

The Role of Nutrition Education in School-age Children in the Prevention of Global Obesity Epidemic

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Abstract BACKGROUND: The scientific field of nutrition education in schools is not expandly studied. **METHODS:** This research adopted the literature review of 17 studies about nutrition, healthy eating, and the relationship between students and teachers. **RESULTS:** In total 6 countries have been overviewed (Finland, Canada, Latin America's countries, Norway, France, and Japan) and Lithuania which is given as an example with very little information. Most subjects were children; however, there is information about youth, adolescents, and pre-school teachers. According to the data few studies showed beneficial and positive results about nutrition education - which exists, but other studies defined negative information or no information about nutrition education only about outcomes from no nutritional education or bad influences around schools, like mobile vendors that increase obesity and bad nutritional habits in children. **CONCLUSIONS:** Nutrition education poses a crucial key role in all scales of education system in terms of the prevention of global obesity epidemic. Extended epidemiological surveys are needed for achieving updated scientific data.

Keywords: exercise, education, diet, schools, obesity, health behavior

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1. Introduction

Nutrition habits of adolescents are in the worst condition between all age groups, which means that these bad nutritional habits can lead to obesity, overweight, chronic illnesses, heart diseases, type 2 diabetes, and many more health problems [1]. That is why nutrition education is an important base for a healthy life and it should be presented in early age stages [2]. The advantages of a healthy eating routine for kids are broadly perceived and it includes improved well - being and learning capacities, which thusly may add to better school marks. Poor dietary examples add to the high commonness of youth bigger weight [2]. The most important thing is that eating habits that were learned in schools usually tend to stay throw the whole life [3]. We were not able to find data about Lithuanian nutrition education except for the 1992 food pyramid which is still in use. Some countries have very good nutrition education like Finland or it is already developing for example in Canada, but also there are countries at the same level as Lithuania, still, no nutrition

education or it is a very low-quality education, like in Latin America. The problem, that children have no education about nutrition in schools does not start only from school programs; the problem also is in schools teachers' education. Norwegian student teachers provided information about insufficient education about nutrition in their studies; they do not get any information about how to teach children about healthy eating [4].

2. Key Concepts and Consideration

Childhood obesity exceeded the capacity of being a health problem, it is now considered as a global epidemic [5]. In order to understand the severeness of childhood obesity; it is crucial to comprehend the potential physical and psychological threats that are caused by this health condition. According to the American Obesity Association, the health problems that are caused by childhood obesity are numerous. Firstly, childhood obesity not only affects a person's life during childhood but also in adulthood as well. It is known that childhood obesity increases morbidity as well as mortality. There are many serious

diseases that may be triggered by childhood obesity such as asthma, hypertension, diabetes, orthopedic problems etc. [5].

According to data, obese children suffer from breathing problems, asthma in particular, more frequently compared to non-obese children. This situation decreases children's quality of life severely. For instance, asthmatic obese children are obligated to start using medicine from early age. They often have breathing difficulties and may end up in hospitals more frequently than their peers [5,6].

Hypertension is another serious health problem that obese children have tendency to suffer from. Hypertension is basically the condition of having a high blood pressure which is quite a risky situation since it may lead to heart problems. According to studies, obese children are likely to have hypertension nine times more compared to non-obese children. In addition, their risk of having high diastolic blood pressure and systolic blood pressure is greater in comparison to non-obese children [5,6].

Another common health problem that is directly caused by obesity in children is orthopedic problems. The condition of having an excessive amount of weight in the body leads to bone deformations in some cases. Since the weight is too much for the body, bowing may be seen in leg bones. Every 3 to 5 out of 10 children who complain having hip pain are diagnosed with obesity [5,6].

Negative effects of childhood obesity reaches beyond just physical problems. Many children with obesity experience social and psychological issues in their daily lives. Obese children are often exposed to offensive jokes, mocking, name calling in regard to their appearance. Even family members and complete strangers are sometimes involved in making such comments. Moreover, obese children are frequently exposed to negative prejudgments made about themselves such as being dirty, being too strong or being lazy [5,6].

