

Original Research Article

The effect of nutrition education on knowledge, nutrients intake, and physical activity of children with overweight and obesity at elementary school in Jakarta Indonesia

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ABSTRACT

Background: Obesity is one of the triple burden malnutrition in Indonesia, alongside undernutrition that increasing over the years. The study was done to evaluate the effect of four weeks nutrition education intervention among children with overweight and obesity.

Methods: This study was a cluster randomized control trial in two elementary school in Jakarta. SD Kramat Pela 07 were selected as a control and SD Kramat Pela 09 as an intervention group. Intervention on school children were conducted for four weeks. Samples were students who were selected with the criteria of having overweight and obesity. An education through video was delivered from the teachers consecutively to the students every week. Nutrition knowledge was collected with a Google-form questionnaire that consist of 15 questions. Nutrient intake was collected with 24-hour recalls before and after the intervention.

Results: A significant increase of nutrition knowledge on both group after the intervention ($p < 0.05$). There was a significant change of fiber intake ($p < 0.05$) after four weeks of intervention. The average duration of physical activity for respondents showed an increase in the intervention group, but it was not statistically significant ($p > 0.05$).

Conclusions: After four weeks intervention, nutrition education improved the knowledge, nutrients intake, and physical activity among school children with overweight and obesity. We recommend the school authorities to enhance the capacity and capabilities of teachers in fostering efforts to improve the health and nutrition of students through school-based learning. Additionally, the consumption of fiber is considered an indicator of healthy food quality in controlling overweight and obesity.

Keywords: Nutrition education, Obesity, School children

INTRODUCTION

Obesity is one of the triple burden malnutrition in Indonesia, alongside undernutrition that increasing over the years. The global nutrition report for the year 2018 highlighted the worldwide prevalence of overweight and obesity in adults, reaching 38.9% across regions from Africa to north America. This report also investigates the escalating rates of overweight and obesity, particularly among adolescents. There was a significant increase in

obesity within the age group of 5-12 years, rising from 11.6% in 2013 to 20% in 2018. The province of DKI Jakarta emerged as the highest-ranking province in terms of overweight and obesity prevalence among children aged 5-12 years, recording 30.1% in 2013, and the second-highest prevalence of 29.2% in 2018.¹ In 2019, screenings conducted by the south Jakarta health office indicated a further increase in the prevalence of overweight and obesity among school-age children, rising from 29.2% in 2018 to 33%.

There are several factors contributing to obesity in school-age children, including lifestyle, genetic factors, and social factors. Firstly, poor dietary habits; the widespread consumption of high-energy foods such as snacks, fast food, and sugary drinks contributes to weight gain. Secondly, sedentary lifestyle; insufficient physical activity leads to a disparity between calorie intake and expenditure.² The pervasive use of electronic devices like television, video games, and smartphones is identified as a prominent contributor to obesity, reducing energy expenditure and physical activity among school-age children. Thirdly, a combination of genetic and environmental factors, such as easy access to unhealthy snacks and limited access to healthcare facilities and playgrounds. Lastly, socio-economic factors, where children from low economic backgrounds are at higher risk due to limited access to healthcare services, supportive physical activity equipment, and healthy foods.²

Children with obesity are very likely to remain obese as adults and are at risk of developing non-communicable diseases (NCDs).³ To prevent the onset of NCDs, including obesity, the World Health Organization (WHO) recommends community empowerment, encouraging individuals to adopt a healthy lifestyle. This involves abstaining from smoking and consuming alcoholic beverages, incorporating ample quantities of fruits and vegetables into the diet, engaging in regular physical activity to maintain a normal weight, and managing mental stress. According to WHO (2011), the consumption of high-fat and high-sugar foods can lead to obesity, a risk factor for cardiovascular diseases, diabetes, and cancer. On the other hand, adequate consumption of vegetables and fruits can reduce the risk of heart diseases and several types of cancer. In Southeast Asian countries, including Indonesia, unhealthy dietary patterns are evident, characterized by low consumption of fruits and vegetables, high salt intake, and the widespread use of trans fats in the food industry.⁴

