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# Improving Students' Knowledge of Breakfast Energy and Protein Consumption through E-Booklet Media

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## Abstract
Malnutrition remains an important health issue in Indonesia, especially among undernourished children. The current nutrition intervention program, Family Nutrition Awareness, emphasizes the importance of breakfast in combating malnutrition. The purpose of this study was to determine the differences in maternal knowledge, energy, and protein consumption of students before and after counseling on breakfast using e-booklet media. This study used a pre-experimental type with a one-group pretest-posttest design. Maternal knowledge was assessed through a questionnaire, and energy and protein consumption was measured using a food recall form. The statistical analysis used was the paired T-test for normally distributed data and the Wilcoxon test for non-normally distributed data. The results showed significant differences in maternal knowledge and children's energy and protein intake before and after the e-booklet-based educational intervention (p=0.002 and p=0.000). This shows the effectiveness of e-booklets as a nutrition education media, which has the potential to positively influence maternal knowledge and improve children's breakfast habits. In conclusion, there is a difference in nutritional knowledge, energy, and protein consumption before and after counseling on breakfast using e-booklets. This study emphasizes the importance of innovative and accessible educational tools in combating malnutrition in Indonesia.

**Keywords:** Nutrition Counseling, E-Booklet Media, Maternal Knowledge, Energy, Protein Consumption of Students, Breakfast.

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## 1. INTRODUCTION

The multiple nutrition problems experienced by developing countries, including Indonesia, are undernutrition and overnutrition. The impact of malnutrition on children is not optimal growth, causing a lack of energy for activities, reduced immunity and antibodies in the body so that children are susceptible to disease, malnutrition can affect brain growth because brain cells cannot develop, and children who experience malnutrition can have behavior that is not calm (Aprilidia et al., 2021; Simbolon et al., 2023). In addition, other impacts caused by malnutrition according to Gizella et al, impaired brain development and intelligence, impaired physical growth and body metabolism, as well as decreased cognitive abilities and learning achievement (Gizella et al., 2016).

In school-age children (6-12 years) breakfast is very important to carry out activities. Breakfast is useful for providing energy, if school children do not eat breakfast, they will experience a decrease in blood sugar levels which is a source of energy to help the brain work, then the body will break down glycogen stores to maintain normal sugar levels (Anggoro et al., 2021). According to Verdiana and Muniroh, children who eat breakfast every day have more energy than children who do not eat breakfast. Children who do not eat breakfast usually show weakness, dizziness or even fainting (Verdiana & Muniroh, 2018). Breakfast or morning meal must also fulfill balanced nutrition. Based on research conducted by Dewi et al, the results showed that the better the breakfast pattern, the better the concentration in students (Dewi et al., 2020). Children's breakfast habits are influenced by several factors, namely environmental factors, family background, diversity of choices and access to locations to get food(Ludin dan Lim, 2016). Based on research conducted by Gemily et al, the factors that influence breakfast habits are gender, mother's education, mother's occupation, breakfast habits in the family, and family encouragement(Gemily et al., 2017).

Maternal knowledge of food and nutrition can affect the nutritional status of children, and the level of maternal knowledge about nutrition also plays a role in the magnitude of nutritional problems. Maternal knowledge can be improved by providing nutrition education through counseling. In order to implement the nutrition counseling process to achieve maximum results, tools or media are needed that can support the delivery of information. The right media and delivery methods will support the process of implementing nutrition counseling (Bertalina, 2013). One of these media is e-booklet media. E-booklets are classified as electronic learning media that can be used anywhere and are easy to carry anywhere(Utami et al., 2019).

Children and adolescents are a vulnerable group to health problems such as overweight, obesity, eating disorders and social media addiction. Therefore, promotional media can be used to increase their knowledge about the importance of a healthy diet and lifestyle, as well as the negative impact of excessive social media. One important health topic to promote is the importance of breakfast for children and adolescents. Breakfast is the first meal consumed after fasting overnight, and can provide energy, nutrition, and cognitive benefits to those who consume it. However, many children and adolescents skip breakfast for various reasons, such as lack of time, appetite, or access to healthy food. This can have a negative impact on their physical and mental health, as well as their academic and social performance(Hoyland et al., 2009; Nicklas et al., 2004).

