The effect of educational programs for healthy nutrition on the composition of children’s breakfasts

**Abstract**

The aim of the study was to examine the effectiveness of two intervention programs for improving the dietary habits at breakfast of two age groups of children: 31 preschool children and 44 children in two 5th-grade classes in an elementary school.

An intervention program was conducted in each group to educate the children about healthy nutrition, tailored to the children’s ages. For the preschool children a short intervention program was developed; it comprised 12 sessions of 20 minutes each, while a national program of 15, two-hour sessions was conducted for the 5th-grade children.

All of the breakfast items were recorded for a period 30 days for the preschool children and 12 days for the 5th-grade children, both before and after conducting the program. Every item of food received a score according to its nutritional quality, and the scores of the items in each meal were summed. T-tests to determine the significance of the differences in nutritional quality of the breakfast items of the children were performed before and after conducting the program.

It was found that the nutritional quality of all groups of components of breakfast and the overall nutritional quality of breakfast improved significantly in both age groups.

It can be concluded from the research results that the intervention program is effective at different young ages and an intervention program such as this one can be conducted in preschools, and subsequently in schools.

**Research Aim**

To examine the effectiveness of two intervention programs for improving the composition of the breakfasts that preschool and 5th-grade children bring from home.

**Design**

Intervention programs were conducted to educate the children about healthy nutrition. Monitoring of the breakfast items brought by the children from their homes was performed for a period of 30 days (preschool children) or 12 days (5th-grade children), both before and after the programs. Each item of food received a score according to its nutritional quality, and the scores of the items in each meal were summed. T-tests were done to determine the significance of the changes in the nutritional quality of the items and of the breakfasts brought by the children before and after conducting the program.

**Setting**

A preschool class in a rural settlement and two 5th-grade classes in an urban elementary school.

**Participants**

Thirty-one preschool children and forty-four 5th-grade children with intermediate socioeconomic status.

**The Intervention Program**

A short intervention program comprising 12 sessions of 20 minutes was developed for preschool children, while a national program comprising 15 sessions of two hours each was conducted for 5th-grade children.

**Results**

The nutritional quality of the groups of breakfast components and the overall nutritional quality of the breakfasts improved significantly in both age groups.

**Conclusions and Implementation**

It is important to conduct intervention programs to improve the nutritional quality of food for both young people and adults. It is important to involve families within the framework of these programs.

**Literature Review**

Nutritional habits in children

Correct, balanced nutrition is one of the main factors necessary for healthy growth and development in children, from both the physiological and psychological perspectives. Developing healthy dietary habits in children has been found effective in preventing nutritional and developmental problems, as well as in preventing acute and chronic disease. 1 2 A central health problem that parents and pediatricians must deal with in the United States, Europe and other countries is an increase in the average weight of children and young adults. In the last 30 years this phenomenon has tripled itself 3 and recent statistics show that one in five American children aged 6-19 suffers from obesity, while one in three suffers from overweight or obesity. 4 5 The definition of obesity or overweight is not uniform, and may vary among different populations. It also depends on age and gender, varies among different countries and regions around the world, and is based mainly on statistics (determining the percentile within the population above which the weight-to-height ratio is found). 6 Among children it is particularly difficult to determine the weight above which the child will be defined as overweight, mainly because children undergo continual growth and development. Therefore, for convenience, it is accepted that overweight is defined when the body mass ratio (BMI; the ratio between weight and the square of height) is above 25 kg/m2 and obesity is defined when this value increases to 30. 7

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 cause weight gain, combined with a decrease in their physical activity. 8 This overexposure of children is expressed both at home, at the family level, and outside of it – at school, and at social gatherings. In fact, in many countries, the entire population, not just children, has demonstrated a significant increase in weight. 8

In parallel to the increase in weight, a significant increase in the consumption of foods rich in sugar and saturated fats, as well as sweet drinks, has been observed among children in recent decades; a correspondingly marked decrease has been observed in the consumption of fresh fruits and vegetables. Children’s nutritional behavior and their nutritional knowledge were identified as significant mechanisms contributing to weight increase. The positive relationship found between consumption of foods rich in saturated fats and sweet drinks and increasing weight during childhood was correlated to the relationship between increased consumption of fruits and vegetables during childhood and a lower risk of weight increase and obesity. 1 2 Unfortunately, most children in the United States do not implement the up-to-date nutritional recommendations to consume at least four servings of fruits and vegetables per day. 5 In fact, some children do not even consume fruits or vegetables daily and it turns out that among these same children there was no correct process of developing a preference for healthy food during early childhood. 9

