



Appropriate Media for Noodles to Increase Food Consumption in School-Age Children

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Abstract

BACKGROUND: Inadequate intake of minerals and vitamins from fruit and vegetable consumption in schools may increase the risk of illness, impair growth and development, and impede adaptation to environmental hazards.

AIM: This study aimed to analyze the effect of educational media containing processed noodles on the acceptability and consumption of vegetables and fruits among elementary schoolchildren.

METHODS: This was a quasi-experimental study with a pre- and post-design approach – data were based on a Comstock visual checklist sheet and a recall form to determine vegetable and fruit consumption.

RESULTS: The results showed that using educational media with processed noodles can increase the acceptability of fruit and vegetable consumption among school-aged children. The composition of nutrients in each processed vegetable and fruit noodle was quite complete and balanced.

CONCLUSIONS: There was a significant difference in the overall increase in the consumption of vegetables and fruits before and after using processed noodle media in elementary schoolchildren in Pontianak.

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Introduction

Nutritional status challenges in Indonesia, especially among children aged 12–59 months, were 7.2% in 2013 and remained high at 30.8% in 2018 [1]. The prevalence of nutritional issues is reportedly higher in Indonesia than that in the world. The World Health Organization (WHO) reported nutritional deficiencies in children at 22.2%. Preschool and underweight children (~15.7%) showed stunted growth (18%) and were overweight (6.6%) [2], [3]. Risk factors that predispose children to nutritional deficiency include inadequate intake of minerals and vitamins sourced from fruits and vegetables [3].

Inadequate mineral intake in children is associated with high mortality and morbidity and exacerbates growth and developmental disorders in children. Deficiencies of vitamins and micronutrients in school-aged children contribute to diseases, imbalance of physical and neuropsychological growth and development, and impaired adaptation to environmental

hazards, thereby reducing learning performance [4], [5]. Severe nutritional problems are caused by a lack of balanced food intake that fulfills its functions as a source of energy and protective and regulatory substances.

Several factors, such as the physical environment, government policies, and individual characteristics, are responsible for the lack of regulatory substance intake [6]. These individual factors are due to a lack of understanding, knowledge, attitudes, and behaviors regarding the importance of sources of regulatory substances in the body's metabolism. In addition, the low consumption of vegetables and fruits is due to the internal environment, including government policies and economic status. The physical environment includes dietary guidelines, exposure to the media, schools where students learn, and personal factors, such as habits, knowledge, and experience [7].

The intake of regulatory substances, including vitamins and minerals, occurs through the consumption of vegetables and fruits [8]. The WHO recommends consuming up to 400 g/person/day of 250 g of vegetables and 150 g of fruits. In Indonesia,

the consumption of vegetables and fruits is still low. The average consumption of vegetables is 70 g/person/day, fruit consumption is 38.8 g/day, and the highest consumption is about 173 g/person/day. Among children aged over 10 years, 93.6% consume fewer vegetables and fruits [9], [10]. In particular, school-age children tend to consume approximately 41% less or are averse to consuming vegetables and fruits [9], [11].

Promising efforts are required to increase the acceptability of vegetables and fruits, especially among school-aged children [12]. The interventions implemented to increase knowledge and behavior of vegetable and fruit consumption are counseling on the importance of their consumption among school-aged children through counseling or nutrition education, advertising through the media, and creative cooking contests [13], [14].

Another option is to promote fruit and vegetable consumption among schoolchildren through sociodramas [15]. However, these efforts have not been optimal, as evidenced by the low consumption of vegetables and fruits, especially among school-aged children. Therefore, it is necessary to increase efforts in other ways, such as in the form of educational media, to increase the consumption of fruit and vegetables in different forms or methods, such as processed noodles.

Several principles to increase the consumption of vegetables and fruits through educational media with processed noodles have added value, namely, enhanced taste, nutritional value, and convenience [16]. We explored various techniques, such as introducing sweet fruits into the diet, providing examples of fruit and vegetable consumption, and an attractive presentation to improve or promote the consumption of vegetables and fruits in children aged 5 years or those at preschool age. The presentation was interesting and included modified noodle media colored according to fruit and vegetable types so that children become interested in their consumption [17], [18]. This study aimed to increase the consumption of fruits and vegetables by modifying processed noodle media from vegetables and fruits to attract consumption by school-age children.

Methods

Design of research

This was a quasi-experimental study with a pre- and post-designed control approach to investigate the causal relationship between the acceptability of noodles and the increase in the consumption of vegetables and fruit among elementary schoolchildren in Pontianak.