Based on the National Report on Basic Health Research, Indonesia 2018, two-thirds (66.7%) of children and adolescents in this age group consume sweetened beverages, mostly those with added sugar (61.8%) compared to carbonated or soft drinks (3.2%) and energy drinks (1.7%), and about half consume instant drinks and packaged beverages.¹

More than three-quarters (76.8%) of children and adolescents do not consume an adequate amount of fruits and vegetables based on the recommended daily intake of five servings per day. Furthermore, two-thirds (62.3%) of them consume soft drinks every day or almost every day, and more than half (54.4%) consume fast food once a week or more. Additionally, 44.6% of children and adolescents report that they only occasionally, rarely, or never have breakfast, a habit that is positively associated with an increased risk of overweight and cardio-metabolic conditions, including in children.⁵⁻⁷

Due to the complexity of the issues surrounding childhood obesity, effective interventions are needed to minimize the risk of NCDs in the future. One strategy that can be employed is school-based intervention, as schools are where children spend the majority of their time outside the home. Schools facilitate peer interactions, allowing for the transfer of knowledge and behavioral changes. They also serve as centralized communities where educational and awareness-based activities can be conducted simultaneously with a larger number of participants. Furthermore, a study by Kipping et al involving 60 elementary schools and 2221 students revealed that the active for life year 5 (AFLY5), a school-based nutritional intervention, was ineffective in increasing physical activity, reducing sedentary lifestyles, and improving fruit and vegetable consumption among overweight elementary school children. Lifestyle changes require more intensive interventions involving families, communities, and schools collectively.⁸ Jacob et al, in their review and meta-analysis, concluded that school-based health education interventions are potential public health measures to reduce BMI within normal limits in children and adolescents. Multi-component interventions involving teachers, parents, and digital components are promising strategies.⁹

Nutritional education interventions for children can be conducted by teachers, researchers, nurses, and nutrition experts. Jacob et al found that in 22 out of 33 nutritional education studies, the education was delivered by teachers, including classroom teachers. According to the study, 19 out of the 22 studies provided training to the teachers before delivering nutritional education. This nutritional education training can serve as continuous professional development for teachers, making it more beneficial.⁹ Furthermore, Qian et al demonstrated that the development of educational materials is the foundation of interventions and should involve teachers, school administrators, parents, and the surrounding community. Nutritional education and physical activities are integrated into classroom and school activities, highlighting the crucial role and capabilities of teachers.¹⁰

METHODS

Study design

This study was a cluster randomized control trial in two elementary school in Jakarta. The research period started from October to November 2023, with the intervention lasting for 4 weeks.

Population and sample

The population consists of school-age children from two elementary schools in South Jakarta, where the prevalence of overweight and obesity is high. Specifically, it is 30% in SD Kramat Pela 07 and 27% in SD Kramat Pela 09.

Inclusion and exclusion criteria

The sample comprises fourth, fifth, and sixth-grade students who meet the inclusion criteria: 1) school-age children; 2) BMI-for-age indicating overweight or obesity (+1 SD to +2 SD) and obesity (>+2 SD); 3) willingness and parental consent. Exclusion criteria include those with chronic illnesses such as diabetes, heart conditions, etc., as reported by parents, and those with special needs.

Based on the sample size calculation using G Power 3.0.10, with $\alpha=0.05$; power 80%; a large effect size of 0.8 for the hypothesis testing of the mean difference between two independent groups, the sample size for each group is determined to be 26 individuals, with an additional 10% reserve, in total 30 individuals for each school.

The population of teachers includes all teachers at SD Kramat Pela 07 and SD Kramat Pela 09. The sample comprises homeroom teachers of grades 4, 5, and 6, and physical education teachers from both schools. The population of mothers consists of all mothers of fourth, fifth, and sixth-grade students from both schools, while the sample includes mothers of students selected for the research.

Intervention

Before the intervention, nutrition and health education modules of school-age children for teachers was developed through several stages, including needs analysis, information gathering, design of nutritional and health modules, and compilation of these modules. The educational modules for teachers were developed based on literature from Seameo Recfon in 2019, Ministry of Education Republic of Indonesia in 2018, the Ministry of Health Republic of Indonesia in 2018, and BPOM in 2018. Teachers and physical education teachers were trained using nutrition and health education module. After completing the training, pre and post-tests conducted to evaluate their knowledge. At the end of training, teachers received certificates as evidence of their competence in nutrition and physical education.