The negative nutritional change that has occurred within the population during recent decades in Western 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. Additional diseases related to obesity in adults that are beginning to be expressed in children are cardiovascular diseases, metabolic syndrome, chronic inflammatory disease and even different types of cancer. 10 However not only are physiological problems related to obesity in children, psychological problems such as negative body image and low self-esteem 5 and even mental health problems such as depression have appeared. Thus overweight children find themselves suffering from teasing and bullying from their peers and from social isolation.

According to the World Health Organization, the weight-gaining epidemic in children is not confined to the United States, but also exists in other countries around the world. 5 For example, a significant increase in weight gain in children has been found in recent years in China. 11 During these years, China has been characterized by an increase in the standard of living, high availability of unhealthy foods, and a lack of knowledge about healthy nutrition and its importance. The researchers of this study concluded that educational and intervention programs must be conducted already at an early age since they improve knowledge, and subsequently, nutritional habits among children, mainly among those in elementary school.

There is broad consensus among researchers and therapists regarding recommendations for healthy life styles for children: a move to healthy nutrition, reduction in screen time, and increase in time spent engaging in games and physical activity, and ensuring an adequate amount of sleep. It has been found that although the nutritional habits and preferences among young children originate in the home, repeated exposure to healthy food outside the home, such as at school or at preschool, can also lead to an improvement in children’s preferences and in their desire to consume healthy food and drinks. 12

The effect of interventional programs on knowledge and on changes in nutritional habits among children

Studies that examine education for healthy nutrition among children emphasize the need and the advantages to conducting intervention programs designed to encourage appropriate dietary habits already at young ages. 12 This approach has two main drivers: the first one relates to the worrying changes that have occurred in recent decades in dietary habits in the Western world, and the serious health consequences of these changes, expressed as a decline in the health of children and young adults. The second one stems from the existence of research evidence indicating that educational programs for correct nutrition can indeed significantly improve the dietary habits of children and young adults. Researchers agree that it is very important to conducted intervention programs in order to promote the implementation of the above recommendations, and that these programs should be designed for both children and their parents. Dietary habits and physical activity are acquired mainly at home; changes toward healthy nutrition and increased physical activity have been found to have a positive influence on children’s weight and good feelings. 5 Durbin et al. reviewed studies on the relationship between developing dietary habits in children, physical activity, and weight gain, during the period 2012-2017. Their clear conclusion is that healthy eating and activity habits can be developed during childhood, and educational activity should be developed in this direction. The changes for the good continue to have an influence on the acquisition of healthy life habitats, leading to consistent changes in indices of health and well-being of today’s children, who are tomorrow’s adults. Dietary habits and the tendency to prefer these or other foods develop at a young age, 13 thus the direction and influence on food preferences at this age can serve as an effective and promising approach to promoting the consumption of healthy food, including fresh fruits and vegetables, whole grain cereals, consumption of plant proteins and drinking of water.

In an attempt to understand how intervention programs work on children, Moss et al. showed that nutritional education programs led not only to the development of health literacy among young children, but also to a change in the foods they preferred to consume – a preference for fruits and vegetables rather than other foods. 14 Keiko et al. 15 found that children’s knowledge about food has an influence on their choices, their preferences, and their food habits in practice. These researchers found an unequivocal relationship between children’s knowledge about healthy nutrition and increased vegetable consumption, emphasizing the importance of instilling this knowledge already at a young age. Akta et al. 12 conducted a 10-week intervention program for 74 children in a public preschool in Turkey. They found that the improvement in children’s food habits was even more significant when the families of those preschool children were involved in the implementation of the program and the improvement in dietary habits was also expressed in the other members of the family. Other studies found that programs that included vegetable gardens existing at the school can also be effective in promoting nutritional knowledge and behavior. Nevertheless, many schools avoid implementing these programs due to a lack of space, resources and experience in the implementation of such programs. 14 Therefore, despite the importance of developing healthy nutritional behavior and developing nutritional health knowledge, and despite the fact that a number of nutritional education programs have been found effective in elementary schools, few teachers actually conduct these programs in their classrooms.