To address this issue, promotional media can be used to increase children's and adolescents' awareness and knowledge of the benefits of breakfast, as well as provide suggestions and examples of healthy and easy-to-prepare breakfast foods. Some of the promotional media used are Posters, brochures, or pamphlets that feature attractive and easy-to-understand images and messages about breakfast, such as "Breakfast is important", "Breakfast is fun", or "Breakfast is healthy". These print media can be distributed in schools, homes, or other public places frequented by children and adolescents. Videos, podcasts or animations featuring stories, testimonials or scientific facts about breakfast, such as "Breakfast makes you smarter", "Breakfast makes you happier" or "Breakfast makes you healthier"(Keski-

Rahkonen et al., 2003; Sincovich et al., 2022). These electronic media can be shown on television, radio, internet, or social media that are popular among children and teenagers..

Effective promotional media should take into account the characteristics, needs, and preferences of the target audience, and use language, style, and design that are appropriate to them. In addition, promotional media should be supported by credible and reliable sources, and include citations and references that are in line with academic standards. E-booklet media is a media to convey material in a concise manner and given attractive images, and specially designed so as to be able to produce interesting learning media. E-booklet is a combination of print and computer media, so that it is able to present information in a structured and interesting way and has a high interactive level.(Rahmiyati et al., 2019). According to research conducted by Rahmiyati et al, it shows that knowledge in the mother's group before and after being given treatment in the form of e-booklet media has increased with an average score before 84.82, increasing to 97.94.(Rahmiyati et al., 2019). Further research is needed to complement existing research, especially regarding "Differences in Maternal Knowledge, Energy and Protein Consumption of Breakfast Students Before and After Counseling About Breakfast with E-Booklet Media.

## 2. RESEARCH METHOD

This study employs a quantitative research approach with a pre-experimental design, specifically utilizing the One Group Pretest Posttest design. The research is conducted at Public Elementary School III Tegalharjo, Glenmore Subdistrict, Banyuwangi Regency. The study is carried out online through a dedicated WhatsApp Group. The population under investigation comprises mothers of students at Public Elementary School III Tegalharjo, Glenmore Subdistrict, Banyuwangi Regency, totaling 160 individuals. The sample consists of 24 respondents selected based on inclusion criteria.

The sampling method employed is Non-Probability Random Sampling, using purposive sampling techniques. In this approach, the sample includes mothers with children actively enrolled in Public Elementary School III Tegalharjo who willingly agree to participate and complete the provided questionnaire.

Data analysis is performed to discern the differences in knowledge and nutritional consumption among elementary school students in the treatment group. Significance is determined at a p-value < 0.05. Data normality is assessed using the Kolmogorov-Smirnov test, where results exceeding a 5% alpha level ($p > 0.05$) indicate normal distribution. For normally distributed data, the parametric paired t-test is applied, while non-normally distributed data are subjected to the non-parametric Wilcoxon signed-rank test.

## 3. RESULTS AND DISCUSSION

From Table 1, it can be seen that the majority of respondents were between 26-35 years old, as many as 13 people (54.16%), while the rest were 36-45 years old as many as 11 people (45.83%). In terms of the mother's education level, most of the respondents have elementary school education background, as many as 13 people (54.16%), followed by high school education background as many as 6 people (25.00%), and junior high school education as many as 5 people (20.83%). The majority of respondents' mothers worked as self-employed, namely 14 people (58.33%), and the majority of respondents' parents' income was more than ≥2,000,000.00, namely 14 people (58.33%). In addition, there was a striking difference in the age of the students, where 13 students (54.16%) were 9 years old, while 11 students (45.83%) were 8 years old.

