DIFFERENCES IN FOOD INTAKE (ENERGY, PROTEIN, FAT AND CARBOHYDRATES) IN CHILD WASTING BY GIVING COOKIES OF PURPLE SWEET POTATO AND TEMPEH FLOUR

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ABSTRACT
Wasting is a malnutrition condition attributable to insufficient food intake and/or disease. Poor quality and quantity nutrition in food intake is particular concern, especially for child wasting. One of the efforts to deal of child wasting is by providing nutrient-rich supplementary foods such as cookies. Cookies of purple sweet potato and tempeh flour have nutritional value of protein (8.06-22.31%) and carbohydrates (63.85-82.42%). The aim of study was to analyze differences in food intake (energy, protein, fat and carbohydrates) in child wasting by giving cookies of purple sweet potato and tempeh flour. The design of this study was quasi-experiment used a pre-posttest design with a controlled group. The study consisted of a control group (100% purple sweet potato cookies), K1 (90% purple sweet potato: 10% tempeh flour) and K2 (80% purple sweet potato: 20% tempeh flour). The intervention for 30 days. The analyze of data used were paired t-test and One-Way Anova. The results found that there was an increase in food intake (energy, protein, fat and carbohydrates) before and after giving cookies of purple sweet potato and tempeh flour and it was statistically significant. There was a significant difference food intake in each group after intervention by cookies (p<0.05). Intervention with cookies of purple sweet potato and tempeh flour could be the alternative to increase food intake in child wasting.

Keywords: Cookies, Food intake, Purple sweet potato, Tempeh flour, Wasting

INTRODUCTION
Malnutrition is one of the nutritional issues that is still become a global problem. Malnutrition is a condition in which children are underweight for their height, caused by disease and insufficient food
intake (1). Malnutrition can lead to a high risk of morbidity and death. Moreover, children with malnutrition (wasted only) have a 2.3 times greater risk of death compared to children who are not malnourished. In addition, malnutrition can also cause physical and mental disorders (2,3). Malnutrition, also known as wasting, has become a particular concern, especially in Asia’s developing countries such as Indonesia. In 2020, more than two-thirds of children aged <5 years who suffer from wasting live in Asia (4).

In Indonesia, the study results of the Indonesian nutritional status (SSGI) show that wasting prevalence has decreased from 7.4% in 2019 to 7.1% in 2021. However, wasting rate has increased to 7.7% in 2022. Specifically in Jambi Province, prevalence of wasting is 9.1% in 2021 and will decrease to 6.6% in 2022. The opposite is true for wasting rate in Kerinci Regency, namely the prevalence of wasting has increased from 3.8% in 2021 to 5.4% in 2022 (5,6).

Wasting occurs due to the lack of nutrient-dense food intake (7). Children with wasting have lower levels of energy, protein, and fat intake compared to childrens with good nutritional status (8). Children aged 6-59 months with wasting are known to have a deficiency of macronutrients intake (<80% AKG) which shows that there is a significant relationship between intake of energy, protein, fat, and carbohydrates towards wasting in children aged 6-59 months (9).

One of the targets of the Sustainable Development Goals (SDGs) in 2030 for the health sector is to end all forms of malnutrition; to reduce wasting rates. One of the nutritional intervention programs to deal with malnutrition issues is supplementary feeding (Pemberian Makanan Tambahan - PMT) (10). PMT is a supplementary food from the main food that can be processed by utilizing local food ingredients to meet the nutritional needs of children and improve their nutritional status (11).

The researcher is using preliminary research at the Kerinci District Health Office area. Children with wasting were given 3 packs (120 g/day) of biscuits for 90 days as the government's PMT program. The PMT distribution for child wasting had been going well. However, interviews with several mothers regarding PMT consumption, show that not all children under five who get PMT had consumed it. This is because some children feel tired of consuming the same PMT every day and some children do not like the taste of milk in biscuits.

Kerinci Regency is one of the regencies with the most sweet potato food products in Jambi Province, including purple sweet potato (12). Purple sweet potato is a vegetable food which is rich in carbohydrates, energy, vitamins, minerals and antioxidants such as anthocyanins. The high carbohydrate content makes it an important source of calories. The nutritional content of fresh purple sweet potato per 100 g is that it contains energy of 123 kcal; protein 1.8 g; fat 0.7 g; carbohydrates 27.9 g; calcium 30 mg; iron 0.7 mg; vitamin C 20.1 mg and anthocyanins 150.7 mg (13,14).