In interviews conducted by Schmitt et al. 3 among teachers in an elementary school, the teachers claimed that the absence of short and easily implementable intervention programs and the lack of time for assimilating independent study programs are the main reasons they do not educate towards healthy nutrition in their classrooms. Teachers were interested in implementing short intervention programs within the framework of health and science lessons. Schmitt et al. developed a short program in accordance with international standards for nutritional education that were formulated to improve nutritional knowledge and behavior among children. The study was conducted on 131 children in ten 2nd-grade classes in the United States, of which 82 participated in the intervention program and 49 did not. The program was conducted twice a week for six weeks; it included provision of health information directed to preferring fruits and vegetables over other foods. It was found that even such a short intervention program could be successful, and in its wake the children reported that they preferred to consume fruits and vegetables over other foods (actual consumption was not examined).

Hu et al. 16 also emphasized the importance of assimilating intervention programs for teachers and students already in preschool, as this is when they acquire important habits for life. The researchers claimed that parents in China tend to spoil their children and give them harmful snacks, fast food and sweetened drinks, resulting in increased morbidity. The researchers were convinced that children should already develop appropriate dietary habits during early childhood that will accompany them throughout their lives.

We can see, therefore, that despite the important role of families in instilling appropriate dietary habits, the intervention programs studied in preschool or school do not always merit the cooperation of the families. It has been found that when children exit the school gates during the summer vacation their food composition tends to change negatively and their food quality decreases significantly. 17

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. 8 18 Many of the studies described above report on the children’s knowledge and preferences in choosing nutrition, preferences that the children themselves reported. 17 19 20 The uniqueness of the current study lies in examining the direct effect of two intervention programs on dietary habits expressed by the composition of the breakfast that the children bring from their homes. The children’s food consumption was documented in real time; we documented the foot items brought for breakfast by children in preschool or in the 5th grade, both before and after conducting the intervention program.

The research aim was to examine the effectiveness of intervention programs in improving the composition of the breakfasts of children in two age groups: preschool children and children in the 5th grade in an elementary school.

The research questions were:

1. Will short nutritional education programs improve the overall nutritional quality of breakfast among preschool children (aged 4-6) and among 5th-grade children (aged 9-10), and if so, to what extent?
2. In the event that these programs indeed have an effect, in which food components will we find a significant change in consumption following exposure to the program?

**Methodology**

Study population

The study was conducted in three classes:

1. A preschool class in the south of Israel, with 31 children aged 4-6. The preschool population is heterogeneous with an intermediate socioeconomic status. The children bring breakfast from home and eat it at preschool.
2. Two 5th-grade classes in an elementary school in the south of Israel with a total of 44 children aged 10-11 with an intermediate socioeconomic status. The children bring breakfast from home and eat it in the classroom.

The intervention programs

1. The preschool intervention program

The program was developed by the preschool teacher researcher with professional academic guidance by an expert in preparing study programs, and in collaboration with a naturopathic nutritionist. The program included 12 weekly sessions of 20 minutes each. The study themes were: understanding the components of the food pyramid, diverse eating, healthy eating habits and importance of and familiarity with different food products (such as fruits and vegetables, cereals, plant and animal proteins, vitamins, natural food and processed food, types of oils and fats, dietary fiber, water and soft drinks). Furthermore, the program included familiarity with methods to identify food types, accompanying eating habits such as increased chewing, hygiene and esthetics in eating. The children set up a vegetable garden, prepared fruit and vegetable salads, prepared healthy sandwiches, cooked vegetable soups, baked small pastries using whole wheat flour, prepared cookies using whole cereals and coconut oil, squeezed citrus juice and produced oil. The program also included involvement of parents who came to the preschool for a health day. The parents enjoyed a healthy breakfast prepared by the children, heard a lecture about the importance and characteristics of healthy nutrition from a nutritionist, received recommendations about the composition of sandwiches and types of foods that should be sent with the children to preschool. Each of the activities also included games, songs and stories on the topic of healthy food. Following accepted practice in preschools, parents received an information page elucidating the importance of healthy food and of improving children’s eating habits. Each week the parents received detailed information about what was being learned in the preschool, experiments that were conducted, new concepts that were learned, and the health benefits of different foods, as well as recipes that were prepared in preschool. The parents were asked to cooperate and back up the intervention program.