The intervention group received nutritional education for four weeks through videos, engaged in physical activity twice a week for two months according to the school curriculum, and received parental guidance. The control group only received nutritional education for four weeks through videos and engaged in physical activity twice a week for two months as per the school curriculum.

An education through video was delivered from the teachers consecutively to the students every week. Video 1 focuses on health and nutrition, video 2 on balanced nutrition, video 3 on cultivating clean and healthy lifestyle behaviors, video 4 on physical activity as lifestyle, video 5 on regular weight monitoring, and video 6 on the importance of breakfast.

Data collection

The recruitment process of child subjects is carried out in collaboration with schools, providing research information to the schools so that subjects can receive information from their classroom teachers.

The nutritional knowledge of elementary school children is measured before the study, after nutritional education in the classroom during the first month, using a nutritional knowledge instrument through a Google form consisting of 15 multiple-choice questions. The questionnaire on the nutritional knowledge of elementary school children has been pre-tested.

The dietary habits of the children are measured by enumerators through a 24-hour recall before the study, and at the end of the study. The 24-hour recall is conducted through direct interviews with parents and children. The results of the 24-hour recall are then translated into nutritional values using the “Panganku” application, serving as an indicator of changes in the dietary behavior or habits of the children, assessed by trained enumerators.

Children’s physical activity included the number of hours spent on physical activities, sports, household chores, play, TV watching, sleep, etc., which were recorded by parents in the child’s health pocketbook before and after the study. Monitoring of physical activity was used as an assessment of changes in the activity of elementary school children as a result of parental guidance in the intervention group.

Data analysis

Data analysis was conducted using a paired t-test before and after the intervention, an independent t-test to examine differences between the two groups to assess the effect of the intervention on changes in nutrition knowledge and nutrient intake.

RESULTS

Characteristics

In Table 1, In the present analysis, the majority of children were boys, although the comparison between the two groups was not significantly different ($p>0.05$). The educational background of fathers and mothers was more skewed towards high school education in the intervention group, while the control group has a higher proportion with college education. The differences in the educational levels of fathers and mothers between the two groups were statistically significant ($p<0.05$). Regarding the fathers’ occupations, there was a higher prevalence of private sector employees in the intervention group, whereas the control group has a greater representation of both private sector and self-employed individuals.

However, this difference was not statistically significant between the two groups ($p>0.05$). The mothers' occupations between the intervention and control groups

were more concentrated in the category of housewife, and there was no significant difference between the two groups ($p>0.05$).

Table 1: Respondents characteristics.

Characteristics	Intervention group (n=30)		Control group (n=30)		P value
	N	%	N	%	
Sex					
Boys	17	56.7	19	63.3	0.792
Girls	13	43.3	11	36.7	
Age (in years)					
9-10	10	33.3	13	43.4	0.388
11-12	20	66.7	17	56.6	
Grades					
Grade 4	7	23.3	10	33.3	0.134
Grade 5	12	40.0	5	16.7	
Grade 6	11	36.7	15	50.0	
Father education					
Elementary	3	10.0	5	16.7	0.002*
High school	24	80.0	11	36.7	
College	3	10.0	14	46.6	
Mother education					
Elementary	2	6.6	1	3.3	0.023*
High school	23	76.7	14	46.7	
College	5	16.7	15	50.0	
Father occupation					
Civil servant	2	6.6	4	13.3	0.231
Private sectors	15	50.0	9	30.0	
Entrepreneur	5	16.7	9	30.0	
Laborer	6	20.0	3	10.0	
No employment	2	6.7	5	16.7	
Mother occupation					
Civil servant	2	6.6	3	10.0	0.404
Private sectors	6	20.0	2	6.7	
Entrepreneur	1	3.3	1	3.3	
Laborer	3	10.0	0	0.0	
Housewife	17	56.7	23	76.7	
No employment	1	3.3	1	3.3	
Nutritional Status at Baseline					
Overweight	13	43.3	13	43.3	1.00
Obese	17	56.7	17	56.7	

Table 2 Distribution of nutrition knowledge of respondents.

