

The Effect of Nutrition Educational Programs on the Composition of Home Prepared Children's Breakfasts

By Ayala Raviv^{} & Ester Aflalo[‡]*

The study aimed to examine the effectiveness of two intervention programs in improving dietary habits in two groups of preschool and fifth-grade students. The programs were tailored to the target age group. The composition of each of the children's breakfasts that were brought from home was recorded both before and after the intervention program. Every food item received a score according to its nutritional quality, and each meal was summed accordingly. T-tests were performed in order to determine the significance of differences between the nutritional quality of the children's breakfast items before and after the intervention. It was found that the nutritional quality of all breakfast components and its overall health quality improved significantly in both age groups. The study's results indicate that the intervention program is effective for a range of young ages. It is recommended to conduct such programs starting in preschools, and subsequently in schools.

Keywords: nutrition educational program, health education, meal components

Introduction

Correct and balanced nutrition is one of the main factors necessary for healthy growth and development in children, from both physiological and psychological perspectives. Fostering healthy dietary habits in children has been found to be effective in preventing nutritional and developmental problems, as well as in preventing acute and chronic diseases (Sharma, Chuang, & Hedberg, 2011; Nicklas & Hayes, 2008). One of the main health problems facing parents and pediatricians in many countries is an increase in the average weight of children and young adults. In the last 30 years the percentage of American children suffering from overweight has tripled (Schmitt et al., 2019) and recent statistics show that one in five American children aged 6-19 suffers from obesity, while one in three are overweight or obese (Sildén, 2018; Durbin, Baguioro, & Jones, 2018). According to the World Health Organization, the obesity epidemic in children exists in Western as well as in Eastern (Qian et al., 2017) and Middle Eastern countries (Albataineh & Badran, 2019) including Israel (Eilat-Adar et al., 2011). In Israel, a three-fold difference in prevalence of overweight was reported in second and fifth graders between 1990 and 2000 (Eilat-Adar et al., 2011) and higher rates of overweight in the youngsters may reflect the occurrence of an obesity epidemic in Israel.

The dramatic increase in overweight and obesity in children in recent decades is attributed, among other factors, to increasing exposure of children to foods that

^{*}Lecturer and Researcher, Hemdat College of Education, Israel.

[‡]Lecturer and Researcher, Hemdat College of Education, Israel.

cause weight gain, combined with a decrease in their physical activity (Kranjac & Wagmiller, 2020). There is a significant increase in the consumption of foods rich in sugar and saturated fats and sweet drinks, expressed both at home, school and social gatherings, together with a correspondingly marked decrease in the consumption of fresh fruits and vegetables.

The negative nutritional change that has occurred within the population during recent decades in many countries has led to increasing illness among children. These illnesses include chronic diseases related to obesity, such as type II diabetes, kidney disease and high blood pressure (Fung, 2016). Obesity in children is also manifested in as psychological problems such as negative body image and low self-esteem have also appeared (Durbin, Baguioro, & Jones, 2018), as well as mental health problems such as depression. Overweight children often suffer from teasing and bullying by their peers and from social isolation (Sildén, 2018; Durbin, Baguioro, & Jones, 2018). In China (Qian et al., 2017; Hu, Li, Huang, & Li, 2010), the increase in the standard of living enabled a greater availability of unhealthy foods, yet there is a lack of knowledge about healthy nutrition and its importance. Qian et al. (2017) concluded that educational and intervention programs must begin being implemented at a young age, since such programs improve knowledge, and subsequently, nutritional habits among children, primarily among those in elementary school. The nutritional behavior and knowledge of Children have been identified as significant mechanisms contributing to weight increase. Some children do not even consume fruits or vegetables on a daily basis, and it turns out that these same children did not undergo an appropriate process of developing a preference for healthy food during early childhood (Escobar, 1999).

Studies that examine education for healthy nutrition among children emphasize the need for and the advantages of conducting intervention programs designed to encourage appropriate dietary habits beginning from a young age (Aktaç Kızıltan, & Avcı, 2019). Researchers agree that intervention programs should be designed for both children and their parents. According to Durbin et al. (2018), educational programs make positive changes and have further influence in encouraging the acquisition of healthy lifestyle habits. Since dietary habits and food preferences develop at a young age (Xu & Jones, 2016), the guidance and influence of programs on food preferences at this age can serve as an effective and promising approach to promoting the consumption of healthy food,

Moss et al. (2013) and Keiko, Todoriki, and Sasaki (2017) found that children's knowledge about food has an influence on their choices, their preferences, and their food habits in practice. There was an unequivocal relationship between children's knowledge about healthy nutrition and increased vegetable consumption. Teachers showed interest in implementing short intervention programs within the framework of health and science lessons (Schmitt et al., 2019).