Obesity rates in people are increasing every year, people are dying of diseases and illnesses that obesity caused. Children's perception of eating healthy has not changed; they think that healthy food is not tasty and that the only tasty foods are sweets, chips, and high in sugar beverages. Eating habits come from family; if they eat unhealthy food then children most probably will do the same thing. Problem is that schools do not teach children about healthy and tasty meals. A child would not eat salads because he does not know why he has to do that, he does not know about the benefits and he does not know that it can be delicious too. School's food is viewed as a very important piece of later life and a nutrition routine which will be used in adulthood. Vegetables and fruits are full of micronutrients and they should be involved in children's daily consumption. Childhood obesity in the last years has tripled its number [7]. That is why schools must immediately improve their nutrition education; put lessons about healthy foods and meals, invent nutritional programs where all of the school community (students, families, teachers and schools staff) and nutrition experts would participate and would learn about healthy diets [8].

3. Nutrition

In 1916 the United States of America (USA) published its first food guide about nutrition, nutritional needs, and

food consumption. It was based on the knowledge that they had at that time. Later on, there have been more food guides but based on that time nutritional problems or situations [2]. Nowadays there are many more and very good nutritional guides, that would be the best example for children to learn, even every family could have it. "This study gives the first indication that encouraging parents to involve their children in the preparation of healthy and balanced meals could be a promising intervention strategy to improve the diets and food intake of children." says van der Horst, Ferrage and Rytz in the 2014th article [9].

An intervention like this could be used in any country, there could be seminars for parents about cooking healthy foods, and this would increase vegetable consumption between children because children in the USA and Europe do not meet needed recommendations in consuming vegetables [9]. For adults it is very hard and takes a lot of time to change some habits that they had, to stop eating something that they like or to start eating completely healthy and that is why children must learn it from the early age while it is still very easy to format their habits and explain to them why healthy food is important. Nutrition education should be in every school and even kindergarten children should start learning about nutrition. Kindergarten is a place to start a regular healthy diet and after it schools should try to keep it in maintenance level.

4. School Based Nutrition Education

Children spend minimum of six hours of their day in school. They spend $\frac{3}{4}$ of a year, in school ground [10,11]. For this reason it is possible to state that schools are one of the key determinants of a child's eating and physical activity habits. It is found to be easier for a child to adopt healthy habits in an environment of friends and peers. Ages between 5-12 are very crucial. It is easier for children to pick up healthy behaviours during these ages and reduce the potential obesity risk [12]. As a child spends their entire day in school, their nutrition schedule depends highly on school lunch programme. The food that is served in school is supposed to be high in protein, carbohydrates, dairy and vitamins. Most lunch programmes offer these nutrients. However, children are also able to access food that includes high amount of fat, sugar and sodium through school cafeteria and vending machines. The prevalence of 'junk food' that is low in healthy nutrients is increasing. Therefore, it is crucial to educate children about nutrition in order to improve their choices [13]. Because of their age and interests, it is beneficial to adapt new methods of teaching. For instance in one school, children were educated about nutrition through use of media and a cartoon [5].

Delivering nutritional education as a part of school's educational programme is found to be quite effective since a great portion of a children's day is spent in school. Also, learning in an environment with peers can be more efficient [14,15,16,17,18]. Through nutritional education in school, children can improve their eating habits, increase their physical activity. Physical education lessons can also be organized accordingly to help children gain healthier habits. Many studies argue that when these

educations are delivered on early age, they are likely to last for years. Therefore, it can be argued that an adult's nutritional habits originate significantly from their eating habits as a child [19,20,21]. Role of teachers is quite effective. It is possible for a teacher to educate the children about the contents of foods and encourage them to make better choices while eating. The teaching process may also include physical activities embedded in the school's education programme [22]. It is a fact that the more a child is overweight, more they tend to make unhealthy choices. For instance, obese children prefer fast food and unhealthy, low nutritious snacks rather than nutritious and healthy food [23].