Research object

This study included the use of processed noodles made from dragon fruit, papaya, pineapple, mustard greens, carrots, and spinach to increase fruit and vegetable consumption among children. The noodle processing was done by making a puree of vegetables and fruits using a blender and noodle processing equipment. The fruits included in this study were papaya, pineapple, dragon fruit, mustard greens, spinach, and carrots (Figures 1 and 2). Another variable that was assessed in this study was acceptability, which was the number of people who received or consumed processed noodles. Fruit and vegetable consumption was determined by the amount or number of vegetables and fruits consumed daily.

Sample size and sampling technique

Fifth grade students from state elementary school of 5 and 9 from North Pontianak were included in this study. The sample size was determined based on calculations using the experimental research method. A sample of 60 children was drawn from the total population. From the total sample, two elementary schools in the North Pontianak subdistrict were selected as the sample.

As many as, 30 students from Class V of state elementary school 5 and 30 students of Class V of state elementary school of 9 were interviewed at each school. A simple random sampling technique was used to select the 30 students from each elementary school.

Research instruments

The instruments used in this study included a checklist and food recall sheet. The checklist measured the acceptability of the number of processed vegetables and fruit noodles that were consumed. The measurement of acceptability was based on Comstock's visual method. The food recall form was used to monitor the increase in the consumption of vegetables and fruits among elementary schoolchildren in North Pontianak.

Flow of research and interventions carried out

The flow of the research on the effectiveness of using educational media to increase fruit and vegetable consumption among school-aged children was conducted and included the preparation of ingredients for making vegetable and fruit noodles using green mustard, carrots, spinach, dragon fruit, papaya, and pineapple. In addition, vegetables and fruits were processed into noodles. Then, the consumption of vegetables and fruits was recorded in a 2 × 24 h recall before the intervention. The intervention

included counseling with vegetable and fruit noodle media and was conducted 6 times. The average duration of counseling with noodle education media was 60 min. Each time the intervention was completed, the acceptability test was administered. One month after the implementation of the counseling intervention, a recall of vegetable and fruit intake consumption was measured over 2 × 24 h. A t-test was conducted to observe an increase in fruit and vegetable consumption before and after the intervention.

Data collection techniques

The data collection techniques in this study included measuring the acceptability of processed papaya noodles, pineapple, dragon fruit, carrots, mustard greens, and spinach using Comstock's visual method. The measurement was performed by assessing the number of processed vegetables and fruit noodles consumed and was assigned a score (value). Elementary schoolchildren in North Pontianak were surveyed using the food recall form to determine the increase in the consumption of vegetables and fruits.

Data processing and analysis

The collected data were processed using a computer program. The processed data are presented as tables, graphs, and text. The data were analyzed using univariate and bivariate analyses. Univariate analysis was used to describe the data related to processed noodles, acceptability, and increased consumption of fruits and vegetables.

Bivariate analysis was used to determine the effects of processed papaya, pineapple, dragon fruit, mustard green, and carrot noodles before and after the 1-month treatment. Statistical analysis was performed using the Kruskal-Wallis test to determine the difference in the acceptability of the provision of processed vegetable and fruit noodle offerings. The Mann-Whitney U-test, with a 5% ($\alpha = 0.05$) confidence level, was used to analyze the difference in consumption before and after treatment.

Official permission, ethical clearance, and informed consent

The health education ethics committee reviewed the study protocol, and ethical permission was provided. Written consent was obtained from all parents of the students, the school, and the Pontianak City Health Service. Official approval was obtained from the Ethics Committee of Poltekkes Kemenkes Pontianak in West Kalimantan (number 147/KEPK-PK); PKP/V/2019.

Results

Acceptability of processed vegetable noodles and fruit

Figure 3 shows that the vegetable noodles' acceptability was very good among elementary schoolchildren. The acceptability of spinach, carrot, and mustard greens noodles was 98.2%, 94.7%, and 88.8%, respectively. The acceptability of spinach noodles is better than that of carrot noodles and green mustard noodles.

