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Involvement of mother in development of fruit and vegetables-based food products for kindergarten students

Endang Widajati, Yohanes Kristianto *

Politeknik Kesehatan Kemenkes Malang. Jl. Besar Ijen 77C, Malang, 65112, Indonesia
* Corresponding Author. E-mail: ykristianto@poltekkes-malang.ac.id

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Abstract: Low fruit and vegetable consumption is a national health problem. This research aimed to analyze the influence of education in the preparation, processing and presentation of fruit and vegetable-based food products. The research was conducted using a pre and post-test design with 30 mothers of kindergarten students in Malang as respondents. Mothers' knowledge about processing fruit and vegetable-based food products was measured before and after the study. The treatment was delivering knowledge and discussion regarding the preparation, processing and serving of children's food using fruit and vegetables. The food acceptability test was carried out to determine the level of children's acceptance of the developed foods products. Changes in maternal knowledge were analyzed using a paired t-test. The results showed that the types of fruit and vegetables commonly consumed by children were watermelon, papaya, bananas, oranges melons, vegetables include carrots and spinach. On average, children consume vegetables two times/day. The mother's food knowledge score after training increased from 72.63 on the pre-test to 83.11 on post-test. Statistically the increase in score was significant ($p < 0.05$). Of the 20 food products produced, almost all of them were liked by children, only two food products received poor acceptance scores, namely pear pudding and vegetable-filled cabins.
Keywords: Fruit; Vegetable; Knowledge; Kindergarten

INTRODUCTION

The average fruit and vegetable consumption of Indonesian population is still below the recommended daily intake. A person's intake of fruit and vegetables is considered sufficient if they consume fruit and/or vegetables, that is a combination of both, at least five portions every day for seven days a week. If fruit and vegetable consumption is less than these provisions, then it is categorized as insufficient. Based on health research Riskesdas data, the proportion of fruit/vegetable consumption per day by the Indonesian population in a week among people aged more than five years old is nationally generally only 1-2 portions. Only 4.6% of the population consumes fruit and vegetables greater than or equal to five portions. The proportion of the population according to age groups ranging from children, teenagers, adults and the elderly who experience a lack of fruit and vegetable consumption does not differ much, that is between 94.1 – 96.8% (Kemenkes, 2019).

Research on kindergarten students shows that the vegetable consumption of the most subjects (93.6%) is under the recommended intakes. The average children's daily vegetable consumption appear only 73.5 grams. Similarly, the fruit consumption of all subject is also lacking, with their daily fruit consumption is an average of only 58.6 grams (Putriana, 2010). The low consumption of fruit and vegetables in pre-school children has also been shown by other studies (Febriana & Sulaeman, 2014; Winiastri, 2020).

Fruit and vegetables have been proven to provide various positive benefits for health of human. Fruit and vegetables contain various vitamins and minerals required by the body. In

fact, the human body is unable to synthesize most of vitamins, therefore they must obtain them from food sources. Vitamins play an important role in metabolism in the body, such as co-factor in energy production and maintain specific body funtions. Vitamin deficiency causes various diseases, for example blindness and beriberi beri (Dewangan & Bhatia, 2023). Furthermore, fruit and vegetables are an important source of dietary fiber. Various studies have proven one of the important benefits of vegetables as foods that reduce the risk of gastric cancer (Ferro et al., 2020). Based on these, various educational efforts have been carried to increase fruit and vegetables including the creation of various media, such as interactive multimedia and videos (Illahi, 2023; Priawantiputri et al., 2023). However, attempts to increase knowledge accompanied by direct practice are still rarely reported in the literature, therefore this research was aimed to provide knowledge to mother of kindergarten children regarding with the benefits of fruit and vegetables for children and provide skills in the development of fruit and vegetable-based food products.