Nevertheless, many schools avoid implementing of nutrition education programs due to a lack of space, resources and experience (Moss et al., 2013) and only few teachers actually integrate these programs in their classrooms.

Many families lack information and are not sufficiently aware of the importance of healthy nutrition and physical activity, and some even intentionally

avoid being aided by educational programs to promote their children's health (Kranjac & Wagmiller, 2020; Povey, Cowap, Scholtens, & Forshaw, 2020).

Many of the studies described above report on the children's actual nutritional knowledge and declared preferences (Lewis, 2017; Eilat-Adar et al., 2011; Pirouznia, 2001). In the current study, we aimed to examine the direct effect of two intervention programs on the dietary habits of the children, as expressed by the actual composition of their breakfast that was prepared at their home and they brought to eat at school. The research questions were:

- a. Will short nutritional education programs improve the overall nutritional and health quality of breakfast among preschool children and fifth-grade children, and if so, to what extent?
- b. If these programs indeed have an effect, in which food components will we find a significant change in consumption following exposure to the program?

The research hypothesis was that the intervention programs will improve the nutritional and health quality of the components of breakfast prepared at home of children in both ages.

Methodology

Research Population

The study was conducted in three classes:

1. A preschool class in the south of Israel, comprising 31 children aged 4-6. The preschool population is heterogeneous with an intermediate socioeconomic status. The children bring their meal from home and eat it at preschool at 10 am.
2. Two fifth-grade classes in an elementary school in the south of Israel with a total of 44 children aged 9-10 with an intermediate socioeconomic status. The children bring breakfast from home and eat it in the classroom at 10 am.

The Intervention Programs

The intervention programs were tailored to the children's ages. For the preschool students, the program was developed by the preschool teacher with professional academic guidance by an expert in curriculum development, and in collaboration with a naturopathic dietician. The program comprised 12 weekly sessions of 20 minutes each. The study themes included the components of the food pyramid, diverse eating, healthy eating habits and the importance of familiarity with different food products (such as fruits and vegetables, grains, plant and animal proteins, vitamins, natural food and processed food, types of oils and fats, dietary fibers, water and soft drinks). The program familiarized participants with methods to identify food types, and accompanying eating habits such as

increased chewing, hygiene and esthetics in eating. The children established a vegetable garden, prepared fruit and vegetable salads and soups, prepared healthy sandwiches, baked pastries and cookies using whole wheat flour and coconut oil, squeezed citrus juice and produced oil. Each activity also included games, songs and stories about healthy food. The parents were asked to cooperate with and be supportive of the intervention program. They came to the preschool for a “health day”. The parents enjoyed a healthy breakfast prepared by the children, heard a lecture from a nutritionist and received recommendations on the composition and the types of foods that should be sent with the children to preschool. Parents were weekly informed about what was being learned in the preschool, experiments that the children did, new concepts that were learned, and the health benefits of different foods, as well as recipes that were prepared in preschool.

For the fifth-graders, the intervention program was based on the Israeli Ministry of Education program called “Food and Nutrition”. The program comprised 15 sessions of two hours each and included four components: a. human nutrition –familiarity with the main food groups; b. health, food and nutrition–technological aspects, means and behaviors for wise and healthy nutrition; c. the structure and function of the respiratory and the digestive system; d. the body as a system –the relationship between the body’s systems and its health. Experimentation by the children included planning healthy menu, self-monitoring of meal components and familiarity with food processing methods.

The Research Process

In each class, all the breakfast items that the children brought from home to eat in school were monitored and recorded by the teacher, before and after conducting the program (in Israel, it is customary to bring meals from home to school). In the preschool class, the monitoring took place over approximately six weeks (six school days per week); data were processed and analyzed from 30 days with complete data of every child’s breakfast in each day. In the school classes, the monitoring could only take place over approximately three weeks before and after the intervention program, from which 12 days with complete data for each student were chosen. Most of the children usually brought a sandwich comprising two slices of bread with some kind of spread, extra protein comprising egg, cheese, salami etc., and either a fruit or a vegetable. The children often also brought a snack as part of their breakfast, namely, an item of processed and packaged food rich in sugar or salt, such as a cookie, chocolate, wafer, fried or fat-rich snack based on potato, peanuts or corn.

