attitudes and practices versus the nutritional status of children of Mapuche and non-Mapuche origin.	200
3. Álvarez et al., 2017 [40]	Ecuador	To determine the association of eating habits and nutritional status in eight- to nine-year-old schoolchildren from the city of Azogues, Ecuador.	315
4. Aparco et al., 2017 [35]	Peru	To determine the impact, in the first year, of an educational-motivational intervention called "Jugando" on body mass index, knowledge about feeding, levels of physical activity, and food consumption patterns in schoolchildren from 1st to 4th grade from four primary schools in Cercado de Lima.	696
5. Ávila et al., 2018 [41]	Mexico	To determine the classification of behaviors and eating habits of school children through the exploration of eleven dimensions.	243
6. Azcorra et al., 2016 [42]	Mexico	To describe the nutritional status and growth patterns of school children (6 to 12 years of age) in three rural communities in the state of Yucatán, Mexico: Yotholín, Xkanchakan, and Chikindzonot.	144
7. Barja et al., 2019 [43]	Spain	To determine the quality of the dietary pattern and the practice of physical activity in primary and secondary schoolchildren in Galicia and its relationship with sex, educational stage and adiposity, and the degree of adiposity, to assess the need to reinforce the current intervention strategies for the promotion of healthy lifestyles.	662
8. Benítez et al., 2016 [44]	Mexico	To evaluate the effectiveness of an educational intervention on the nutritional status and the level of knowledge about food patterns and physical activity in schoolchildren.	368
9. Bergel et al., 2017 [45]	Argentina	To analyze the relationship between nutritional status and residence socio-environmental conditions in school-age children from the Department of Villaguay, Entre Ríos, Argentina.	1435
10. Bibiloni et al., 2017 [46]	Spain	To Evaluate the results of a nutrition education program developed with local resources to improve diet quality and reduce the prevalence of overweight and obesity in the population.	1199
11. Briones et al., 2018 [36]	Mexico	To determine the effect of a physical activity program and extracurricular nutritional education on anthropometric variables and eating habits in school-age children.	35
12. Casas et al., 2015 [47]	Spain	To analyze the level of quality of life and nutritional status in a sample of primary school children.	298

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13. Delgado et al., 2017 [48]	Chile	To relate the nutritional status with the levels of self-esteem and physical performance in schoolchildren between 8 and 10 years of age.	236
14. Díaz et al., 2015 [29]	Mexico	To evaluate the impact of an educational intervention program on the change in attitude towards school obesity, and knowledge about healthy eating, better eating behaviors; increased physical activity; the practice of exercise, and the ability to sustain incorporated changes.	19
15. Díaz et al., 2015 [49]	Spain	To Evaluate the effect of an intervention in nutrition and physical activity (PA) on the reduction of obesity in schoolchildren.	312
16. Encina et al., 2019 [50]	Chile	To compare eating behavior in schoolchildren from different schools according to nutritional status.	270
17. Espinosa et al., 2019 [51]	Mexico	To assess genetic damage and eating habits of children with obesity and normal weight.	33
18. Fernández-García et al., 2019 [52]	Spain	To Describe the effect of overweight and obesity in eleven-year-old schoolchildren on tests assessing strength, both lower and upper extremities, as well as speed.	423
19. Flores et al., 2019 [53]	Mexico	To identify the waist circumference measurement area that best determines childhood obesity, contrasted with obesity indicators.	107
20. González and Díaz, 2015 [54]	Colombia	To determine family characteristics associated with the nutritional status of school children in the city of Cartagena, Colombia.	544
21. González et al., 2016 [55]	Spain	To assess the dietary patterns of school-age children in La Mancha Centro (Ciudad Real), Spain.	1142
22. González et al., 2017 [37]	Spain	To establish the levels of body mass indexes, degree of adherence to the Mediterranean diet, and self-concept in a sample of Primary Education students and to determine the possible physical-healthy and psychosocial differences after carrying out the "SportFruits" intervention program.	79
23. Martínez & Trescastro, 2016 [31]	Spain	To evaluate the pilot experience of the food and nutrition education intervention carried out at the "La Serranica" Public School of Aspe, Alicante (Spain), to promote knowledge and healthy eating habits.	29
24. Martínez et al., 2017 [56]	Spain	To describe the prevalence of excess weight (overweight and obesity) and its association with the practice of sports activity and lunch in schoolchildren aged 6-12 years.	153
25. Martínez et al., 2016 [57]	Spain	To estimate the prevalence of overweight/obesity and thinness in school-children born between 2007 and 2008 from Castilla-La Mancha, Spain, in 2013-2015.	1490
26. Mosquera et al., 2016 [58]	Colombia	To determine the nutritional status by anthropometry, eating habits and iron status in school-children aged nine to eleven years old from a public school in Valledupar, Colombia.	155
27. Pura et al., 2017 [59]	Mexico	To analyze the nutritional status and eating habits of Mexican indigenous schoolchildren, depending on their gender, age, and community of origin.	230