Purple sweet potato has a low protein nutrient content. Therefore, it is necessary to add other ingredients to complement the lack of protein nutrients, namely tempeh flour. Tempeh flour in 100 g
dry weight (bk) contains 50.18% protein, 25.02% fat, 22.88% carbohydrates and 53.08 mg total isoflavones (15). Research by Ibrahim et al. (2018) related to giving purple sweet potato biscuits for 30 days as much as 50 g showed an effect on energy intake, iron, and body weight before and after the intervention (16). From this description, the researchers were interested in analyzing differences in food intake (energy, protein, fat and carbohydrates) in child wasting by giving cookies of purple sweet potato and tempeh flour.

**METHOD**

This research is a quasi-experimental with pretest-posttest control group design. This study included three groups of subjects, namely the control group (given purple sweet potato cookies), treatment group 1 (given purple sweet potato cookies 90%: tempe flour 10%) and treatment group 3 (given purple sweet potato cookies 80%: tempeh flour 20%). The research was carried out at selected Community Health Centers in the working area of the Kerinci District Health Office from March to May 2022, while the research intervention lasted 30 days.

The study population is 24-59 months of child wasting in Kerinci Regency. The selection of the research sample was carried out using a multistage sampling technique. The inclusion criteria are malnourished toddlers (weight/height) of age 24-59 months, having a KIA book, attending Posyandu for the last 2 months, parents' income below <Rp. 2,500,000, and parents or family willing to take part in the study. The exclusion criteria were having a history of congenital diseases, and taking supplements. In addition, there is also a loss of follow-up criteria that includes children with fever or diarrhea for 3 consecutive days during the study, children who stop or do not wish to continue the research, have moved outside of the Kerinci Regency and passed away.

The study consisted of 51 respondents, namely each research group consisted of 17 subjects. Prior to the intervention, the research subjects underwent a 24-hour recall interview to determine their food intake. After that, each subject was given purple sweet potato and tempeh cookies for 30 days. However, during the study, 4 subjects were excluded from the study. The reasons why these four subjects were excluded from the research were that two subjects had a fever for three days in a row, one subject had not been at home for several days without informing the researcher or enumerator and another subject had not finished the cookies that had been given. Then another 24-hour recall interview was conducted to see food intake after giving purple sweet potato cookies. This research has passed the ethical test and received ethical approval with Number: 20/UN27.06.11/KEP/EC/2022.

The research data were analyzed using the SPSS Software application version 25. The results of the research were statistical tests using paired t-test and One-way ANOVA test. Paired t-test to see the difference before and after the intervention, while the One-way ANOVA test to see the effect between treatment groups.
RESULTS AND DISCUSSION

Univariate analysis in this study includes the frequency distribution of the characteristics of research subjects. The research subjects were grouped into three groups based on the treatment given in the study.

Table 1. The Characteristics of Research Subjects

<table>
<thead>
<tr>
<th>Group</th>
<th>Gender</th>
<th>Age</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
<td>24-36 months</td>
<td>&gt;36-59 months</td>
</tr>
<tr>
<td>Control</td>
<td>7 (46.67%)</td>
<td>8 (53.33%)</td>
<td>7 (46.67%)</td>
<td></td>
</tr>
<tr>
<td>KP1</td>
<td>10 (62.5%)</td>
<td>6 (37.5%)</td>
<td>11 (68.75%)</td>
<td></td>
</tr>
<tr>
<td>KP2</td>
<td>7 (43.75%)</td>
<td>9 (56.25%)</td>
<td>11 (68.75%)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>24 (51.06%)</td>
<td>23 (48.94%)</td>
<td>29 (61.7%)</td>
<td></td>
</tr>
</tbody>
</table>

Control= group given 100% cookies of purple sweet potato
KP1= group given cookies of 90% purple sweet potato + 10% tempeh flour
KP2= group given cookies of 80% purple sweet potato + 20% tempeh flour

From Table 1 it can be seen the characteristics of research subjects who experienced wasting, namely gender and age group. The number of children under five experiencing wasting based on sex between boys and girls is not much different, but boys (51.06%) are slightly more than girls (28.94%). Research by Kevin et al. (2017) also found that the percentage of malnutrition occurred slightly more in boys than girls (11). A study conducted by Ahmadi et al. (2018) states that the incidence of wasting has a statistical correlation with gender, in other words, there is a significant difference between gender and the occurrence of wasting. The prevalence of wasting in Ahmadi studies was found more in boys than girls (3).