Each of the food items brought by the children was classified into one of four groups –type of bread or grain, sandwich filling or spread, fruit or vegetables, drink (see Table 1) and received a health score. The score was higher when the food item was healthier and contained less undesirable components. Items that contained simple sugars, sweeteners, processed or preserved food and a high content of saturated and trans fats received the lowest score. Items that contained whole grains, high proteins and vitamins content, fruits and vegetables and water to drink received the highest score. The score, that was determined in consultation with a naturopathic dietician, followed an integrated approach that places

importance on including components from the different food groups while avoiding or reducing the abovementioned undesirable components. In the preschool, only water was provided by the teacher and she did not permit the children to bring snacks for breakfast, both before and after the intervention program. In contrast, some fifth-grade children were free to bring sweetened drinks and snacks from home.

The lowest score for an item of food or drink was 1, indicating poor nutritional value. The highest score was 6 and expressed high nutritional value without negative ingredients. All the scores were positive (>0) for the statistical analysis. We treated snacks like any component with poor nutritional value, and counted the number of children who brought a snack during each of the monitoring days. A positive nutritional value for this component would be considered not bringing it at all, meaning, a low average daily number of snacks brought by the children would be preferred to a high number.

To test whether the nutritional quality of the children's breakfasts would improve after the intervention program, a paired sample t-test was conducted to compare the scores of each component before and after the program. A t-test was also conducted on the overall scores (before and after the program) of the nutritional quality of the breakfast, comprising the sum of its four scores (bread/grain, spread/filling, fruit/vegetable and drink).

The Study was approved by the Institutional Review Board of Hemdat College of Education and appropriate consent procedures were followed.

Table 1. Scores of Children's Breakfast Items

Score	Type of bread/grain	Type of spread/filling	Vegetable/fruit	drink
1	High polyunsaturated trans fat baked pastry (such as Bourekas, Malawach)	Smoked salty preserved processed meat (such as Pastrami, Kabanos, cold cuts) Chocolate spread		Sweetened juice Cola Carbonated drink
2		Strawberry jam		Chocolate milk
3	White bread Pizza Crackers	High fat cheeses (25%-40% fat) Yellow hard cheeses of 30-50% fat Butter		
4	Rice cakes			
5		Omelet/herb omelet Tuna spread Tuna and egg spread Tahini	One vegetable or fruit	Milk
6	Whole wheat bread	White low fat soft cheeses such as Cottage cheese, Feta, Mozzarella, Goat cheese Hard-boiled egg Avocado Carob spread	Two vegetables or fruits	Water

Results

Preschool Children

Table 2 presents the average scores given to the preschool children’s breakfast items, for 30 days before and for 30 days after the intervention program. In accordance with the research hypothesis, we found a significant difference in the quality of the meal between the first measurement before the intervention program and the second measurement after it, with a strong effect size ($t=16.09$, $p<0.001$, $d=2.89$). The overall nutritional quality of the breakfast was lower before the intervention program ($M=10.34$, $SD=1.69$) than after it ($M=13.02$, $SD=1.60$).

The intervention program significantly improved the nutritional quality of three components: bread/grain, spread/filling and fruit/vegetable ($t=7.96$, $p<0.001$; $t=6$, $p<0.001$; $t=5.39$, $p<0.001$; respectively, Table 2). An improvement in the nutritional quality of the preschool children’s breakfast means that more children began bringing sandwiches made with whole wheat bread, increased the amount of fruit and vegetables they consumed, and consumed more healthy spreads/fillings in their sandwiches, such as healthy cheese, avocado or egg, and less salami or chocolate spread.

Table 2. Nutritional Quality of Preschool Children’s Breakfasts Before and After the Intervention Program (N=31)

	Before		After		<i>t</i> (<i>df</i> =30)
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Bread/grain	2.97	0.09	4.05	0.74	7.96**
Spread/filling	3.25	0.75	3.78	0.59	6.00**
Fruit/vegetable	2.14	1.30	3.12	0.78	5.39**
Overall nutritional quality	8.35	1.70	10.95	1.60	16.66**

** $p<0.001$.

Fifth Grade Children

Forty-four 5th-grade children were monitored using the same method that was used for the preschool children, but the number of days was less – 12 days before and after the intervention program. In accordance with the hypotheses, we found a significant effect of the intervention on the fifth-grade children (Table 3), with a very strong effect size ($t=21.35$, $p<0.001$, $d=3.21$).