1. The 5th-grade intervention program

The intervention program was based on the Ministry of Education study program called “Food and Nutrition”. The two classes, one with 24 students and the other with 20 students, participated in the program, which comprised 15 sessions of two hours each. The program’s components were: a. human nutrition – the importance of water and food for the human body, familiarity with the main food groups. b. health, food and nutrition – technological aspects, means and behaviors for wise and health-promoting nutrition. c. the structure and function of the respiratory system, comprehensive study of the structure and function of the digestive system. d. the body as a system – on the relationship between the body’s systems and its health. Experimentation by the children included: planning healthy menus, self-monitoring of meal components and familiarity with food processing processes.

The research process

In each class where the intervention program was conducted, the breakfast items the children brought from their homes to eat in the class were monitored and recorded before and after conducting the program. In the preschool class, the monitoring took place over ca. six weeks during each period (six study days per week); data were processed and analyzed from 30 days that included complete data of the breakfasts of every child, both before and after the intervention program. In the school classes the monitoring took place over ca. three weeks before and after the intervention program, from which 12 days before and 12 days after the program were chosen. It was not possible to use all of the data collected during the monitoring because some of the students were often absent both before and after the program was conducted. We chose 12 days with complete data for every student. 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. By snack we mean 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. The preschool children drank only water that they received from the preschool teacher while the school children often brought a drink from home.

Each of the food items brought by the children received a score according to a classification into four groups: type of bread or cereal, sandwich filling, fruit or vegetables, drink (see Table 1). The score was higher when the nutritional value of the food item was healthier and contained less undesirable components. Items that contained simple sugars, sweet drinks, processed or preserved food and a high content of saturated and trans- fats received the lowest score. Items that contained whole grains, foods rich in proteins and vitamins, fruits and vegetables and water to drink received the highest score. The score that was determined, in consultation with a dietician and naturopath, expressed an integrated approach that places importance on including different components of the food groups while avoiding or reducing the abovementioned undesirable components. In the preschool, drink was provided by the preschool teacher; therefore, both before and after the intervention program the children drank only water at breakfast. For the 5th-grade children the situation was different, and some brought sweetened drinks from home.

The lowest score for an item of food or drink was 1, expressing negative 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. With respect to the snack, we treated this item like any component with negative nutritional value; therefore, we counted the number of children who brought a snack during each of the monitoring days. Due to the negative nutritional value of this component, a positive nutritional value would be considered not bringing it at all, meaning, a low value of the average number of snacks brought by the children per day would be preferred to a high value.

In order to test the research hypothesis that the nutritional quality of breakfast would be better after the intervention program a paired sample t-test was conducted to compare the scores of each group of items. To compare the general quality of the breakfast before and after the intervention program, a t-test was conducted on the overall score of the nutritional quality of the breakfast, comprising its four scores (bread/cereal, spread/filling, fruit/vegetable and drink).

Table 1. Table of scores of children’s breakfast items

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Score | Type of bread/cereal | Type of spread/filling | Vegetable/fruit | drink |
| 1 | BourekasMelawach | PastramiChocolate spread |  | Sweetened juiceColaCarbonated drink |
| 2 |  | Strawberry jam |  | Choc milk |
| 3 | White breadPizzaCrackers | Garlic-dill cheeseButterYellow cheese |  |  |
| 4 | Rice cakes |  |  |  |
| 5 |  | Omelet/herb omeletVegetableTuna spreadTuna and eggTahini | One vegetable or fruit | Milk |
| 6 | Whole wheat bread | White cheeseCottage cheeseBulgarian cheeseTzfat cheeseHard-boiled eggAvocadoCarob spread | Two vegetables or fruits | Water |