Age characteristics were grouped into 2, namely age 24-36 months and age >36-59 months. The age group that experienced the most wasting was in the age group >36-59 months (61.7%). This results are relevant to research by Diniyyah and Nindya (2017) that the majority of wasted toddlers are aged 24-36 months. In this age group, children are vulnerable to experiencing nutritional problems such as wasting. At the age of 2 years, toddlers have also entered the weaning period and adopt a diet like their parents, so food intake is very important to support the toddler's growth process (8). After the first two years of life, children's growth begins to slow down and their appetites tend to decline. This is because kids start to exhibit their own eating habits, such as choosing their own food, being fussy about what they eat, avoiding certain foods, and eating on their own (17). The different of result was found that children with wasting are more young than old. According with study conducted by Odei Obeng et al. (2023) was found that wasted children ages 6-23 month (65.69%) had a higher than wasted children aged 24-59 month (34.31%) (18). There was age of transition from exclusive breastfeeding and complementary breastfeeding to family feeding is a contributing factor to the high incidence of undernutrition globally (19). In addition, during toddlerhood there is a very rapid growth and development phase, if nutritional needs are not met properly it will vulnerable to malnutrition (11).
Septiani et al. (2017) in their research stated that the proportion of children with poor nutritional status was more in the age group >18 months (20).

Table 2. Food Intake Before and After Giving Cookies of Purple Sweet Potato and Tempeh Flour

<table>
<thead>
<tr>
<th>Group</th>
<th>Food Intake ± SD</th>
<th>Δ Mean</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before</td>
<td>After</td>
<td></td>
</tr>
<tr>
<td>Energy</td>
<td>893.83 ± 113.53</td>
<td>1155.03 ± 77.46</td>
<td>261.2</td>
</tr>
<tr>
<td></td>
<td>862.03 ± 93.94</td>
<td>1210.82 ± 65.05</td>
<td>348.78</td>
</tr>
<tr>
<td></td>
<td>788.47 ± 109.48</td>
<td>1213.28 ± 88.24</td>
<td>424.80</td>
</tr>
<tr>
<td>P</td>
<td>0.024b</td>
<td>0.074</td>
<td>0.00b</td>
</tr>
<tr>
<td>Protein</td>
<td>24.69 ± 3.36</td>
<td>29.99 ± 3.07</td>
<td>5.30</td>
</tr>
<tr>
<td></td>
<td>26.438 ± 16.32</td>
<td>32.96 ± 3.07</td>
<td>6.52</td>
</tr>
<tr>
<td></td>
<td>22.15 ± 5.99</td>
<td>32.76 ± 4.31</td>
<td>10.60</td>
</tr>
<tr>
<td>P</td>
<td>0.189</td>
<td>0.044b</td>
<td>0.003b</td>
</tr>
<tr>
<td>Fat</td>
<td>24.76 ±</td>
<td>32.00 ± 2.06</td>
<td>7.24</td>
</tr>
<tr>
<td></td>
<td>19.90 ± 2.57</td>
<td>34.10 ± 2.41</td>
<td>14.2</td>
</tr>
<tr>
<td></td>
<td>21.65 ± 5.21</td>
<td>37.20 ± 3.84</td>
<td>15.55</td>
</tr>
<tr>
<td>Pkw</td>
<td>0.075</td>
<td>0.000b</td>
<td>0.001b</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>140.45 ± 20.31</td>
<td>186.22 ± 15.87</td>
<td>45.76</td>
</tr>
<tr>
<td></td>
<td>147.31 ± 21.71</td>
<td>193.93 ± 14.74</td>
<td>46.61</td>
</tr>
<tr>
<td></td>
<td>124.80 ± 20.47</td>
<td>189.26 ± 17.21</td>
<td>64.46</td>
</tr>
<tr>
<td>P</td>
<td>0.012b</td>
<td>0.406</td>
<td>0.032b</td>
</tr>
</tbody>
</table>

Ket: (*) paired t-test | p: one-way anova test
(**): Wilcoxon test | p*: kuskal wallis test
b: significant (p<0.05) | Δ: difference in value before and after intervention

Table 2 presents the difference in the average value of food intake (energy, protein, fat and carbohydrate) before and after the intervention of giving cookies of purple sweet potato and tempeh flour. It shows a significant increase in energy intake in the three study groups (control, KP1 and KP2). The results of the paired t-test showed a statistically significant difference in energy intake before and after the intervention (p<0.05). The highest increase in energy intake occurred in group 2 treatment with an average difference in energy intake of 424.80 cal, while the increase in energy intake in the control group and treatment group 1 were 261.2 cal and 348.78 cal respectively. The difference in average energy intake between study groups also showed significant differences (p=0.000).

According to the 2019 nutritional adequacy figures (RDA), the average energy intake requirement for toddlers aged 1-3 years is 1350 kcal and ages 4-6 years is 1400 kcal (21). Giving 100 g of cookies of purple sweet potato and tempeh flour for 30 days in the study This increases energy intake in child wasting. The average energy intake before the intervention in each group was less than 80%. The same study showed a significant effect on energy intake by giving purple sweet potato biscuits to toddlers aged 12-36 months who were experiencing malnutrition in the working area of the Somba Opu Health Center (14).