METHODS

This current research was conducted using a pre-test and post-test design. The participated respondents were 30 mothers of a private kindergarten students at City of Malang, Indonesia. The respondents were recruited using the total sampling method. The mothers were initially given questionnaire to measure their knowledge related to fruit and vegetables preparation as the pre-test. Subsequently, the set of topics were delivered to them. This included discussion on how to develop home-made food product using fruit and vegetables as ingredient for their children. The nutrition topics delivered to the respondents include the importance of fruit and vegetables for children, determination of portion size of fruit and vegetable for children, development of snacks based on fruit and vegetable, preparation and processing, and estimation of nutrient contents of the developed food products. The research design of the study is presented in Figure 1.

	Pre-test	**Treatment**	**Post-test**
- Respondents	→P1	→X	→P2

Note: P1 = pre-test, X = treatment, P2 = post-test

Figure 1. The Research Design

At the end of study, the mothers were assessed for their knowledge and skills related to topics which had been delivered. Twenty snack products resulted from the study were assessed for food acceptance using the kindergarten students as the prospective consumers. The obtained score on knowledge was processed and presented descriptively using the following group of classifications: "Good", "Fair", "Insufficient", and "Minimum" with the respective scores of 76% or above, 56-75%, 40-55%, and below 40%. Measurement of the developed food products acceptance was carried out using the visual estimation method with the Comstock approach. The measurement was done by visually estimating the amount of the prepared food which was left unconsumed by the kindergarten students. Nutrient contents of the developed food products were estimated using nutrients database of Indonesian food available within Nutrisurvey software (Erhardt, 2007). The final score used the assessment were divided into five categories, namely "finished completely" (score 4), "a quarter remained" (score 3), "a half remained" (score 2), "three fourth remained (score 1), and "completely unconsumed" (score 0) (Kemenkes, 2013). Paired t-test was performed to determine the difference score between pre and post-tests using R software and *dplyr* package (R Core Team, 2023; Wickham et al., 2023).

RESULTS AND DISCUSSION

Characteristic of Respondents

Most of the mothers (50%) involved in this research were aged 31 – 35 years old whose general education mostly (53.3%) at senior high school. The level of education is a fundamental requirement for achieving optimum health. Research conducted in 56 countries shows that parental education, especially mothers, provides positive significant benefits toward children's nutritional status. The benefits obtained in fact tend to increase with increasing level of education. Families with the mother has higher education tend to have a smaller chance of their children to experience malnutrition (Alderman & Headey, 2017; Vollmer et al., 2017). Characteristics of respondents in detail are presented in Table 1.

Table 1. General Characteristic of the Respondents

Age (years):	Number	Percentage
- 25–30	7	24.4
- 31–35	15	50.0
- 36–40	4	13.3
- 41–50	4	13.3
Education:		
- Elementary school	3	10
- Junior high school	1	3.3
- Senior high school	16	53.3
- Diploma	2	6.67
- Graduate	7	23.4
- Post graduate	1	3.33

This current study revealed that the kindergarten children generally had low food preference to fruit and vegetables. The number of children who liked fruit and vegetables was only 23.3%. The types of vegetables the children often consume were limited to carrots and spinach, while form fruit group included watermelon, papaya, bananas, oranges and melons. This is in line with other research which shows that children's preferences for fruit and vegetables are inconsistent (Azadirachta et al., 2017). Several factors have been known to be the important determinant to children preference to fruit and vegetables consumption. These include sensory qualities, satiating power, event during consumption, availability related to season and processing methods, prices, peer influence, and outcome expectations (Krølner et al., 2011).

Effect of Education

The average knowledge of the mother on fruit, vegetable and their correlation to health before the study was 72.63 ± 16.89 and increased to 83.11 ± 15.19 after the nutrition education. The number of mothers whose knowledge categorized as “Good” at the post-test was greater than at the pre-test. On the other hand, the number of mothers with knowledge in the “Fair” and “Insufficient” categories decreased during the post-test. There was no mother whose knowledge fell under “Minimum” category. The increase in mothers' knowledge was statistically significant ($p<0.05$). The distribution of mothers based on their level of knowledge before and after the study is presented in Figure 1. Nutrition education regarding the importance of fruit and vegetable consumption for early childhood health carried out by Yassin (2023) also shows the similar results. This may reflect the high enthusiasm of mothers in seeking fruit and vegetable intake for their children. The nutrition knowledge of mothers, especially regarding fruit and vegetables, and their consumption habits have an influence on their children consumption (Winiastri, 2020). Apart from mothers, providing fruit and vegetable education to

elementary school children has also been proven to increase children's knowledge (Hariani et al., 2021). Based on this, future research might be designed to look at the importance of mother and child coordination in determining the type of fruit and vegetables to consume so as to increase intake.