Nutrition Knowledge	Intervention group (n=30)	Control group (n=30)	P value
	Mean±SD	Mean±SD	
Before intervention	74.62±10.70	78.00±10.46	0.729
After intervention	82.87±9.85	85.0±8.68	0.313
P value	0.000*	0.000*	

*There is a significant difference before and after the intervention ($p<0.05$) using the paired sample t-test.

Table 3: Distribution of energy and macro nutrients of respondents.

Nutrients	Intervention group (n=30)	Control group (n=30)	P value
	Mean±SD	Mean±SD	
Energy (kcal)			
Before intervention	1487.23±530.90	1485.34±510.74	0.369
After intervention	1567.93±461.36	1558.99±480.18	0.942
P value	0.308	0.185	
Protein (gm)			
Before intervention	47.67±17.20	46.67±18.57	0.057
After intervention	49.18±15.73	50.50±19.75	0.668
P value	0.428	0.054	
Fat (gm)			
Before intervention	52.68±21.54	59.90±25.94	0.496
After intervention	58.87±20.18	60.69±22.72	0.941
P value	0.054	0.910	
Carbohydrate (gm)			
Before intervention	200.60±85.17	187.87±64.96	0.853
After intervention	211.40±81.54	210.76±75.67	0.975
P value	0.673	0.063	
Fiber (gm)			
Before intervention	3.76±2.60	5.37±3.25	0.460
After intervention	7.40±7.30	5.62±3.91	0.953
P value	0.005*	0.673	

*There is a significant difference before and after the intervention ($p < 0.05$) using the Paired Sample t-test.

Table 4: Distribution of physical activity of respondents.

Physical activity (hours)	Intervention group (n=30)	Control group (n=30)	P value
	Mean±SD	Mean±SD	
Before intervention	1.46±0.63	1.66±0.38	0.894
After intervention	1.65±0.27	1.65±0.34	0.449
P value	0.076	0.729	

Nutrition knowledge

From Table 2, based on the paired sample t-test, it is known that the nutritional knowledge of children in both groups increased significantly ($p < 0.05$). However, the results of the independent t-test show that there was no significant difference in nutritional knowledge between the two groups ($p > 0.05$).

Nutrients intake

Based on the paired sample t-test, it is known that energy, protein, fat, and carbohydrate intake increased in both the intervention and control groups, but the increase was not significant ($p > 0.05$). Meanwhile, fiber intake increased significantly in the intervention group from 3.76 g to 7.40 gm ($p < 0.05$), but in the control group, fiber intake increased without reaching significance ($p > 0.05$).

Physical activity

Based on the Table 4, the average duration of physical activity for respondents showed an increase in the

intervention group, but it was not statistically significant ($p > 0.05$). In contrast to the intervention group that experienced an increase, the control group showed a decrease in the average duration of physical activity, and it was not statistically significant ($p > 0.05$). The results of the independent t-test indicate that there was no significant difference in physical activity between the two groups ($p > 0.05$).

DISCUSSION

The educational background of fathers and mothers is more skewed towards high school education in the intervention group, while the control group has a higher proportion with college education. Parental education is one of the risk factors for the occurrence of overweight or obesity in children. School children with mothers who have completed high school or college education have a three times greater risk of obesity compared to those with mothers who only have completed elementary school.¹¹ Mothers with higher education have a greater opportunity to work, resulting in less time to care for their children. Parental education and occupation also have a positive

relationship with family income, impacting the risk factors for increased obesity in children.¹² Conversely, a study in Gorontalo, Indonesia found that the risk of overweight and obesity is higher in children with low-educated fathers or mothers (not completing high school). Parents with low education usually have less knowledge about health and nutrition, leading to less active implementation of a healthy lifestyle, inadequate supervision of their children's physical activities and lifestyles, and the inability to determine the quality and quantity of food suitable for their children.¹³

It is known that the nutritional knowledge of children in the intervention group increased significantly ($p < 0.05$), which is consistent with the study conducted by Sujitha before the nutrition education program. The pre-test score was 4.33 out of 15, but after the nutrition education program, the score increased to 14.55, as proven by the paired t-test results ($p < 0.05$). This indicates that nutrition education plays a crucial role in raising awareness about obesity, nutrition, and health in general. Nutritional education is an essential component of a coordinated school health approach.¹³