**Results**

Preschool children

To test the research hypothesis that the nutritional quality of the breakfast would be better after the intervention program than before it, 30 measurements were conducted for each child in the preschool class before the intervention program, and 30 measurements were conducted after the intervention, for three of the research indices: the bread/cereal, the spread/filling and the fruit/vegetable component. Moreover, for each student an overall score was calculated for the nutritional quality of the breakfast that was the sum of the scores of the meal components. For each component and for the overall score a paired sample t-test was calculated. Table 2 presents the average scores given to the breakfast items of the preschool children, for 30 days before the intervention program and for 30 days after the program. It was found that in accordance with the research hypothesis there is a significant difference in the quality of the meal between the first measurement before the intervention and the second measurement after the program, 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) compared to its quality after the program (M = 13.02, SD = 1.60).

The results of the tests (Table 2) show that the intervention program significantly improved he nutritional quality of three components: bread/cereal, 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). The preschool teacher did not permit the preschool children to bring snacks for breakfast. Similarly, the children did not bring drinks from home; rather, the preschool teacher gave them water. Therefore, there is no treatment of these components as part of the breakfast and there is no difference in their consumption before and after conducting the intervention program. The meaning of an improvement in nutritional quality of the preschool children’s breakfast is 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 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 |  |  |
|  | *M* | *SD* | *M* | *SD* | *T(df=30)* |
| Bread/cereal | 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

School 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, a significant difference between the first measurement and the second measurement was also found for 5th-grade children (Table 3), with a very strong effect size (t(44) = 21.35, p < 0.001, d = 3.21). The nutritional quality of the breakfast was lower before the intervention program (M = 11.03, SD = 2.25) than after the intervention program (M = 19.79, SD = 1.96).

Table 3. Nutritional quality of school children’s breakfasts before and after the intervention program (N=44)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Before |  | After |  |  |
|  | M | SD | M | SD | t |
| Bread/cereal | 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

When we tested the effect of the intervention program on each of the components that comprise the overall score (bread/cereal, spread/filling, fruit/vegetable and drink) we found a significant difference for each of the components before and after the intervention program. The smallest, but significant, difference was found for the bread/cereal component (t = 7.79); more meaningful differences were found for the spread/filling (t = 16.39), type of drink (t = 13.77) and fruit/vegetable (t = 12.39) components. Regarding the drink component, after the intervention program the school children tended to replace sweetened or carbonated drinks with water. For the four meal components an improvement was found in the nutritional quality score. For three of the meal components – bread/cereal, spread/filling and amount of fruit/vegetables, the score was higher among the 5th-grade children than among the preschool children. In general, similarly to the preschool children, the school children moved 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.

Consumption of snacks before and after the intervention

Monitoring of snack consumption could be done only among the school children since the preschool children were not permitted to bring snacks to preschool. Regarding this component, we only tested whether the children brought processed snacks enclosed in packaging, in other words, snacks such as sweetened breakfast cereals, cookies and chocolates, as well as fried snacks with a high content of fat and salt. Another disadvantage of this type of snack is their consumption between meals rather than during meals, a fact that may disrupt the consumption of healthy components during their meal. Monitoring of the snack component revealed a significant decrease in its consumption by the school children following the intervention program (t = 7.08). The average consumption per child per day 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 5th-grade children following the intervention program. We assume that some of the children replaced consumption of snacks with consumption of fruit or vegetables.