The average protein intake before the intervention was almost the same between groups but it increased slightly in the KP2 group after the intervention. The results showed that giving purple sweet
potato cookies and tempeh flour increased protein intake before and after the intervention in each study group and was statistically significant. The highest increase in protein intake occurred in the KP2 group at 10.6 g, while the increase in protein intake in the control and KP1 groups was 5.3 g and 6.52 g. The difference in average protein intake between study groups showed a significant difference.

The increase in protein intake in the KP2 group occurred because the cookies given contained a higher protein nutritional value than the control and KP1 groups. The higher the tempeh flour formulation added, the higher the protein content (22). Based on proximate test carried out on cookies of purple sweet potato and tempeh flour, the nutritional value of cookie’s formula on KP2 (80% purple sweet potato flour + 20% tempeh flour) had a protein content of 22.31%, while the cookies on control and KP1 were 8.06% and 14.43%, respectively. A similar study showed an increase in protein intake in the group given 100 g of tempeh biscuits for 4 weeks in toddlers aged 12-59 months with poor nutritional status (23). Research by Herawati et al. (2020) in the form of giving eel biscuits showed a significant effect on increasing intake of energy, protein, fat, carbohydrates, zinc and vitamin A in children who are sick. This is because the nutritional content of eel biscuits is higher than standard RS snacks. Eel biscuit/100g is 516.79 kcal of energy, 11.4 g of protein, 27.55% fat and 55.67 g of carbohydrates. The results of this study, eel biscuits increase the intake of protein, fat and zinc in hospitalized patients (24).

The mean fat intake before the intervention in each group ranged from 19.9-24.6 g. There was an increase in fat intake in all study groups and showed a statistically significant difference between before and after the intervention (p<0.05). The highest increase in fat intake occurred in the KP2 group from 21.65 g to 37.2 g. Giving cookies of purple sweet potato and tempeh flour showed a significant effect on the difference in average fat intake between study groups (p=0.000).

The increase in fat intake after giving cookies of purple sweet potato and tempeh flour occurs because the nutritional content of fat in the cookies was quite high. The nutritional content of fat in cookies comes from the ingredients used to make cookies. Tempe flour is not only high in protein but also high in fat. Tempe flour in 100 g dry weight contains fat as much as 25.02% (15). In addition, sources of fat are also obtained from other cookie ingredients such as eggs and margarine.

The average carbohydrate intake between study groups was similar at the start and end of the study. However, carbohydrate intake in the KP2 group was slightly less than the other two groups. However, after the intervention each group had almost the same carbohydrate intake. The highest increase in carbohydrate intake was in the KP2 group of 64.46 g. Whereas in the control group and KP1 the increase in carbohydrate intake was not much different, namely 45.76 g and 46.61 g. The results of the paired t-test on carbohydrate intake showed a statistically significant difference (p<0.05).

Giving cookies of purple sweet potato and tempeh flour for 30 days as nutrient-dense additional food shows an increase in food intake (energy, protein, fat and carbohydrate) in wasting toddlers.
Additional food or snacks play an important role in providing additional contributions to meet nutritional adequacy, especially energy and protein (25). Cookies are given as much as 100 g for 30 days. The results of the proximate test showed that the nutritional value of the cookies included 406.5-417 cal of energy, 8-22.3% protein, 4-7.6% fat and 63.8-82.4% carbohydrate.

The increase of food intake in this study was not only from the cookies of purple sweet potato and tempeh flour consumed. But also sourced from the main food and snacks or outside snacks that are purchased. Septiani explained that children’s consumption levels increased after being given 100 g/day of corn, green bean and tempeh cookies for 14 days. The food intake that has not reached normal is due to daily consumption not meeting children's needs due to some being lazy to eat and prefer to consume snacks. The appetite of children aged 1-3 years decreases because generally at this age children have difficulty eating or only like snack foods that are classified as empty of calories and nutrition, beliefs, and food selection. Ignorance of the mother can lead to food selection errors, especially for children under five and it can cause nutrients quality and quantity are not sufficient to meet the body's needs (26).

**CONCLUSION AND SUGGESTIONS**

Giving cookies of purple sweet potato and tempeh flour increases food intake (energy, protein, fat and carbohydrate) in child wasting. Statistically, there were significant differences in energy, protein, fat, and carbohydrate intake before and after giving cookies of purple sweet potato and tempeh flour. And there were also significant differences in energy, protein, fat, and carbohydrate intake between treatment groups.

Further research is suggested to be able to provide new innovative interventions in food processing, especially purple sweet potato, and tempeh flour. It is necessary to provide nutritional assistance and education to families who have under-fives with undernourished status to help achieve good nutritional status.

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