Providing engaging education can help individuals absorb information easily, especially for children. According to Firdaus in 2016, videos are audio-visual media that can enhance learning outcomes by involving imagination and increasing students' motivation to learn. Audio-visual media can stimulate a desire to know more.¹⁴ This aligns with research conducted on elementary school children aged 8-13, showing an increase in respondents' knowledge after being given animated videos, with the average scores before and after watching the videos for three days.¹⁵

Knowledge of nutrition in school-age children is crucial for various stakeholders contributing to a child's growth and development, including parents, close family members, educators, the government, and even the community. The role of teachers in this regard is tied to their responsibilities as competent educators continually developing themselves, being sensitive to the needs of children, and understanding all elements and factors involved in quality early childhood education. One of these factors is the importance of nutrition for children. Therefore, teachers must equip themselves with good knowledge about nutrition as one of the essential needs for children. With a good understanding of this, teachers can build a good relationship with parents through education about the nutritional needs of children and the importance of nutrition in their growth process.

Nutritional knowledge helps instill responsibility in individuals regarding healthy eating patterns. Although diet programs are known to reduce anthropometric measurements, over time, their effectiveness diminishes without proper nutritional knowledge. Nutritional knowledge can help children make informed decisions about their food intake and adopt healthier eating

patterns. Nutrition education also aids in controlling portions and reducing excess energy stored as fat by maintaining a balance between intake and energy expenditure. This explains the positive results shown by learning about changes in eating patterns.¹⁶⁻¹⁸

Research results indicate that after nutritional education, only fiber intake increased significantly in the intervention group. This aligns with research in Bandung, Indonesia, indicating that education through animated video media shows an increase in the consumption of vegetables and fruits, although statistically, the increase is not yet significant.¹⁹ Many factors need to be considered to increase vegetable and fruit consumption in children. Besides providing knowledge about the quantity and importance of consuming vegetables and fruits as a source of fiber, it needs support from the immediate environment, such as parents and teachers.

Energy, protein, fat, and carbohydrate intake increased in both the intervention and control groups, but the increase was not significant. A study conducted on fourth to sixth-grade students found a correlation between increased protein consumption and nutritional status. To support their growth, children need an adequate amount of protein. Although elementary school children develop more slowly than babies, it is essential to provide high-protein foods as they are more physically active. Protein plays a significant role in the growth of children, but excessive consumption can lead to the accumulation of fat in the body.²⁰

In addition to nutritional intake, physical activity also plays a crucial role in controlling obesity in school children. The average duration of physical activity for respondents showed an increase in the intervention group. Physical activity in this study is not only carried out at home but also includes sports activities at school, with sports activities taking place every Monday, Tuesday, and Wednesday at SDN Kramat Pela 07 from 09:15 am to 11:35 am. Meanwhile, at SDN Kramat Pela 09, physical activity and sports are conducted every Monday, Tuesday, and Thursday from 08:00 am to 09:50 am. Based on the data summary obtained from the physical education teachers, all respondents at SDN Kramat Pela 07 and SDN Kramat Pela 09 always participate in sports activities from start to finish.

An effective physical education program holds significant value in addressing childhood obesity, as indicated by Williams et al.²¹ A physical educator plays a crucial role as a key member within a school's interdisciplinary team.

Schools, as educational institutions, have some influence on changing children's behavior in choosing their food through education. It is often found that children find it easier to digest and implement information provided by teachers than information or encouragement from parents.¹⁹

One significant limitation in our study pertains to the selection process of the control group. Ideally, schools for the control group should have been randomly chosen to ensure unbiased representation. However, due to unforeseen circumstances, SDN Kramat Pela 01 declined participation in the research. Then, it was replaced with a school that was willing to participate, which was SDN Kramat Pela 07.

CONCLUSION

After eight weeks intervention, nutrition education improved the knowledge, nutrients intake, and physical activity among school children with overweight and obesity. We recommend the school authorities to enhance the capacity and capabilities of teachers in fostering efforts to improve the health and nutrition of students through school-based learning. Additionally, the consumption of fiber is considered an indicator of good or healthy food quality in controlling overweight and obesity.

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