4.1. Nutrition Education in Finnish Schools

School meals are like an academic tool to teach children how to eat properly and healthy. It also leads to eating more vegetables and fruits [24]. Meals in Finnish schools are also free. It began in 1948 and still is so. A child who takes clubs or activities after school hours also gets a healthy snack. It is done for the child's well being, his/her learning capacity, improvement, and development (Finnish National Agency for Education, 2012) [25]. At present, an all-around adjusted free school lunch comprising of a hot dinner, a plate of mixed greens, bread, and milk is served each school day to every single student. All of the meals that are served for children meets needed requirements and also must be tasty for children, so that they would enjoy it [24]. This study shows, that 80 to 90% of children usually eat school meals. Although they skip some parts of the food, despite that it was showed that school meals are the healthiest food that they eat throughout the day [26].

Finland is one of the countries that have a very high education of nutrition in schools. They have three home economic lessons per week and they have to learn there how to cook and also about food benefits and proper nutrition (for students aged from 15 to 16 years old). This subject has topics about food recommendations, about healthy food and how to prepare food in different kinds of ways and healthier ones. Home economic lessons are one of the most likable for children in 9th grade. It is the second lesson after physical activity [24].

4.2. Nutrition Education in Canadian Schools

Canada's school's program also has Home economics food and nutrition (HEFN) lessons. Joyce Slater and Aynsle Hinds made a study about young adults' approach towards HEFN lessons [27]. The study conducted out of 206 participants. $\frac{3}{4}$ of the participants had HEFN in middle schools, but unfortunately in 12th-grade nutrition education dropped by 9%. But based on all answers, lessons about nutrition are needed and it can prevent obesity or overweight. The table of Slater & Hinds, 2014 shows that almost all respondents - 95.6%, said that HEFN lessons have to be in schools, almost 90% (88.3%) reported that they learned very important skills in that lesson. Some of the participants (30.7%) even said that it is as important as math and also $\frac{3}{4}$ said it was easy credit too. This study shows that HEFN is a valuable lesson and opportunity to get basic knowledge and get new skills in

the food and nutrition sector. Young adults replied that HEFN has great potential in reducing the risk of obesity, chronic diseases, and also in new cooking techniques that maybe children will not learn at home. "The positive views of HEFN education exhibited in this study suggest that it can be an important vehicle for transferring critically important foundational knowledge and skills to youth." [27].

4.3. Nutritional Education in French and Japanese Schools

The semi-structured qualitative study was made in French and Japanese schools. In France, it was mainly done in Paris, and in Japan, it was done in Utsunomiya city. There were 26 participants. All of the participants agreed, that lunch meals in schools are very important and good educational tools. Children try different foods, they taste everything and they start to like healthy food. Some parents said that they are very happy that school gives their child lunch because the parents still do not know how to make healthy food that their children would like or they do not have time for preparing lunch boxes. Children during lunchtime discuss healthy food and they tell everything about it back at home. It is also important that children would have memorable and fun times during meals [28].

4.4. Nutrition Education in Latin America's Schools

The best choice to eat in Brazil schools is shops that are really near the schools, but the food there is mostly energy-dense and nutrient-poor products [27]. The latter ones, of course, are the most popular and that is why shops have way less natural and healthy foods. Because of this situation in Brazil, the government is trying to change it and they try to reason with shop owners to sell healthier foods [29]. Around Mexico public schools there are about 6 mobile vendors. Some results show how these mobile vendors affect children's Body Mass Index (BMI) to higher ones [30]. Latin America has no significant proves about nutrition education in schools. It is known, that because of inadequate food sell in schools and around schools, the rates of childhood obesity are getting higher [31].