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28. Ríos-Pérez et al., 2015 [30]	Mexico	To evaluate the association of expected learning in healthy eating and physical activity with anthropometric indicators of obesity in urban school-children in the state of Hidalgo, Mexico.	920
29. Sanabria et al., 2017 [60]	Paraguay	To evaluate the degree of acceptance and percentage of adaptation to the nutritional requirements of the school lunch for boys and girls from two public schools in Asunción, Paraguay.	102
30. Serral et al., 2019 [61]	Spain	To analyze the association between childhood overweight and obesity in the city of Barcelona, Spain according to socioeconomic variables in third-year primary school students.	3624
31. Shamah et al., 2017 [62]	Mexico	To evaluate the effect of the SaludArte service program on nutrition education and food assistance components, within participating schools between 2013 and 2015.	1620
32. Togo et al., 2016 [32]	Mexico	To compare the habitual consumption of food by children in an urban versus a rural area in Arandas, Mexico.	196
33. Varela et al., 2018 [63]	Colombia	To develop a proposal for the synthesis of the information obtained from the Health Habits Questionnaire related to Childhood Overweight/Obesity in Colombia.	239

* Tables may have a footer.

4. Discussion

Overall, the results found in this review, most of the interventions in FNE improve knowledge after the implementation of the programs, which shows a positive response. The FNE interventions are positive, since they guide healthy lifestyles, modify eating behaviors and learn practices or knowledge in food and nutrition. In addition, the evaluated studies of interventions that involve more than one aspect studied, such as FNE, increased physical activity, participation of parents, teachers, and transformation of healthy schools and community environments, cause positive physical changes by improving nutritional status and knowledge. It is necessary to continue implementing FNE programs to contribute to the health of school-age children and improve their lifestyles.

The results of the present review are consistent with other available reviews. For example, a review conducted in Brazil using 13 articles published between 2000 and 2011 showed that FNE improves the knowledge of nutrition and food choices of school-age children [64]. However, the revised studies that involved anthropometric measurements did not have changes in their nutritional status [64,65]. Despite this, working in schools to achieve positive changes in children's health and that prevention remains the first step in combating overweight and obesity.

The results on the FNE in the present scoping review are similar to a review performed in Spain based on 17 articles [66]. Several reviews have concluded the need to intervene in schools through FNE actions [67,68]. Primary prevention interventions have a positive influence on healthy lifestyles. Another review carried out in Peru on the effectiveness of an educational intervention to promote healthy eating in school-age children evaluated ten articles; they reported that FNE interventions have a high probability of improving knowledge about healthy lifestyles in children [69]. It seems that educational interventions have a greater impact on knowledge and attitude towards healthy eating. Therefore, surveillance systems in schools must incorporate a variety of indicators and not just anthropometric markers.

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The duration of the interventions is fundamental to achieving success in an FNE intervention. If a study fails to show changes, for example, in the weight of school-age children, it may be that this intervention was carried out in a short period and does not necessarily reflect problems with the effectiveness of the FNE intervention. Long-term interventions are associated with higher changes in the lifestyles of school-age children, including nutritional status [35,44,70,71]. It is essential to extend the time frame of FNE interventions to achieve stronger and more sustainable changes over time. In addition, FNE must have a comprehensive approach, considering the environment and all actors in schools such as parents, teachers, and the community.