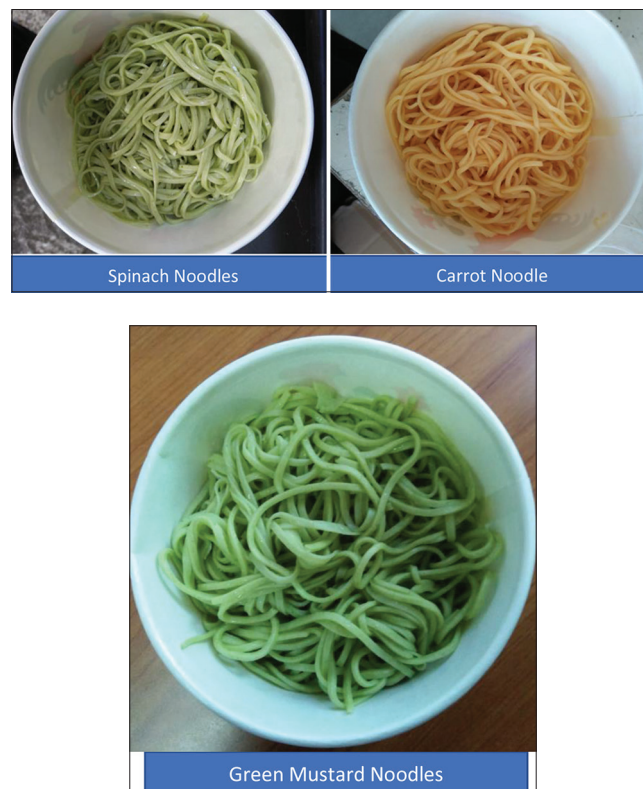
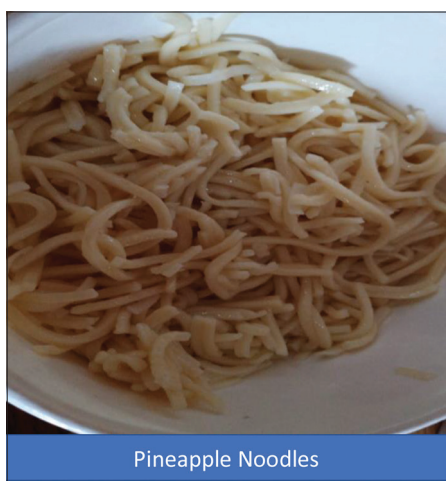


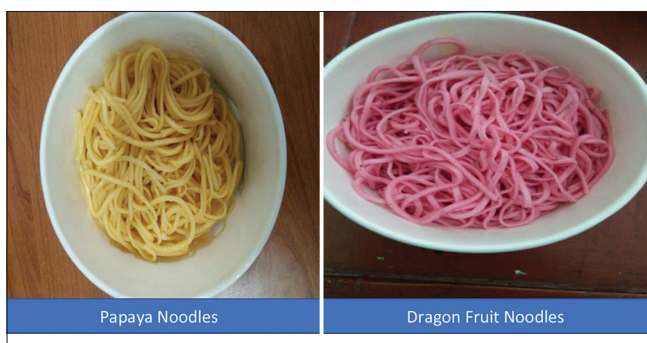
Figure 1: Spinach noodles, carrot noodles, and green mustard noodles

Statistical analysis revealed no difference in the acceptability of spinach, carrot, and green mustard noodles ($p = 0.089$).

The acceptability of the pineapple, papaya, and dragon fruit noodles was 96.4%, 94.6%, and 99.1%, respectively, and belonged to the very good category. The acceptability of dragon fruit noodles was better than that of pineapple and noodles. Statistical analysis revealed no significant difference in acceptability between papaya, pineapple, and dragon fruit noodles ($p = 0.546$). This shows that health education through vegetable and fruit noodle media can increase the acceptability of consuming both vegetables and fruit among elementary schoolchildren in Pontianak.



Pineapple Noodles



Papaya Noodles

Dragon Fruit Noodles

Figure 2: Pineapple noodles, papaya noodles, and dragon fruit noodles

Nutrient content of vegetable and fruit noodles

Based on an analysis of the Indonesian Food Composition Table (TKPI) conducted in 2019, the nutritional content of processed vegetables and fruits prepared in the form of modified noodles is high. A processed green mustard noodle weighing 450 g (250 g wheat flour, 150 g mustard greens, and 50 g chicken eggs) provided 1016 kcal of energy. One processed mustard vegetable noodle contains 194.4 g of carbohydrates 35.5 g of protein, 549.5 µg of Vitamin A, 37.5 mg of Vitamin C, and 173 mg of calcium. A processed dragon fruit noodle weighing 450 g provided 1064.6 kcal of energy. It provided up to 209.97 g of carbohydrates, 32.27 g of protein, 95 µg

of Vitamin A, 60 mg of magnesium, and 173 mg of calcium.

A total of 209.97 g of carbohydrates provides 1016 kcal from 450 g of processed dragon fruit noodles. Based on the carbohydrate value, the energy can be calculated based on the TKPI. The energy value per 100 g of dragon fruit is 910 kcal. The energy value of processed dragon fruit noodles is as follows:

1. (250 g wheat flour/100 g of wheat flour) × the energy value (333 kcal); the energy received from wheat flour in the processed noodles is (250 g/100 g) × 333 kcal = 832.5 kcal
2. (150 g of dragon fruit/100 g of dragon fruit) × the energy value (71 kcal); the energy received from dragon fruit in the processed noodles is (150 g/100 g) × 71 kcal = 106.5 kcal
3. (50 g fresh eggs/100 g of eggs) × the energy value (154 kcal); the energy received from fresh eggs in the processed noodles is (50 g/100 g) × 154 kcal = 77 kcal.