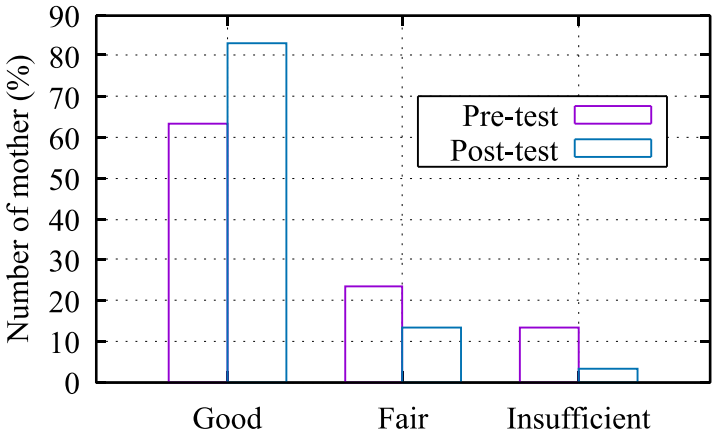

Figure 2. Knowlegde Changes of Mother Before and After Study

The Developed Fruit and Vegetables-based Food Products

This research produced twenty fruit and vegetable-based processed food products. The resulted food products consisted of two groups, namely products with a dominant salty or savory taste and groups with a sweet taste. Initially the product was conceptualized, discussed with the mothers, then cooked and served to the children. The selection of vegetables and fruit used in product formulation was based on the children preferences. The resulting product might be used as a snack or side dish for case as omelette filled with vegetables, vegetable nuggets, roulade with vegetables added. Ingredients used to develop the salty or savory products included wheat flour, rice, noodles, macaroni, white bread and sweet corn. As a source of protein, the ingredients used were chicken, sausage and milk. Meanwhile, the ingredients for making pudding snacks included fruit as a source of vitamins, minerals and fiber, gelatin, sugar, eggs, milk, as well as other additional ingredients such as chocolate powder, raisins. The added vegetables to develop salty products included carrots, spinach and broccoli. The type of snack is chosen based on the types that the children like, for example if a child does not like vegetables but likes nuggets, then vegetables can be substituted for nuggets, if a child does not like vegetables but likes omelettes, then vegetables can be mixed into omelettes. Similarly, should children do not prefer fruit but like pudding, then fruit can be added to the pudding. Making healthy snacks is very challenging, apart from meeting the important nutrients contained in fruit and vegetables, good snacks require to in line with children preference. There still widely available snacks which are unhealthy because they are too salty, too sweet and high in fat (Hess et al., 2016). The developed food products for this study are presented in Table 2.

It should be emphasized that mothers are required to have knowledge of healthy food and creativity to motivate children to have good food consumption habits. Apart from being healthy, several things mother should do to increase the appeal of food are use of garnishes. Snacks with a salty and savory taste can be decorated with parsley, celery, cucumber, red chilies, spring onions, tomatoes, onions and others. Meanwhile, snacks that taste sweet can be decorated with cherries, strawberries, pandan leaves, kiwi, canned fruit or ready-made ingredients such as raisins, chocolate sprinkles, sprinkles of cheese and so on. The availability of healthy

and attractive foods is very necessary as indicated in research where children tend to consume unhealthy snacks if these foods are available at home (van Ansem et al., 2015).

