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Original Article

1  
Gardening-cooking based intervention  
for improving healthy eating habits  
in preschool children

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**Abstract**

**Background** Preschool children generally have inadequate fruit and vegetable intake, but a high intake of calories. Nutrition education taught from an early age might instill good eating habits and behavior, especially regarding fruit and vegetable consumption.

**Objectives** To compare preschoolers' fruit and vegetable preferences, fiber intake, and consumption of high-calorie food before and after a gardening-cooking intervention.

**Methods** This study had a quasi-experimental, pre- and post-test design, as well as intervention and control groups. Subjects were preschool children aged 4-6, selected by purposive sampling, with 33 subjects in each group. The intervention group engaged in nutrition education, gardening, and cooking programs for 9 sessions. While the control group was not given the programs, only given nutrition education at the end of data collection. Data were analyzed using independent T-test, paired T-Test, Wilcoxon, and Mann-Whitney tests.

**Results** There were significant increases in attitude score, fruit and vegetable preference, and fiber intake, as well as decreased intake of high calorie foods ( $P < 0.05$  for all) before and after treatment in the intervention group. In contrast, there were no significant changes in the control group.

**Conclusion** Gardening-cooking based intervention for 9 sessions is effective in improving attitudes, fruit and vegetable preferences, and fiber intake, as well as reducing high-calorie food consumption in preschool children. [Paediatr Indones. 2024;64:218-26; DOI: 10.14238/pi64.3.2024.218-26 ].

**Keywords:** cooking; gardening; attitude; food preference; eating habits; preschool children

Good nutrition is crucial for children's growth and development. Preschool children's eating habits not only have a significant impact on their short-term childhood nutrition and health status but are also related to their health status in adulthood and significantly impact their lifelong health status. Poor eating behavior during childhood affects imbalanced nutrition, growth failure, obesity, metabolic syndrome, and other diseases in the future.<sup>1</sup>

Fruits and vegetables are the main sources of micronutrients. Micronutrients are necessary for body metabolism such as in making antibodies, decreasing the risk of chronic diseases, and as enzyme co-factors. Adequate amounts of fruits and vegetables should be consumed by pre-school children (3-6 years) since this is the golden period for their growth and development.<sup>2</sup> Exposure to fruit and vegetables from an early age will give rise to a preference for and consumption of fruit and vegetables as adults.<sup>3</sup> Psychosocial variables such as attitudes and knowledge about fruits and vegetables

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are identified as major factors that influence healthy eating habits in children.<sup>4,5</sup>

School gardening and cooking programs have become a popular tool for educating children about nutrition and improving their nutritional intake. Most gardening and cooking programs take a hands-on approach, where children participate in planting and growing fruits and vegetables, as well as preparing and tasting the harvest.<sup>6</sup> Gardening programs and nutritional education have been used as interventions to improve children's vegetable consumption. Previous studies have shown that gardening experiences at school or in communities had a positive impact on children's food preference and eating behavior with regards to vegetables.<sup>1,7-11</sup> The addition of gardening programs to school curriculums improved children's vegetable preference and intake, regardless of the types of vegetables planted.<sup>12,13</sup> A cooking-based intervention at school was also an effective program to increase children's ability to prepare their own meals, as well as their preference and selection of healthier food.<sup>1,11</sup> Other studies have also shown that food preferences, nutritional knowledge, as well as cooking and food preparation skills improve through cooking program in schools, resulting in healthy eating habits.<sup>7</sup>

A gardening-cooking-based program is one type of school-based nutrition educational approach. Such gardening-cooking programs engage children in active learning about nutrients, balanced nutrition, gardening methods, and food safety, as well as preparing and cooking foods. We aimed to assess if the intervention improved children's attitudes, preferences, and intake of fruits and vegetables, as well as reducing consumption of high-calorie foods.

## Methods

This quasi-experimental study with pre- and post-tests compared intervention and control groups was conducted from December 2022 - March 2023. Inclusion criteria were pre-school children aged 4-6 years who attended school for 4 hours effective school time/day, the school location were in urban area and have a large garden area, and have similar curriculum characteristics. The urban areas in our study was defined as places that provide a lot of fast food and contain high-calorie foods (obesogenic

environments).<sup>14</sup> Similar curriculum characteristics was defined as the private schools under the Muhammadiyah Foundation. Children with chronic illnesses which could influence the study results were excluded.