Table 3. Nutritional Quality of 5th grade Children’s Breakfasts Before and After the Intervention Program (N=44)

	Before		After		<i>t</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Bread/grain	2.86	0.47	3.58	0.52	7.79**
Spread/filling	2.66	0.81	4.85	0.48	16.39**
Fruit/vegetable	2.69	1.44	6.59	1.48	12.39**
Drink	2.80	1.03	4.75	0.72	13.77**
Overall nutritional quality	11.03	2.25	19.79	1.96	21.35**

** $p<0.001$.

We found a significant and positive effect of the intervention program on each of the components that comprise the overall score (bread/grain, spread/filling,

fruit/vegetable and drink). The smallest effect was found on the bread/grain component ($t=7.79$); more meaningful effects were found on the spread/filling ($t=16.39$), type of drink ($t=13.77$) and fruit/vegetable ($t=12.39$) components. Regarding the drink component, the school children tended to replace sweetened or carbonated drinks with water following the intervention program. For three of the meal components – bread/grain, spread/filling and amount of fruit/vegetables – the score was higher among the fifth-grade children than among the preschool children. Similarly to the preschool children, the school children transitioned from consumption of white bread and fillings such as pastrami and chocolate spread to consumption of whole wheat bread and spreads with improved nutritional value and healthier ingredients, such as cheese, egg, avocado or carob spread.

Monitoring of snack consumption could be done only among the fifth-graders, since the preschool children were not permitted to bring snacks. For the category of snacks, we only tested whether the children brought processed snacks enclosed in packaging, such as sweetened breakfast grains, cookies and chocolates, as well as fried snacks with a high content of fat and salt. Another disadvantage of such snacks is that they were mostly consumed between meals, which may disrupt the consumption of healthy components during the children's meal. Snack consumption decreased significantly following the intervention program ($t=7.08$). The average consumption decreased from 0.45 snacks ($SD=0.22$) per child per day before the program to 0.18 snacks ($SD=0.12$) per child per day after the program. Some children stopped consuming this component entirely. In parallel to the decrease in snack consumption, we observed an increase in the number of fruits and vegetables consumed by the fifth-grade children following the intervention program. We assume that some children replaced consumption of snacks with consumption of fruit or vegetables.

Discussion

This study aimed to examine the effects of educational nutrition programs on the actual consumption of the breakfast components that students brought from their homes to eat in school, as it is customary in Israel. Two age groups were studied: preschool children (aged 4-6) and fifth-grade children (aged 9-10). The uniqueness of this study lies in the fact that it examined actual consumption of the meal components, in contrast to many other studies that examined reports or attitudes expressed by the subjects about their food consumption (for example Schmitt et al., 2019; Qian et al., 2017; Xu and Jones, 2016; Keiko, Todoriki, & Sasaki, 2017; Lewis, 2017; Eilat-Adar et al., 2011, Pirouznia, 2001).

The research results demonstrate that in both age groups the intervention programs were found to be effective. In three food components, the type of bread/grain, the type of spread/filling and the fruit/vegetable, there was a significant improvement in both groups. For the bread/grain component, the effect in both groups was similar and we observed a transition from consumption of white bread to consumption of whole grain bread. For the spread/filling component, we observed a transition in both groups from sugar-rich spreads such

as jam and chocolate spread to healthy spreads based on cheese, egg, avocado or carob spread. This change in the type of spread was greater among the 5th graders compared to the preschool children. Similarly, we observed a significant increase in both groups in the consumption of fruits and vegetables following the intervention program, and in this case too, the improvement was greater among the school children than among the preschoolers. Furthermore, the overall quality of the breakfast increased significantly in both groups, once again to a greater extent among the school children than among the preschool children. It is possible that the higher effect sizes of nutritional quality of the breakfast components among school than among preschool children ($d=3.08$ vs. $d=2.89$) stems from the fact that school children have a greater influence than preschool children on the foods items they consume. Nevertheless, both age groups consisted of young children, and in most cases the parents prepare the children's breakfast or at least are involved in choosing the meal items. In any case, since parents have an essential role in shaping the knowledge and nutritional behavior of their children (Stage et al., 2018), it is suggested to promote an intervention program for those same parents in order to achieve ongoing, continued involvement in maintaining healthy nutrition throughout their children's childhood and adolescent years (Payas, Budd, & Polansky, 2010).

Regarding the other two groups of items, the snack and the drink components, no change in consumption was found for preschool children in this study since even before the program the children received water to drink from their teacher and were not permitted to bring snacks to class. In contrast, the school children were free to bring whatever drinks or snacks they wanted for breakfast. Our results show that the intervention program managed to change habits related to drinking sweetened drinks and consuming snacks among the school children—they began to consume more water at breakfast and reduced their consumption of sweetened or carbonated drinks. Similarly, they reduced their consumption of cookies and sweet snacks.

