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Effectiveness of school-based obesity prevention programme among elementary school children in Jakarta

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ABSTRACT

Introduction: Prevention and treatment of overweight and obesity are easier in children than in adults. This study was conducted to evaluate the Smart Eating and Healthy Activity (SEHAT) programme, an intervention programme involving parents, teachers, and students in Indonesia to prevent obesity at schools. The intervention was conducted in the form of seminars and leaflets distribution to parents, training of teachers, training of student health cadres, training of students by trained teachers, health promotion to school canteen vendors, and promoting healthy home food weekly. **Methods:** This non-randomised controlled trial study was conducted from January to May 2016 in North Jakarta. The primary outcome was body mass index (BMI) changes measured with SECA® digital scale for weight and microtoise for height measurements. The secondary outcomes were changes in children's knowledge, self-efficacy and behaviours, measured using self-made questionnaires, and physical activity using the Physical Activity Questionnaire for Older Children (PAQ-C). A total of 278 fourth and fifth-grade elementary school students aged 9 to 11 years old were recruited and grouped into intervention group (121 students) and control group (157 students). **Results:** The study reported a significant change between intervention and control groups on knowledge (1.28 vs 0.31), attitude (1.85 vs 0.06), physical activity (0.14 vs -0.32), eating fruits and vegetables (0.02 vs -0.78), and BMI (0.33 vs 0.71). **Conclusion:** The five-month SEHAT intervention programme effectively promoted knowledge on healthy eating and physical activity for obesity prevention by increasing physical activity, eating fruits and vegetables, and maintaining students' BMI.

Keywords: body mass index, children, healthy eating, physical activity, school-based intervention

INTRODUCTION

The World Health Organization (WHO) declared obesity a global pandemic because its occurrence is in developed and developing countries. Globally, over 340 million children and adolescents aged 5-19 years were overweight and obese in 2016 (WHO, 2021). In Indonesia, obesity prevalence is highest among children 5-12 years old, with a prevalence of 9.2% compared with children aged 13-15 and 16-18

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years (4.8% and 4.0%), respectively. The highest prevalence of obesity in children aged 5-12 years in Indonesia is in Jakarta, with approximately 14.0% (Kementrian Kesehatan RI, 2018).

Childhood overweight and obesity can persist into adulthood, causing an impact on both physical and psychological health, which reduces their quality of life. A research showed that over 60% of overweight children will continue to be overweight in early adulthood (Nittari *et al.,* 2019). Simulation research estimated that more than half (57.3%) of the children and adolescents would be obese by 35 years old, and half of the total prevalence of obesity begins in childhood (Ward *et al.,* 2017). Furthermore, one of the risk factors of adulthood obesity is adiposity rebound in early childhood. The impact of obesity can include short-term effects such as early puberty in children, menstrual irregularities, sleep disorders, psychological issues, as well as long-term consequences such as cardiovascular diseases, type 2 diabetes, high cholesterol level, liver diseases, and other chronic diseases (Kansra, Lakkunarajah & Jay, 2021; Sahoo *et al.,* 2015; Yan & Mi, 2021). Furthermore, several studies reported that obesity has become an economic burden in both developed and developing countries. The impact on health care cost includes the increased spending on obesity-related illnesses of a country (Biener, Cawle & Meyerhoefer, 2017; Tremmel *et al.,* 2017).

Childhood is a critical period because there is rapid development in physical, neurological, and social functions. Thus, prevention and treatment of overweight and obesity are considered more accessible during this period. Besides, it has been shown that intervention of obesity in adulthood faces more difficulties than in childhood (Lambrinou *et al.,* 2020; Yan & Mi, 2021). Therefore, childhood populations are a priority in implementing obesity intervention strategies.

School-based interventions are considered essential because: 1) primary school education is compulsory and reaches all children with varied backgrounds, 2) schools are places where children spend most of their time, 3) schools offer education and opportunities for physical education and activities, 4) schools offer an environment to easily apply interventions, 5) schools can also reach many children in a short time, 6) schools have teaching staff who can facilitate and contribute to intervention programmes, and 7) schools can actively involve parents in certain activities (Lambrinou *et al.*, 2020; van de Kolk *et al.,* 2019).

This research was based on the Social Cognitive Theory (SCT) from Bandura (Tougas *et al.*, 2015). This SCT states that human behaviour results from the interaction between personal factors (such as self-expectations, self-perceptions, goals, and intentions), cognitive, and environmental factors. Bandura explained that self-efficacy plays an essential role in an individual's capacity to organise and execute things, thus affecting his/her self-esteem and ability to compete with other individuals (Fertman & Allensworth, 2010; Tam *et al.,* 2012).