Data taken included attitudes, fruit and vegetable preferences, and food intake through interviews with parents. The attitude questionnaire consists of 12 questions on preschool children's attitudes towards fruit and vegetable consumption, which were adapted from previous research on consumption with subtle modifications to adjust the study objectives.<sup>15</sup> We modified this questionnaire by changing the questions slightly and eliminating questions that indicated perceptions. Subjects' parents answered 'Yes' or 'No' to each question, then a score of '1' was given for each 'Yes' answer and '0' for each "No" answer. Then we tested the reliability of the questionnaire using Cronbach's alpha, which was 0.749, thus, it was deemed reliable as an assessment.

The fruit and vegetable preferences were assessed by parental interview, with answers on a Likert scale. A list of 55 types of fruits and vegetables was read and parents could choose from 'dislike a lot' to 'like a lot'. 'Not applicable' should be answered for items that the child had never tried. Each answer was scored from 0-6, with higher scores representing greater preference.<sup>16</sup> We modified this questionnaire to adapt the fruits and vegetables available in Indonesia, and the reliability using Cronbach's alpha was tested with 30 parents, and the results were reliable (0.858).

High-calorie foods, fruit and vegetable consumption were collected with the validated *Semi-Quantitative Food Questionnaire* (SQ-FFQ) for preschool children. High-calorie foods are those that contain a high amount of energy per serving. They typically have a higher concentration of fats, sugars, and/or carbohydrates. The SQ-FFQ questionnaire consists of 133 food items including: 1) snacks, fried foods, and processed foods 2) salty food/chips 3) candy and ice cream 4) cake, pastry, and biscuits 5) soft drink and 6) fruits and vegetables to measure the fiber intakes. The SQ-FFQ possible answers were never; 1-3x/month; 1-2x/week; 3-4x/week; 1x/day; or >1x/day.<sup>17</sup> A food photo book was used to help parents estimate the real portion of each food item.<sup>18</sup>

A module on gardening-cooking was developed as the nutritional education guideline and adjusted

for preschool-aged learning objectives. This module was reviewed by the school principals and educational experts. This method was incorporated in the school curriculum. It consisted of 9 sessions (Table 1) of gardening activities, during which children were taught how to plant seeds, water, and harvest. The vegetables to be planted were water spinach and lettuce, as they are easily grown and harvested. Cooking activities were cutting, washing, and cooking fruit or vegetables such as cabbage, carrots, mushrooms, water spinach, honeydew melon, papaya, dragon fruit, and pineapple. The cooking activities were guided by the research teams, also monitor and standardize the activities undertaken by the control group to ensure they are similar to those in the intervention group. The intervention group participated in 3 sessions/per week. The control group had no intervention. The pre-test was given to both groups before the intervention, and the post-test was conducted after 35 days of intervention.

We conducted sex matching to ensure comparability between the intervention and control groups. Statistical analyses were performed with IBM SPSS version 20.0 software. Shapiro Wilk was used to evaluate the data distribution. Paired sample T-test (normal data) and Wilcoxon (not normal data) were used to compare pre- and post-test results within each group. Independent T-test and Mann-Whitney were used to compare the intervention and control group results. If the P value <0.05 is considered statistically

significant. This study was approved by the Alma Ata University Ethics Committee. Informed consent was received from before the study was started.

## Results

A total of 66 children were selected and randomly assigned to either the intervention or control group (33 subjects each). Table 2 shows that the majority of subjects characteristics. There was no difference in terms of attitude related to fruit and vegetable consumption within each group. Only 1 out of 12 attitude questions had a significantly higher score than before, which was, “My child likes to eat vegetables,”  $\chi^2=0.006$ ;  $P<0.05$  (Table 3). However, the mean consumption of high calorie food was lower in the intervention group before and after intervention (Table 4).