5. Norway Preschool Teachers and Their Education

Teachers play an incredible and persuasive job in kids' lives [32] and a relationship between children and teachers is linked to many different outcomes [33]. One big problem which is also not helping children nutrition is that teachers have no education about nutrition in the first place. Norwegian pre-school teachers have to study for three years of bachelor's, and in these three years, they get no information about healthy eating. A qualitative study about Norwegian student pre-school teachers and what education they get from their studies show that after graduation, teachers understand that they are in lack of

knowledge if talking about nutrition. "It was only after the interviews with student preschool teachers that they realized that they lacked mediating knowledge about the diet" [4].

6. Family Based Nutrition Education

As important as school-based nutritional education is, there are other factors. In order to achieve better results in improving eating and physical activity habits, families play a crucial role. In fact, the impact of family environment is found to be one of the most important factors. Families can be included in the nutritional education programmes since they are able to create a healthier environment for the child. Also, parents pose as role models to many children. When a child is overweight, it is a challenge to help parents accept the situation. In addition, it is also a tough process to convince parents that the recommended diets will do no harm to their child's health. For these reasons, it is a challenge to get parents to acknowledge the importance of this process. However, it is equally crucial to involve parent in the obesity prevention process because of their undeniable effect on children [24,35,36]. Studies indicate that, it is more likely for a child to quit weight loss process if the if they don't enough support from the family [37,38].

7. Discussion

It is stated in one study that is conducted in Canada schools that nutritional intake of school children is influenced directly by their socio-economic status and it is argued that school food programs may potentially help overcome this obstacle in healthy nutrition [39]. An eating program was applied in schools of Alberta. An extensive number of schools followed a healthy food program. Soonly, vegetable, and fruit intake demonstrated an increase. As a result, it was observed that obesity percentage among children in the participant schools decreased significantly compared to other schools [11].

Between the years 2008 and 2015, the Child Nutrition Council of Manitoba in Canada implemented a nutrition program called Vegetable and Fruit Snack Program. The program was implemented in the schools in the district. In this process, great progress was achieved in terms of vegetable and fruit consumption among students. In addition to the change in nutritional behaviors, the social capabilities of students showed improvements [40,41]. Several researches analyzed the difference between consuming food brought from home and provided by the school with a school food program. Many studies indicated that school food programs provide a healthier nutritional environment for students [42,43,44]. Also, there are studies in the literature that support the idea that school-based food programs promote vegetable and fruit intake among children. It also provides an equal environment for all children to have access to healthy food regardless of their socio-economic status [45,46].

School intervention in nutrition was investigated in a study that was conducted on 10 to 12-year-old schoolchildren in Norway. Out of the 164 participant

children in the study, 55 were provided healthy and charge-free food during school lunchtime each day. The process was observed for 6 months and the results were estimated with the questionnaire method. According to the results, the nutritional intake of the 55 children who were given healthy foods each day, increased importantly [47].

Dubuisson et al. stated in their study that the school lunch policy in France is quite efficient in terms of providing adequate nutrition to children [48]. In Sweden, new legislation about school food was introduced. Children can access healthy meals during lunch without any charge. This system was observed to benefit the nutritional behaviors of children [49, 50]. One study was conducted to analyze how nutritional behaviors, body mass index, and body mass may vary after being subjected to a food education program in school. 49 female adolescents who obese participated in the study. After the following 4 months, the intervention group who followed the school-based nutritional program showed significant improvements compared to the control group. The study emphasized the significance of school education in nutrition [51].

A study conducted in Tehran, Iran focused on the relationship between nutritional education during childhood and obesity. Subjects, chosen from different schools were provided with a nutritional education program at four stages. Families were asked to improve their habits, schools were banned from selling unhealthy food, nutritional education was provided to children and physical activity was included in school's curriculum. According to the researchers, findings demonstrated that the intervention group showed great change during this process. It was estimated that children in the intervention group lost weight and less BMI [52].