**Table 1.** Characteristics of respondent

| Distribution of respondents | Total of Respondents | |
|---|---|---|
| | Total (n) | Percentage (%) |
| Age | | |
| 26-35 | 13 | 54.16 |
| 36-45 | 11 | 45.83 |
| Total | 24 | 100.0 |
| Mathers of Education level | | |
| Elementary School | 13 | 54.16 |
| Junior High School | 5 | 20.83 |
| Senior High School | 6 | 25.00 |
| Total | 24 | 100.0 |
| Mathers of Occupation | | |
| Farmer | 2 | 8.33 |
| Self-employed | 14 | 58.33 |
| Private Employee | 1 | 4.16 |
| Laborer | 1 | 4.16 |
| Not Working | 6 | 25.00 |
| Total | 24 | 100.0 |
| Parent's income | | |
| ≥2,000,000.00 | 14 | 58.33 |
| <2,000,000.00 | 10 | 41.66 |
| Total | 24 | 100.0 |
| Age of Student | | |
| 8 years old | 11 | 45.83 |
| 9 years old | 13 | 54.16 |
| Total | 24 | 100.0 |
| Gender | | |
| Male | 14 | 46.66 |
| Female | 16 | 53.33 |
| Gender | 30 | 100.0 |
| Grade Level | | |
| II | 11 | 45.83 |
| III | 13 | 54.16 |
| Total | 24 | 100.0 |

**Table 2.** Average Mother's Knowledge Score based on Questionnaire Materials.

| Number of Instrument Material | | Number of Correct Answers | | | | % Improvement |
|---|---|---|---|---|---|---|
| | | Pre-test | | Post-test | | |
| | | N | % | N | % | |
| 1 | Definition of Breakfast | 17 | 70.8 | 22 | 91.6 | 20.8 |
| 2 | Protein source foods for breakfast | 13 | 54.1 | 16 | 66.6 | 12.5 |
| 3 | Examples of breakfast menus that comply with balanced nutrition guidelines | 11 | 45.8 | 17 | 70.8 | 25.0 |
| 4 | Meal portions in one day | 17 | 70.8 | 20 | 83.3 | 12.5 |
| 5 | Vegetable protein food sources | 14 | 58.3 | 19 | 79.1 | 20.8 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 6 | Food ingredients that are a source of energy | 21 | 87.5 | 23 | 95.8 | 8.3 |
| 7 | Good breakfast time | 19 | 79.1 | 22 | 91.6 | 12.5 |
| 8 | Benefits of breakfast | 17 | 70.8 | 20 | 83.3 | 12.5 |
| 9 | One serving of fish for children | 11 | 45.8 | 13 | 54.1 | 8.3 |
| 10 | Characteristics of a healthy breakfast according to balanced nutrition guidelines | 19 | 63.3 | 22 | 73.3 | 10.0 |
| 11 | One of the points of balanced nutrition message | 13 | 54.1 | 15 | 62.5 | 8.4 |
| 12 | Food sources of animal protein | 18 | 75.0 | 21 | 87.5 | 12.5 |
| 13 | Protein needs of children aged 7-9 years | 9 | 37.5 | 11 | 45.8 | 8.3 |
| 14 | Energy needs of children aged 7-9 years | 10 | 41.6 | 15 | 62.5 | 20.9 |
| 15 | Programs that have been implemented to overcome nutrition problems | 16 | 66.6 | 21 | 87.5 | 20.9 |
| 16 | Impact of not having breakfast | 13 | 54.1 | 18 | 75.0 | 20.9 |
| 17 | Breakfast proportion of daily needs | 7 | 29.1 | 14 | 58.3 | 29.2 |
| 18 | Vegetables that contain high fiber | 18 | 75.0 | 23 | 95.8 | 20.8 |
| 19 | Balanced nutrition message for children aged 6-9 years | 14 | 58.3 | 18 | 75.0 | 16.7 |
| 20 | Use of oil in 1 serving | 15 | 62.5 | 16 | 66.6 | 4.1 |

According to Table 2, the average knowledge score of mothers based on the questionnaire material before the intervention showed that the respondents answered most of the questions about the need for breakfast proportion of daily needs. Before counseling using e-booklets, out of 24 mothers, only 7 mothers answered correctly (29.1%). However, there was a decrease in the number of respondents who answered incorrectly after the intervention so that there were 10 mothers who answered incorrectly (41.6%) and 14 mothers who answered correctly (58.3%). The increase in knowledge scores before and after the intervention was not only due to the counseling media in the form of e-booklets that were easy to understand, but also because of the counseling methods used, namely lectures and questions and answers.