Before the program, there were no significant difference between the intervention and control groups in high-calorie food. The intervention group had significantly lower consumption of high-calorie foods after the programs, with a decrease from 1,063.3 Kcal/day to 858.70 Kcal/day (Table 5). This finding was also seen in the decreased intake of snacks, fried foods, processed foods, salty foods, chips, candies, ice cream, cake, pastry, biscuits, and soft drinks (Table 4). The intervention group had significantly different attitudes scores about fruit, vegetable, and fiber intake

**Table 1.** Gardening-cooking activities

Session	Gardening-cooking activity	Program goals for session
1	Information on nutrition, gardening and cooking of fruits and vegetables	Learn about healthy foods and high-calorie foods
2	Coloring fruits and vegetables	Learn about the varieties of fruits and vegetables
3	Planting vegetables from seeds at school and at home	Learn how to garden
4	Puzzle of portion food ‘Eat My Plate’	Learn healthy portion of each food
5	Mathematics	Increase children’s numeracy skill Learn about the varieties of fruits and vegetables
6	Cooking vegetable “soup” (cutting, washing, cooking vegetables)	Learn simple cooking skills to prepare vegetables Learn the varieties of vegetables
7	Making the “fruit satay”	Learn simple cooking skills to prepare fruits Learn the varieties of fruits
8	Cooking vegetables “pecel” (activities of cutting, washing, cooking vegetables)	Learn simple cooking skills to prepare vegetables Learn the varieties of vegetables
9	Making the fruit juice	Learn simple cooking skills to prepare fruits Learn the varieties of fruits

consumption before and after the programs. Fruit preference, vegetable preference, and fiber intake significantly increased after intervention ( $P=0.000$  for all) (Table 6).

<sup>1</sup> In contrast, there were no difference in the control group in terms of attitude and high calorie food score neither fruit, vegetable, and fiber intake preference scores, pre and post-test (Tables 5 and 6).

## Discussion

The objectives of the gardening-cooking programs for preschool children were to increase their knowledge, attitude, and behavior about the importance of healthy eating. This experience was hypothesized <sup>12</sup> to increase their fruit and vegetable consumption as well as decrease intake of unhealthy foods, such as high

calorie foods. In our study, nine gardening-cooking sessions was organized during the school program. Our intervention group had significantly improved median attitude scores as well as lower mean high-calorie food consumption post-intervention compared to pre-intervention. A Korean study involving 136 school children and parents on a nutrition education program combined with gardening and cooking for 12 sessions proved <sup>15</sup> effective in increasing children's preference for vegetables and increasing parents' knowledge.<sup>10</sup>

Attitude is the process of evaluating an object or situation accompanied by a feeling of liking or disliking something and creating a certain response or behavior. The types of responses include positive/good and negative/unfavorable to events, people, or things.<sup>19</sup> Children's attitudes towards the fruit and vegetables represented in 12 questions, only one

**Table 2.** Subject's characteristics

Characteristics	Groups	
	Intervention (n=33)	Control (n=33)
<sup>6</sup> Gender, n		
Male	17	17
Female	16	16
Age, n		
5 years	16	3
6 years	17	30
Paternal educational level attained, n		
Junior high	2	0
Senior high	13	10
College	18	23
Maternal educational level attained, n		
Junior high	1	0
Senior high	13	10
College	19	23
Paternal occupation, n		
Unemployed	1	0
Laborer	4	1
Private employee	21	11
Civil servant	4	8
Entrepreneur	1	13
Maternal occupation		
Unemployed	15	18
Laborer	2	1
Private employee	10	6
Civil servant	4	3
Entrepreneur	2	5
Monthly incomes		
<sup>7</sup> <IDR 2,000,000	4	2
IDR 2,000,000 - 5,000,000	22	21
>IDR 5,000,000	7	10

attitude statement from the questionnaire had a significant increase: ‘My child likes to eat vegetables,’ followed by increased vegetable preference score and fiber intake. A Study had shown that the exposure to different types and textures of foods through school gardening-cooking programs can help reduce neophobia, which is a fear or reluctance to try new foods, especially fruits and vegetables.<sup>8</sup>

Attitudes and food preferences are formed during the childhood period and are the main predictors shaping healthy eating behavior.<sup>20</sup> The

planting, harvesting, and cooking activities in the gardening-cooking program are effective ways to increase children’s intake of fruits and vegetables and help children understand the importance of eating healthy foods.<sup>11</sup> Moreover, the positive experiences of harvesting and cooking fruits and vegetables with peers may have a longer-term influence on healthy eating behavior. This result is in line with the study conducted in the USA, which showed that 361 children involved in gardening and cooking programs at school, showed an increase in average