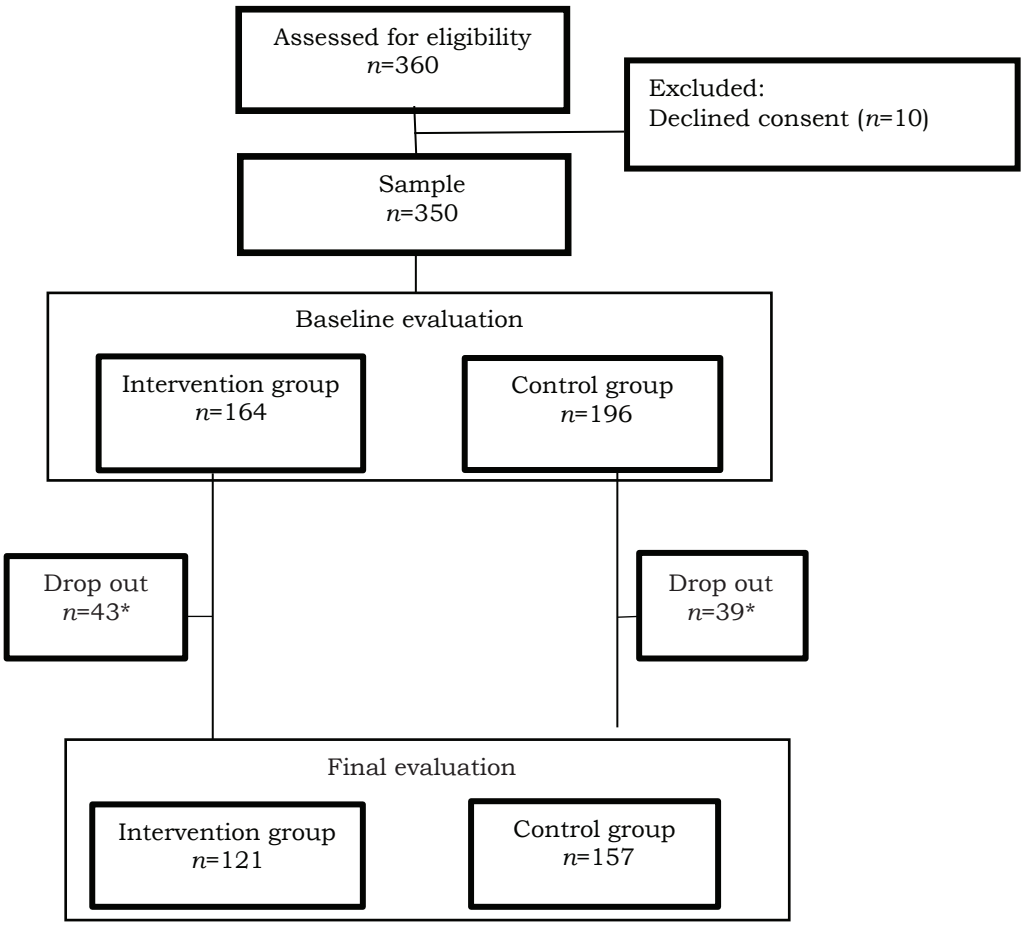
The SEHAT (Smart Eating and Healthy Activity) programme, a school-based health promotion intervention, was implemented to prevent the increasing prevalence of obesity in primary school students. The target participants of this study were children aged 9-11 years old because they could fill out the questionnaire and the incidence of obesity begins to increase at this age (Sahota *et al.,* 2001).

MATERIALS AND METHODS

Study design & procedures

This was a quantitative research using a quasi-experimental non-equivalent pre-test and post-test control group design. This study took place in North Jakarta with a heterogeneous society of different ethnicities, religions, and socioeconomic status, like most Jakarta areas.

The school criteria was accredited-A elementary schools with a prevalence of at least 30% overweight and obese students in grades IV and V. The intervention group was selected based on the number of students who were overweight and obese, and their availability to participate in the health promotion programme to prevent obesity in elementary school children. Students from each group were taken from two different elementary schools, one public school and one private school in North Jakarta. The intervention was conducted in Penjaringan Subdistrict, and the control group was conducted in a different sub-district from the intervention group, namely Pademangan District.



*The parents or the students did not fully attend the programme or the respondent data were incomplete

Figure 1. Flow chart of study population during the intervention study

This study was conducted during the 2015-2016 academic year. Although initial data were taken in early January 2016, the programme was held from January until May 2016 and evaluated in early June 2016.