**Discussion**

The aim of the study was to examine the effects of the healthy nutrition educational program on the actual consumption of the breakfast components that students bring from their homes to eat in the classroom at school. Two age groups were studied: preschool children (aged 5-6) and 5th-grade children (aged 9-10); the intervention programs were tailored to the children’s ages. 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. In the current study, monitoring was conducted to document the components of the breakfast brought by the children from their homes for a period of 30 days (preschool children) or 12 days (school children) both before and after the program; thus it was possible to compare and test whether a change in these components had occurred and whether the children consumed healthier ingredients after they were exposed to the intervention programs. The research results demonstrate that in both age groups the intervention programs were found to be very effective. In three food components, the type of bread/cereal, the type of spread/filling and the fruit/vegetable, a significant improvement was found in both groups. For the bread/cereal component, the effect in both groups was similar and we observed a transition among the children 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. The change in the type of spread was greater among the school children 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 difference in consumption after intervention compared to before it was greater among the school children than among the preschool children. Furthermore, the overall quality of the breakfast increased significantly in both groups, and it is clear that the effect size was different; the increase in overall nutritional quality of the breakfast among school children was markedly greater than among the preschool children. It is possible that the finding that the effect size of nutritional quality of the breakfast and of some of its components among school children was greater 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 content of the food they prefer to consume, as well as having a greater influence in deciding for themselves which food items they will take with them to school. Nevertheless, in both age groups we are dealing with young children, and in most cases the parents prepare the breakfast components for them or at least are involved in choosing the items of this meal. Since parents have an essential role in shaping the knowledge and nutritional behavior of their children, 21 it is necessary 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 teenage years. 22

Regarding the other two groups of items, the snack component and the drink component, no change in consumption was found for preschool children in this study following the intervention program because the children received water to drink from the preschool teacher (they did not bring drinks from him), and they were requested by her not to bring cookies or sweets to preschool. In contrast, the school children could bring whatever drinks or snacks they wanted to bring from home for breakfast. Among the elementary school children, it was found that the intervention program also managed to change habits related to drinking sweetened drinks and consuming snacks. Following the intervention program the elementary school children 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 1 14 19 and with firm recommendations to conduct intervention programs not only among children but also among their parents, 17 both for elementary school children and preschool children. 12 The two programs that were conducted in the current study were different from each other in their content because they were tailored to the children’s ages. Moreover, there was a difference between the programs in the extent of parental involvement: in the preschool class the teacher involved the parents actively, inviting them to a join a breakfast activity in the preschool and listen to a lecture from a nutritionist, as well as sending information to the parents on a weekly basis. The 5th-grade teacher did not initiate direct activity with the parents. The result we received, showing that the improvement in the nutritional value of the breakfast components among school children was greater than the improvement among the preschool children, may 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. 12 13 Furthermore, as the findings of the current study show, it is important to continue to educate for healthy nutrition also at older ages, as correct guidelines and effective programs have an important effect and significant potential for change and improvement in nutritional habits also – and even more so – at school age.

The intervention programs were relatively short and lasted for 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 education system does not have a greater allocation of study hours in the field of 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 expressed in the two age groups will not last long, since long-term behavioral change is a complex process and is not usually achieved after such a short intervention. There are reports showing that teachers prefer to conduct relatively short intervention programs for the purpose of nutritional change 3 but other reports indicate higher effectiveness of long-term programs. 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. 23 24 It is therefore recommended to re-examine the effect of short-term programs on nutritional changes and on eating habits after more time has passed since the learning process and assess whether the new habits have become established and to what extent these habits 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 school children, 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.

Another limitation of the study is that the monitoring was carried out only on the breakfast that was brought to school or preschool, while the meals the children ate in their schools were not monitored. We do not know whether a change also occurred in the children’s nutrition in the other meals consumed at 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 treatment of breakfast components, but it is possible that other nutritionists would evaluate the food components differently.

This study was conducted in a preschool class and in a school class before the COVID crisis and was written during the crisis. The current crisis empowers and emphasizes the importance of health education among the children, and no less among the parents, since the parents mainly prepare and determine the composition of the foods and drinks in and between the meals. During the current crisis most schools in many countries were closed, and among the other consequences of this study, the nutrition of children confined to their houses changed and depended only on what was served to them in their homes. In many countries there are programs for serving subsidized meals at school, 25 and during the COVID crisis and the lockdown all of the responsibility was transferred to the family, where the children were located. Similarly, during vacation, when the children leave the school environment, the food composition tends to deteriorate, and the children experience a decrease in nutritional quality. 17 Therefore we propose nutritional education for both children and adults. Such a program was tested in 2016 in the United States; 17 it was found to be effective and an improvement was observed in nutritional habits, in other words, 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 the educational intervention program to improve the children’s nutrition in order to promote correct nutritional habits among children and their families, and to ensure persistence of healthy nutritional habits for the optimal development, prevention of disease and well-being of children.