**Table 3.** Analysis of attitudes related to fruit and vegetable consumption

Variables	Intervention group (n=33)			Control group (n=33)		
	Pre-test	Post-test	P value	Pre-test	Post-test	P value
My child likes to eat vegetables, n						
Yes	14	26	0.006	25	28	0.263
No	19	7		8	5	
My child likes trying new types of vegetables, n						
Yes	16	22	0.056	18	19	0.786
No	17	11		15	14	
My child tries to eat lots of vegetables, n						
Yes	14	17	0.325	22	19	0.374
No	19	16		11	14	
My child eats vegetables every day, n						
Yes	9	11	0.488	15	20	0.096
No	24	22		18	13	
When eating, my child asks for more than one type of vegetable, n						
Yes	7	10	0.325	10	17	0.051
No	26	23		23	16	
My child likes to eat fruit, n						
Yes	5	27	0.572	31	31	1
No	28	6		2	2	
My child likes trying new types of fruits, n						
Yes	24	24	1	21	19	0.572
No	9	9		12	14	
My child tries to eat lots of fruits, n						
Yes	23	22	0.786	25	21	0.254
No	10	11		8	12	
My child eats fruit every day, n						
Yes	17	14	0.184	15	17	0.535
No	16	19		18	16	
When eating, my child asks for more than one type of fruit, n						
Yes	12	10	0.535	18	13	0.134
No	21	23		15	20	
Eating fruits and vegetables makes my child rarely constipated, n						
Yes	29	29	1	30	28	0.325
No	4	4		3	5	
My child does not need to be encouraged to eat fruits and vegetables, n						
Yes	27	27	1	26	24	0.488
No	6	6		7	9	

fiber intake from 12.8 grams to 13.5 grams.<sup>9</sup> Several studies revealed that gardening-cooking programs increased children's nutrition, gardening, and cooking knowledge, as well as children's preference for fruits and vegetables.<sup>21</sup>

Median fiber intake significantly increased in the intervention group compared to the control group, from 2.60 to 12.30 g/day. Nutritional intervention of introducing fruits and vegetables through the daily practices increases children's daily food preferences as they become familiar with various fruits and vegetables.<sup>22</sup> Increased preference for fruits and

vegetables also aligns with more fiber intake.<sup>20</sup> However, while the median fiber intake of children in our study increased to 12.30 (range 3.10-33.70) g/day post-intervention, it was still below the Indonesian nutritional recommendation of 20 g/day.<sup>23</sup> A study also reported that preschool children living in urban areas whose parents were given a booklet explanation on the benefits and importance of fruit and vegetable consumption, increased their fruit and vegetable intake, but the amount was still less than recommended.<sup>24</sup>

Previous research showed that fruit and vegetable

**Table 4.** Analysis of the mean consumption of high-calorie foods pre- and post-test

Mean consumption of high-calorie foods (SD), Kcal/day	Intervention group			Control group		
	Pre-test	Post-test	P value	Pre-test	Post-test	P value
Snack, fried food, processed food	515.83 (144.43)	415 (179.82)	0.001	517 (175.08)	522.94 (164.08)	0.472
Salty food, chips	110.97 (53.16)	90.33 (53.88)	0.013	99.84 (81.22)	88.90 (41.46)	0.801
Candy, ice cream	113.69 (53.16)	91.51 (42.46)	0.003	129.54 (96.20)	111.65 (72.25)	0.469
Cake, pastry, biscuit	93.96 (32.55)	64.73 (25.94)	0.000	67.57 (32.93)	77.71 (28.81)	0.063
Soft drink	228.82 (73.38)	198.86 (81.38)	0.003	170.36 (84.09)	175.50 (69.49)	0.458

**Table 5.** Analysis of gardening-cooking based interventions on attitudes and consumption of high calorie foods

Variables	Intervention group (n=33)	Control group (n=33)	P value
Mean total attitude score (SD)			
Pre-test	5.84 (2.00)	7.36 (2.32)	0.006
Post-test	8.96 (1.94)	7.81 (2.28)	0.031
P value	0.000	0.33	
Mean total high calorie food (SD), Kcal			
Pre-test	1,063.30 (246.07)	985.64 (303.91)	0.258
Post-test	858.70 (255.16)	981.77 (214.84)	0.038
P value	0.001	0.919	