Participants

This study used proportional stratified non-random sampling for both intervention and control groups. The inclusion criteria were: 1) students aged 9-11 years old; 2) students with normal and overweight body mass index (BMI); and 3) students who were willing to participate. The exclusion criteria were: 1) students who did not take the pre-test or post-test; 2) students who left or changed school in the middle of the intervention; or 3) students who did not complete the training.

In total, four schools were selected in this study. Initially, 360 students were assessed. Of these, 82 students were excluded based on the exclusion criteria due to several reasons such as family issues and waking up late. In total, the study analysed 278 students, which consisted of 121 students in the intervention group and 157 students in the control group (Figure 1). All participants took pre-test, post-test, and provided their weight and height measurements.

Approval and consent

This study's ethical clearance was approved by the Ethical and Research Committee of Atma Jaya Catholic University of Indonesia, Faculty of Medicine. All fourth and fifth-grade students who met the inclusion criteria were provided with verbal information about the study at the time of recruitment. In addition, written information was also provided to parents or guardians and they were asked for their written consent prior to their child's participation in this study.

SEHAT programme

This intervention aimed to prevent childhood obesity by expanding their knowledge, manners, self-efficacy, and outcome expectations of obesity prevention, which would be continued through available human resources at schools, including teachers and students as student health cadres. Student health cadres were eligible by specific criteria (such as intelligent, healthy, enthusiastic leadership, and responsible) and had been trained to carry out some efforts to maintain and improve their own health as well as that of their friends, family, and environment (Direktorat Jenderal Pendidikan Dasar, 2014). These student health cadres were expected to become role models in healthy living for their friends, especially in preventing overweight and obesity. In addition, this intervention also involved parents because they were responsible for regulating their children's eating patterns and behaviours as well as daily physical activity.

The SEHAT intervention programme consisted of six components. Firstly, health promotion to parents by health workers and psychologists was conducted through seminars on nutritional status and obesity, healthy food, physical activity, reading dietary facts, and a parenting guide based on their child's personality. In addition, parents also were given leaflets consisting of four topics about nutritional status and obesity, healthy food, physical activity, and how to read nutritional facts every two weeks. Secondly was training for teachers. Teachers were trained to be facilitators by health workers and given knowledge about healthy food, physical activity, measuring nutritional status, and reading nutrition facts. Thirdly, training of students by trained teachers was done with the help of some doctors. Materials given included information about healthy food, physical activity,

obesity, measuring nutritional status, healthy snacks, and reading nutrition facts. Fourth, training of student health cadres included how to motivate their friends. Fifth, health promotion to canteen managers was conducted by health workers about preparing, processing, and serving healthy food; and lastly, healthy food was brought from home once a week. Every Wednesday, students were asked to bring healthy food, including vegetables and fruits, to be eaten together at school during recess.

Instruments

The primary outcome of this study was BMI changes, and the secondary outcomes were changes of children's knowledge on healthy foods and drinks, physical activity, self-efficacy, and behaviour in physical activity and food intake. A trained research team measured students' BMI. Weight measurements were done using a SECA® digital scale to the nearest 0.1kg, and height measurements were done using a microtoise tape to the nearest 0.1cm. Questionnaire was used as data collection tool. Students were divided into small groups consisting of ten people and asked to fill out a questionnaire with the help of a facilitator. There were 15 questions about healthy foods and drinks, physical activity, and obesity with true or false options. A score of one was given for each correct answer and zero for each wrong answer. The expectation of the outcome was assessed with six statements, where each statement was given three choices with a Likert scale: important, doubtful, and not necessary. For example: "Regular exercise makes me healthy". Self-efficacy was assessed with 15 statements, divided into three groups. Each group consisted of five statements of self-efficacy, i.e., healthy eating behaviour, physical activity, and sedentary lifestyle. For example: "It is hard for me to eat vegetables if I am not eating with my parents" and "I am lazy to keep exercising if no one accompanies me". Every statement was given three choices with a Likert scale: agree, neither agree nor disagree, and disagree. Physical activity was assessed using the Physical Activity Questionnaire for Older Children (PAQ-C). Each answer was given a score of 1 for very low physical activity, 2 for low physical activity, 3 for adequate physical activity, 4 for high physical activity, and 5 for very high physical activity. The results were obtained from the average score of nine questions (Kowalski & Taylor, 2004). Fruits and vegetables intake and eating behaviours were assessed by filling out questions about like and dislike of eating fruits and vegetables, and the frequency of intake during the last week.

Data analysis

The collected data were analysed with IBM SPSS Statistics version 22.0 (IBM Corp, Armonk, New York, USA). Double entry was done before analysis to avoid data entry errors on quantitative data. A p-value of 0.05 was set as the cut-off for statistically significant results. T-test was used to measure the differences between intervention and control groups before and after the intervention.