A study was conducted by Bacardí-Gascon and colleagues, in order to understand the relationship nutrition education on children and obesity. Children were provided with a nutritional education programme that included their school environment and family environment. The aim of the programme was to educate children about how their choice of food affects their body. The study continued for almost half a year. In the end of the study, research stated that the nutrition education programme decreased BMI of children. Children were observed to make healthier food choices and get involved in physical activities. The study showed that it is possible to change children's eating habits through education [53].

8. Conclusion

In summary, providing nutritional education in schools is an effective and necessary method for the development of nutritional behaviours and physical wellness. Nutrition education will play a key role in the adoption of a lifestyle that will base in systematic exercise and proper regimen. An educational system oriented in Physical Fitness will protect the students from the negatives effects of sedentary life (colon cancer etc). According to "The Exercise-Telomere Hypothesis" exercise might have a great effect against telomere attrition [54]. Hippocrates the pionner of Medicine recognised the need for a balanced diet and exercise [55]. Regarding our extensive literature review,

there is evidence that school-based nutritional programs can help children gain healthy eating behaviors that are likely to continue in their adulthood. It is important to emphasize the importance that school education in nutrition is quite effective in the prevention of several nutrition-related health problems such as obesity. For this reason, it is the statement of this study that nutrition education is a method that should be popularized and promoted in schools. The long term effects of this method are to be further studied.

Conflict of Interest Statement

The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

The Founding Sources

The authors report no involvement in the research by the sponsor that could have influenced the outcome of this work.

Authors' Contribution

Oral Onur given substantial contributions to the conception or the design of the manuscript, to acquisition, analysis and interpretation of the data. Nikitas Nomikos revised it critically. All authors contributed by writing, editing, and reviewing the manuscript, and read and approved the final version of the manuscript.

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The current epidemic of inactivity and the associated epidemic of obesity are being driven by multiple factors (societal, technologic, industrial, commercial, financial) and must be addressed likewise on several fronts. Foremost among these are the expansion of school physical education, dissuading children from pursuing sedentary activities, providing suitable role models for physical activity, and making activity-promoting changes in the environment.Â

Prevention of Overweight in Children and Youth. Given the challenges of reversing existing obesity in the pediatric population, preventive tactics are likely to be the key to success. Unfortunately, controlled prevention trials have been somewhat disappointing to date.Â

Age-Appropriate Recommendations for Physical Activity. The Role of Schools in Preventing Childhood Obesity. The State Education Standard. 2004.Â

Here is a summary of health education and school wellness obesity prevention recommendations, based on a review of expert guidance from the Centers for Disease Control and Prevention, the Institute of Medicine, the Alliance for a Healthier Generation, and others. For more detailed guidance on these recommendations and ideas for putting them into practice, explore the source list and the links to other resources. Health education in schools. School education seems to be one of the most effective and most recommended preventive actions. A particularly important task of modern school is health education, that is, those elements of the school education program in which children and.Â

To enhance the prevention and intervention efforts of childhood obesity, there is a strong need for the early detection of psychological factors contributing to its development and maintenance. Rather than a stable condition, childhood obesity represents a dynamic process, in which behavior, cognition and emotional regulation interact mutually with each other.Â

The same trend of decreasing overweight through age classes was observed in both populations. 1. Obesity among children and adolescents has reached epi-demic proportions in the Americas.^{1,2} Even if the causes of this epidemic are complex and more research is needed, much is known about the consequences and actions that must be undertaken to halt it. Over the past decade, many countries in the Region, have been putting some of those actions into place and it is now time for the Pan American Health Organization (PAHO) to take the leadership role by unifying these efforts and supporting Member States by launching a regional public health initiative.Â

4. Physical activity plays an important role in the prevention of obesity, and the levels need to be sufficiently high to counteract excess energy intake.