**Table 6.** Analysis of gardening-cooking based interventions on food preference and fiber intake

Variables	Intervention group (n=33)	Control group (n=33)	P value
Median fruit preference score (range)			
Pre-test	3.17 (1.37-4.57)	3.17 (0.00-4.07)	0.734
Post-test	3.50 (2.77-4.57)	3.17 (0.53-4.07)	0.003
P value	0.000	1.000	
Median vegetable preference score (range)			
Pre-test	2.48 (0.68-4.48)	2.68 (1.16-4.48)	0.369
Post-test	3.16 (1.16-4.48)	2.68 (1.36-4.00)	0.001
P value	0.000	0.078	
Median fiber intake (range), g			
Pre-test	2.60 (1.30-4.90)	2.80 (0.50-9.60)	0.842
Post-test	12.30 (3.10-33.70)	2.90 (1.20-9.60)	0.000
P value	0.000	0.432	

consumption was higher in children and adolescents who were given various interventions such as gardening and cooking activities than in those who experienced only one mode of education.<sup>12,25</sup> Moreover, forming new habits, especially healthy eating, takes around 66 days.<sup>26</sup> Thus, it is important to continue the program periodically in order to teach preschool children other nutritional knowledge besides fruits and vegetables. The program could be extended gardening-cooking activities, daily food intake recommendations, food tastings, farm visits, storytelling and role-playing about nutrition and eating habits, and family involvement. Our control group showed no changes in attitudes, fruit and vegetable preferences or intake, because they did not participate in the gardening and cooking activities. However, changes in attitudes and behaviors can occur through education and skill attainment, increasing children's knowledge and interest.<sup>8,19,20</sup> Subjects' vegetable intake was still less than recommended, possibly because of the short intervention duration and the fact that gardening activities were focused only on growing vegetables, because growing fruit takes longer.

The limitation of our study was the short intervention time. Longer-term follow-up assessments would provide a more comprehensive understanding of the program's effectiveness. Thus, the gardening-cooking intervention activities requires serious attention and effort, because it requires a long time, substantial financing, adequate land, and involves a community of schools, teachers, students, and parents.

Research consistently shows that parents play a crucial role in shaping their children's eating habits. Role modeling, in particular, has been identified as a significant factor in influencing children's attitudes and behaviors towards food.<sup>27,28</sup> Numerous studies indicate that children are more likely to adopt healthy eating habits when their parents consistently model and engage in nutritious food choices and behaviors.<sup>27-29</sup> In this study, parent's behavior was not investigated which may influence attitudes, fruit and vegetable preferences, fiber intake and high-calorie foods (confounding factor). Investigating the role of parental behavior in shaping children's eating habits is important for understanding the complex and multifaceted factors that contribute to children's eating habits. By considering factors such as role modeling, mealtime structure, food

availability, and feeding practices, researchers can gain a comprehensive understanding of how parental behavior influences children's eating habits and develop interventions and strategies that empower parents to create a positive food environment for their children (promoting healthy food choices, teaching cooking skills, involving children in meal planning and preparation, and encouraging family meals).

Future research should consider conducting a randomized controlled trial to increase the rigor of the study design and strengthen the validity of the findings. This will help to further establish the effectiveness of the intervention in influencing the outcomes.

In conclusion, Gardening-cooking based intervention for 9 sessions is effective in improving attitudes, fruit and vegetable preferences, and fiber intake, as well as reducing high-calorie food consumption in preschool children. These programs offer valuable insights and recommendations for schools, parents, and children. For schools, exploring the integration of gardening and cooking programs into preschool curriculum or extracurricular activities each week and also collaborations with local farms, nutrition experts or community organizations to enhance program delivery and impact. For parents, adopt a positive and supportive attitude toward promoting healthy eating habits in their children by serving as positive role models, making healthy choices, involving children in meal preparation and planning, and others. For children, incorporating food literacy and nutrition education into gardening and cooking programs will enhance children's understanding of where food comes from, how it grows, and its nutritional value. Teaching children about the benefits of eating a variety of fruits and vegetables can help them make informed food choices and develop lifelong healthy eating habits. Also, providing a variety of healthy options and allowing children to participate in meal planning and preparation can help foster a sense of ownership and empowerment in their eating behaviors. This can lead to a positive relationship with food and a lifetime of healthy eating habits.



<sup>3</sup> **Conflict of interest**

None declared.

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