RESULTS

Characteristics of the study participants between two groups were found to be not statistically significant (p>0.05) at the start of the study; thus, it can be concluded that there were no baseline differences between intervention and control groups (Table 1).

At the end of the SEHAT programme, the results showed a significant increase in knowledge mean values (p<0.05). On the contrary, there were no significant differences in self-efficacy and outcome expectations between pre-test and post-

Table 1. Demographic profile of the study participants

Variables	Intervention (n=121)		Control (n=157)		p-value
	mean±SD	n (%)	mean±SD	n (%)	
Sex					
Male		52 (43.0)		68 (43.3)	0.955
Female		69 (57.0)		89 (56.7)	
School year					
Grade IV		51 (42.1)		72 (45.9)	0.538
Grade V		70 (57.9)		85 (54.1)	
BMI (kg/m^2)	17.53±2.28		17.17±2.28		0.171
Father's educational status					
Primary school passed		33 (27.3)		29 (18.5)	0.453
High school and above		88 (72.7)		128 (81.5)	
Father's occupation					
Employed		120 (99.2)		157 (100.0)	0.255
Unemployed		1 (0.8)		0 (0.0)	
Mother's educational status					
Primary school passed		43 (35.5)		36 (22.9)	0.178
High school and above		78 (64.5)		121 (77.1)	
Mother's occupation					
Employed		29 (24.0)		35 (22.3)	0.743
Unemployed		92 (76.0)		122 (77.7)	

test on intervention group (p>0.05). Still, the mean values of those variables in the intervention group tended to increase.

There was also an increase in the variables of the intervention group by as much as 8.5% on knowledge, 0.3% on outcome expectations, 1.4% on self-efficacy on eating fruits and vegetables, 1.0% on self-efficacy on physical activity, 0.1% on physical activity, and 0.1% on eating fruits and vegetables behaviour. After the intervention period, the increase in BMI in the control group was higher than the intervention group (0.71 vs. 0.33) (Table 2).

Delta-mean between intervention and control groups for knowledge, physical activity, eating fruits and vegetables behaviour, and BMI variables were found to be statistically significant (p<0.05), and the intervention was shown to affect these variables (Table 3).

DISCUSSION

This study aimed to explain the SEHAT programme implementation and results after the programme was implemented for five months. Results after the SEHAT intervention programme showed that there was significant differences in the mean values of knowledge, physical activity, and eating fruits and vegetables behaviour in the intervention group compared to control group, but no significant differences in the outcome expectations, self-efficacy on eating fruits and vegetables, and self-efficacy on physical activity before and after the intervention. Insignificant self-efficacy results could be affected by students' poor outcome expectations in consuming healthy foods and increasing physical activity in daily life.

In Indonesia, parents consider themselves more powerful and often

Table 2. Mean comparison of knowledge, self-efficacy, outcome expectations, behaviour, and BMI before and after intervention

Variable	*Control*			
	Mean±SD	*p-value*	*Mean±SD*	*p-value*
Knowledge				
Pre-test	10.50±2.06	<0.001*	10.87±1.96	0.023*
Post-test	11.79±2.08		11.18±2.11	
Self-efficacy on eating fruits and vegetables				
Pre-test	11.99±2.22	0.446	12.60±2.06	0.199
Post-test	12.20±2.20		13.02±1.83	
Self-efficacy on physical activity				
Pre-test	11.61±2.27	0.582	11.82±2.04	<0.001*
Post-test	11.76±2.19		11.90±2.22	
Outcome expectations				
Pre-test	16.30±1.56	0.763	16.31±1.88	<0.001*
Post-test	16.36±1.84		16.68±1.77	
Physical activity				
Pre-test	2.49±0.55	0.368	2.55±0.58	0.012*
Post-test	2.63±0.63		2.23±0.58	
Eating fruits and vegetables behaviour				
Pre-test	9.82±2.61	0.948	10.01±2.50	<0.001*
Post-test	9.83±2.41		9.23±2.50	
BMI (kg/m^2)				
First measurement	17.53±2.28	<0.001*	17.17±2.28	<0.001*
Sixth measurement	17.85±2.33		17.88±2.60	

*$p<0.05$

show their dominance and expect their children to obey their wish. This is by characteristics of the Indonesian culture, where a large power gap exists and indicates individual inequalities in the society (Hofstede, 2001). Based on focus group discussion results, it was shown that most parents required their children to consume the food they have provided. The occurrence of a significant increase in knowledge without increment in outcome expectations and self-efficacy of the intervention group could be caused by parental influence on children's behaviours and eating patterns so that children only obeyed their parents while not increasing their own self-efficacy. Furthermore, based on the Family Systems Theory and Social Cognitive Theory, studies have found that controlling and restricting practices from a parent would result in higher BMI and lower self-efficacy in adolescents (Loncar, 2019).