Table 2. The Developed Fruit and Vegetable-based Food Products and Their Acceptabilities

No	Food Products	Energy (Kcal)	Fibre (mg)	Acceptance (%)
1.	Tomato Pudding	88.2	0.7	85,9
2.	Orange Pudding	97.3	0.7	85,3
3.	Layered Strawberry Pudding	81.4	0.9	80,6
4.	Dragon Fruit Pudding	82.2	3.5	85,3
5.	Melon Pudding	85.7	0.9	85,9
6.	Layered Mango Pudding	107.2	0.7	80,6
7.	Guava Pudding	95.8	6.4	87,5
8.	Pineapple Pudding	96.5	1.5	89,3
9.	Mix Fruit Pudding	106.8	1.6	84,1
10.	Vegetable Bitterballen	127.8	0.8	88,1
11.	Steamed Vegetable Macaroni	261.1	1.2	80,6
12.	Spinach Cake	143.7	0.6	96,7
13.	Vegetable Omelette	91.9	0.6	89,6
14.	Vegetable Noodle Balls	125.2	1.3	91,3
15.	Carrot Cake	144.0	1.0	83,3
16.	Veggie Mix Baked Rice	227.5	1.3	88,1
17.	Vegetable Rollade	78.7	5.4	90,3
18.	Vegetable Nuggets	163.2	0.5	93,3
19.	Vegetable Filled Cabin	287.2	2.4	77,4
20.	Pear Pudding	81.4	1.0	77,1

Note: Energy and fibre contents were calculated per serving size

As can be seen from Table 2, the acceptability of the developed product are generally good. For all types of products, the amount of food waste is not more than a quarter (score 3). Children like processed vegetable products such as spinach cake, vegetable rolls, vegetable noodle balls and vegetable nuggets. Spinach cake is preferred because of its attractive particularly in shape, roulade is liked because of its attractive appearance, while nuggets are a type of food that children like and mothers often serve because they are considered practical. Processed products that are less acceptable for children are pear pudding and vegetable-filled cabins. This may be because children are not used to eating the pears, therefore they could not accept the typical taste of the pears very well. Likewise for vegetable-filled cabins which have relatively low acceptance, this may be related to the use of types of vegetables that children do not like. Apart from that, it may also be related to family eating habits. Eating habits of parents, including feeding strategies, are the dominant factors that determine food habits of the respective children (Scaglioni et al., 2018).

Fruit and vegetable-based food products that have a good level of acceptance in this research can be used as formulas and are provided in children homes. This could be a mean of increase the availability and develop eating habits to fruit and vegetable not only for children but also for the whole family members. As shown by a study in pre-school children, the availability of fruit at home has been shown to increase fruit consumption significantly. However, this does not apply to vegetables (Damayanti et al., 2018). This shows the importance of making efforts such as mixing in food formulas such as those produced in this study. Different levels of children's acceptance of fruit and vegetables can be caused by differences in the taste of fruit and vegetables. In general, fruit has an innate taste that is easier to accept because it contains sweet sugar compounds. Sweet taste is the basic taste that is most easily accepted by

the human senses compared to other basic tastes, namely bitter, salty, sour (Gravina et al., 2013).

CONCLUSION

In general, kindergarten children have low preference on fruit and vegetables, only 23.3% of the sample said they like to eat them. The types of vegetables that children often consume are carrots and spinach, while of fruit group includes watermelon, papaya, bananas, oranges and melons. Mostly children consume vegetables twice daily. The energy and nutrients content of the developed food product in this study which has a sweet base taste in form of pudding is: energy 81.4 - 107.2 Kcal, carbohydrates 12.4 - 16.9 grams, fat 2.5 - 4.9 grams and protein 2, 3 - 3.1 grams, and fiber 0.7 - 6.4 mg. Meanwhile, the food products with a salty and savory taste contain energy between 91.2 - 287.2 Kcal, carbohydrates 3.1 - 13.2 grams, fat 6.6 - 15.4 grams and protein 3.1 - 13.2 grams, and fiber 0.5 - 5.4 mg. The level of children's acceptance of the food produced in the study is generally high. Mothers' knowledge on fruit and vegetables and how to incorporate them in the development of their children favorite foods increases significantly ($p<0.05$) after the education. It is recommended that the products resulting from this research be used to increase fruit and vegetable intake of mainly pre-school children.

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