Figure 2 shows a proposed conceptual framework for the implementation of FNE against overweight and obesity in schools. The results can contribute to the implementation of nutritional interventions within the school curriculum, with the help of ministries such as ministries of education, health, social development, or agriculture to achieve a positive impact on the learning of healthy lifestyles in school-age children. Finally, the evidence shows that comprehensive FNE interventions such as physical activity, participation of parents, teachers, community environment, and transformation of healthy schools, cause positive effects on nutritional status, improve knowledge, and contribute to chronic non-communicable disease prevention.

The findings of this review should be analyzed considering some limitations. A limitation of this study was that a systematic review and meta-analysis were not performed to research statistical conclusions. One strength of this review was the compilation of high-quality articles across country contexts to understand the range of FNE intervention modalities being used in school programs. Interventions from an early age have been shown to have a positive effect on increasing knowledge and improving lifestyle.

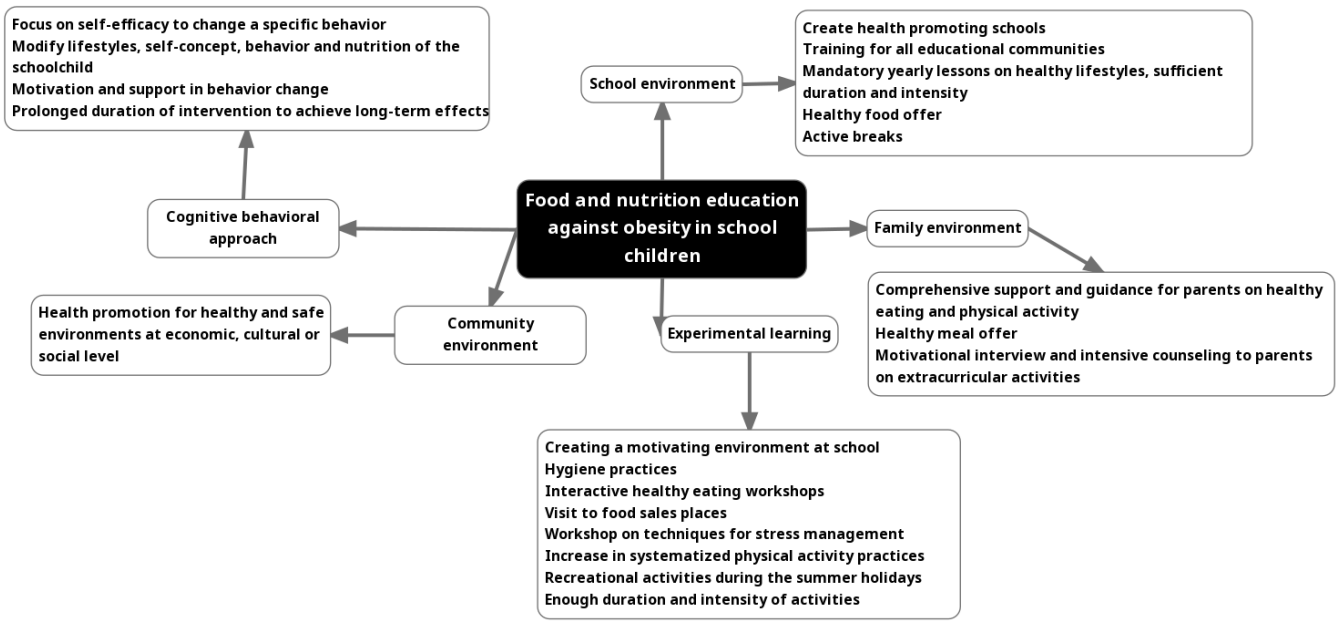

Figure 2. Conceptual model proposed for the FNE against overweight and obesity in schools.

5. Conclusions

In conclusion, FNE interventions come in many varieties regardless of context. However, they all have several common attributes for addressing the nutrition of school-aged children. Understanding the relative impacts of different types of FNE interventions on

child health and nutrition, by context, may be important follow-up work to inform policy and programming investment for countries wishing to achieve improved population-level health and nutrition.

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