Use of processed noodles and total vegetable and fruit intake

As shown in Table 1, the total vegetable consumption of elementary schoolchildren in Pontianak was 106.69 g/person/day before exposure to processed noodle media. After health education with noodle-processed media, the total vegetable consumption increased to 190.82 g/person/day in elementary schoolchildren. Statistical analysis using the Mann-Whitney U-test showed that there was a significant difference between the total vegetable and fruit consumption before and after exposure to health education with processed noodles among elementary schoolchildren in Pontianak (p = 0.011).

Table 1: Noodle processed media and average vegetable and fruit intake in elementary schoolchildren in Pontianak

Paparan media mie	Mean	Min ± max	SD	p ^a
Vegetable and fruit				
Before	106.69	0 ± 390	104.24	0.011*
After	190.82	0 ± 657	175.46	

^aMann-Whitney U-test, *Significant ≤0.05.

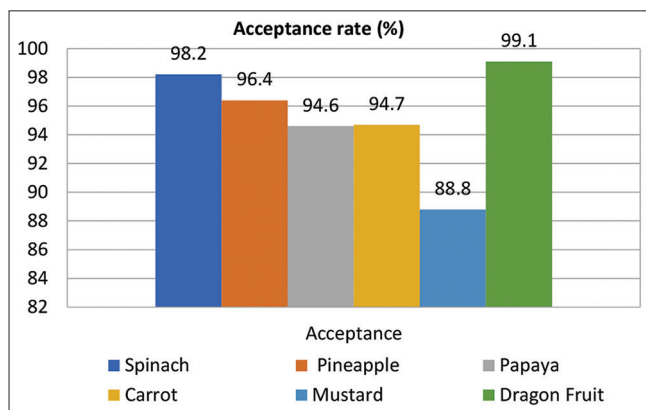


Figure 3: Acceptance rate of vegetable and fruit noodles

Discussion

Before processed noodle media education, the total consumption of vegetables and fruits in school-aged children was 106.69 g/person/day. After processed pasta education using vegetable and fruit noodle-processed media, the total vegetable consumption of vegetables and fruits increased to 190.82 g/person/day. However, the total consumption of vegetables and fruits did not reach 400 g/person/day, which is the daily recommended value by the WHO and FOA 2015 guidelines. However, the use of extension media with processed noodles increased the acceptability

of vegetable and fruit consumption. With the use of educational media to increase the consumption of fruit and vegetables with processed noodles, both vegetables and fruits were given to elementary school students. The average acceptability rate was found to be very good.

The use of educational media, especially to increase the consumption of vegetables and fruits through local food products such as processed noodles, must be attractively designed, be made from available materials and at affordable prices, and have a balanced composition of nutrients [17]. Educational media with processed vegetable and fruit noodles, if presented in a very attractive and colorful way according to the color of fruits and vegetables, can increase the acceptability and consumption of vegetables and fruits [12], especially among school-aged children. Various activities can be undertaken to increase the consumption of vegetables and fruits. These activities include the promotion of these foods. This promotion can improve knowledge and attitudes and change the behavior or habits of children regarding the consumption of vegetables and fruits [19]. For promotional activities to be practical and effective, they must be conducted several times with a break. This method is expected to achieve optimal results in changing the understanding, habits, and acceptability of vegetable and fruit consumption [18].

In addition, it is recommended that processed vegetable and fruit noodles in moderate portions contain complete nutrient content or composition, produce relatively high energy, and are more likely to be accepted by school-age children than by large portions [17]. The results showed that a standard serving of processed dragon fruit noodles weighing 450 g could provide up to 1064.6 kcal of energy.

The use of processed noodle media increases the overall consumption of vegetables and fruits. Before using processed noodle media, the average total intake of vegetables and fruits was 106.69 g/person/day, which increased to 190.82 g/person/day. Processed noodle media were used several times on 3 consecutive days for 2 weeks, within a 1-month evaluation period. Expanding the diet with local food product media, especially processed noodle media, can increase the consumption of vegetables and fruits as seen previously [12], [20].

For this reason, we hoped that processed noodles with vegetables and fruits could be used as a medium for the health education of school-aged children. Using health education methods, processed local food products, such as processed noodles, can achieve the overall goal of increasing vegetable and fruit consumption [21]. This can be served mainly to children, especially elementary schoolchildren.

Conclusions

This study demonstrated a significant difference in the total consumption of vegetables and fruits before and after eating processed noodle media among elementary schoolchildren in Pontianak. The acceptability of the processed fruit and vegetable noodles was very good. Based on these significant findings, the Indonesian government, through the health department and the public health centers, can use the media to process noodles from vegetables and fruits as an educational tool to increase the consumption of vegetables and fruit among school-age children. In the event of fruit and vegetable price escalation, the health departments or community health centers must explore replacement food sources for school-aged children, such as noodles made from fruit and vegetables.

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