Our findings about the effectivity of the intervention programs on healthy nutrition are in line with previous reports (Sharma, Chuang, & Hedberg, 2011; Moss et al., 2013; Eilar-Adar et al., 2011). The extent of parental involvement was different in the programs. The preschool teacher involved the parents actively by inviting them to a joint breakfast activity in the preschool and to a lecture from a dietician, and sending them weekly relevant information. In contrast, the fifth-grade teacher did not initiate direct activity with the parents. In relation to this, our results showing that the improvement in the nutritional value of the breakfast components among school children was greater than that of the preschool children, needs further investigation to demonstrate that this change for the good can be credited mainly to the children.

Nonetheless, the fact that the preschool children also managed to change and improve certain nutritional habits shows that it is important to instill healthy nutritional habits already in early childhood (Aktaç, Kızıltan, & Avcı, 2019; Xu & Jones, 2016), but it is also important to continue to educate for healthy nutrition at older ages, as correct guidelines and effective programs have an important effect

and even more significant potential for improvement in nutritional habits at school age.

The intervention programs were relatively short, lasting only 12-15 weeks. The main reason for this is that this type of program is part of the science and health study program and the Israeli education system does not allocate more hours for nutritional education. The monitoring of the changes that occurred among the children was also relatively short and lasted only a few weeks. Therefore, it is possible that the nutritional improvement found here might not last long, since long-term behavioral change is a complex process and is not usually achieved after such a short intervention (Gao et al., 2014). There are reports showing that teachers prefer to conduct relatively short intervention programs for nutritional change (Schmitt et al., 2019) but other reports indicate higher effectiveness of long-term programs (Koning, Voelker, & Haque, 2011; Gao et al., 2014). There is evidence that year-long and even six-year programs have a more significant effect on improving the nutritional habits of children and reducing their weight (Koning, Voelker, & Haque, 2011; Price, Cohen, Pribis, & Cerami, 2017). It is therefore recommended to re-examine the effect of short-term programs on nutritional changes and eating habits after more time has elapsed, to assess whether the new habits have become established and to what extent they have become permanent.

Another limitation of this study relates to the difference in the study period for the two age groups. It is possible that because the monitoring was shorter among the fifth-graders, we found a greater improvement in the meal components shown by these children in comparison to the preschool children. A longer monitoring period would enable better examination of the extent of the effect of the intervention program. A further limitation of this study is that the monitoring was carried out only on the breakfast that was brought to class, and not on the meals the children ate in their homes. We do not know whether a change also occurred in the children's nutrition in the other meals consumed in the home. Future studies will test the students' reports on lunches and dinners as well as on food consumption between meals. We also note that the food items consumed received quality scores according to the accepted nutritional value of breakfast components, but it is possible that other nutritionists would evaluate the food components differently.

This study was conducted before the COVID-19 crisis and was written during its occurrence. The current crisis empowers and emphasizes the importance of health education among children, and no less among parents, since the parents are the primary actors in preparing and determining the composition of children's food and drinks. During this crisis, schools in many countries were closed. In many countries, there are programs for subsidized meals at school (Rollins, 2020). Due to lockdown periods, all responsibility for meals was transferred to the family, as children were confined to their home. This may be comparable to periods of summer vacation, where it has been found that when children leave the school environment, their food composition tends to deteriorate and they experience a decrease in nutritional quality (Lewis, 2017). Seeing that children's nutrition is so dependent on their adult caregivers, we thus propose that nutritional education be

provided to both children and adults. Such programs were tested in the United States (Lewis, 2017), and China (Gao et al., 2014); it was found to be effective and led to an improvement in nutritional habits, namely, an increase in the consumption of fruits and vegetables and a decrease in the consumption of sweets and foods rich in salt.

It is important to conduct follow-up studies on educational intervention programs intended to improve children's nutrition (Khan and Bell, 2019), in order to promote correct nutritional habits among children and their families and to ensure the persistence of children's healthy nutritional habits for optimal development, disease prevention, and well-being.

Conclusions

The main finding of the current research show that as early as in kindergarten, and later in school, children managed to change and improve certain nutritional habits. This implies the importance to begin the implementing of nutrition educational programs as early as in kindergarten, and re-teach them in higher classes accordingly. The nutrition intervention programs should be implemented in cooperation with the children's families, as they play an important role in the preparation of healthy meals for their children and are to be encouraged to apply the principles of healthy nutrition both in and outside the school. The development and carrying out of the programs should involve experts from various fields such as science, nutrition, medicine and cooking, that will contribute from their expertise and experience. The learning process itself should include not only academic knowledge but rather involve experiencing the preparation of healthy meals, so to encounter the children to practice healthy diet and make its application into their important habit over time.

Finally, our main conclusion is that the instillation of healthy nutritional habits should start already in early childhood and extend later on at older ages, as correct guidelines and effective programs have a significant potential for improvement of nutritional habits at any age.

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