After the intervention, there was a significant difference in mean BMI between intervention and control groups. Judging from the results, the SEHAT programme was considered successful in maintaining the stability of BMI in the intervention group. There were also no participants who changed to low or poor nutritional status. Significant differences between intervention and control groups on knowledge, eating fruits and vegetables behaviour, and

Table 3. Mean differences between pre-test and post-test in outcome variables for intervention and control groups

Variable	*n*	*Mean difference*	*p-value*
Knowledge			
Intervention	121	1.28±2.52	<0.001*
Control	157	0.31±2.50	
Self-efficacy on eating fruits and vegetables			
Intervention	121	0.21±2.98	0.531
Control	157	0.42±2.62	
Self-efficacy on physical activity			
Intervention	121	0.15±2.93	0.602
Control	157	0.09±2.54	
Outcome expectations			
Intervention	121	0.06±2.12	0.232
Control	157	0.37±2.18	
Physical activity			
Intervention	121	0.14±0.72	<0.001*
Control	157	-0.32±0.74	
Eating fruits and vegetables behaviour			
Intervention	157	0.02±2.84	0.029*
Control	121	-0.78±2.80	
BMI			
Intervention	121	0.33±1.01	<0.001*
Control	157	0.71±0.89	

*p<0.05

physical activity helped the intervention group achieve success in maintaining their BMI to be relatively stable compared to the control group. However, there was no significant difference between outcome expectations and self-efficacy, most likely because their eating patterns and behaviours, as well as physical activity were generally still determined by their parents.

Some factors that influence obesity prevalence causing different results from published school-based interventions were challenging to compare, including comparing this study with others' results. However, the present results were in accordance with several pieces of research that showed that school-based obesity prevention programmes combined with parents' involvement had favourable effects on children's weight status, dietary, physical activity, and sedentary behaviour (Norman *et al.,* 2019; Verjans-Janssen *et al.,* 2018).

Ultimately, the results from the evaluation of the SEHAT programme were considered successful in preventing obesity. Still, as children grow older and enter the adolescence period, parent-child relationships may change, whereby parental influence may decrease. Children will have a larger peer group, spend more time with them, and receive increasing support from their peers (Gao & Cummings, 2019). They will have more exposure to the outside world, including the obesogenic environment, where high-calorie fast food is booming and technological advances greatly facilitate human work, causing energy requirements for daily activity to decrease and sedentary

lifestyle to increase. High self-efficacy on a healthy lifestyle will control their negative health behaviours, excessive eating, and weight by not consuming excessive calories. This preventive healthcare self-efficacy is shown to be one of the significant factors in obesity (Altan & Bektas, 2017). Parenting styles are also associated with a child's and adolescent's self-efficacy; therefore, a good parenting style is favourable (Loncar, 2019). Apart from healthy food and physical activity, training and providing information on good parenting is also important in school-based health promotion programmes on preventing obesity.

Limitations and strengths

The limitation of this study was the limited number of students who met the inclusion and exclusion criteria so that purposive sampling methods were used. The study also assessed the students' behaviours based on questionnaires regarding their activities during the previous week, which could risk a recall bias. In addition, behavioural assessment on eating fruits and vegetables did not include the number of servings eaten per day, but only on students' preference and frequency of eating fruits and vegetables on average per day. However, measures had been taken to reduce these shortcomings. The behavioural assessment was conducted by a facilitator, and there was no time limitation for the process. Therefore, students had ample time to recall their activities in the past week.

Moreover, this was the first study in Indonesia that assessed the intervention programme, not only on knowledge, but also on behaviour and self-efficacy in children themselves, as well as in their parents.

CONCLUSION

The five months school-based intervention SEHAT programme for obesity prevention in fourth and fifth-grade primary school students was effective in increasing knowledge and giving positive influence on students' manners about the importance of healthy food and physical activity for preventing obesity in North Jakarta, Indonesia.

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Authors' contributions

FK, principal investigator, conceptualised and designed the study, prepared the draft of the manuscript, led the data collection and did data analysis; YSP, involved in study project, gave input for data analysis, reviewed the manuscript; DI, gave input in study design and data collection, and reviewed the manuscript; FTD, conceptualised and designed the study, analysed data results, reviewed the manuscript.

Conflict of interest

The authors declare that there is no conflict of interest.

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