The highest value of knowledge before the intervention lies in the material of understanding breakfast, food ingredients that become a source of energy, good breakfast time, food sources of animal protein, the impact caused by not having breakfast, the characteristics of a healthy breakfast in accordance with balanced nutrition guidelines, and vegetables that contain high fiber. After the e-booklet-based educational intervention, there was an increase in the number of correct answers starting from questions number 1 to 20. This shows that respondents have understood the breakfast material, balanced nutrition guidelines, and balanced nutrition messages for children aged 6-9 years. However, the lowest score for knowledge was during the pre-test on the proportion of breakfast to daily needs. Out of 24 respondents, only 7 mothers answered correctly. However, based on the final post-test score, there was an increase in the number of respondents who answered correctly to 14 out of 24 respondents. This shows that e-booklet-based educational interventions are effective in increasing mothers' nutritional knowledge and improving children's breakfast habits.In this study, there were several respondents who answered correctly during the pre-test, but answered incorrectly during the post-test. For example, respondents with a high school education background and working as self-employed in question numbers 2,3,7,11,14,15,18,19 answered correctly during the pre-test, but answered incorrectly during the post-test. Meanwhile, respondents with a high school education and not working/housewife at question numbers 9,17,19,20 answered incorrectly during the pre-test, but answered correctly during the post-test

after being given counseling. Respondents with a junior high school education and not working/housewife at question numbers 4, 8, 9, 14, 15, 17, 19 answered incorrectly during the pre-test and still answered incorrectly during the post-test.

At the time of the post-test, most respondents experienced an increase in nutritional knowledge, which was indicated by several questions that were answered correctly by respondents. The questions that were answered most correctly by respondents were numbers 1, 3, 7, 8, 16, and 18, which related to the definition of breakfast, examples of breakfast menus in accordance with balanced nutrition guidelines, good breakfast time, the benefits of breakfast, the impact of not having breakfast, and examples of foods that contain fiber. Meanwhile, the questions that could not be answered correctly by some respondents were numbers 10, 11, 13, 14, 17, and 9, which related to the characteristics of breakfast in accordance with balanced nutrition guidelines, one of the messages of balanced nutrition, nutrient needs based on the 2019 RDA, and the proportion of breakfast.

This study showed that an e-booklet-based educational intervention was effective in increasing mothers' nutrition knowledge and improving children's breakfast habits. However, it should be noted that the results of this study are pre-experimental with a one-group pretest-posttest design, so the results need to be interpreted with caution.

**Table 3. Distribution of Average Knowledge Score of Mothers Before and After Counseling with E-booklet Media.**

| Knowledge Variable | N | Mean | Std. Deviation | Average difference | *p-value** |
|---|---|---|---|---|---|
| Before counseling | 24 | 58.33 | 13.324 | 13.75 | 0.002 |
| After counseling | 24 | 72.08 | 16.999 | | |

**Paired T-test. Significant > 0.05*

Table 3 shows an increase in the average score of knowledge about breakfast before and after counseling using e-booklet media. The increase in the average knowledge score was due to the fact that most respondents had never received counseling about breakfast, so when filling out the questionnaire before the intervention, the respondents answered less precisely. However, after being given counseling, respondents could answer the questionnaire more precisely. The results of the analysis using the Paired T-test showed that the average knowledge of respondents before being given counseling with e-booklet media was 58.33, while after being given counseling with e-booklet media, the average knowledge of respondents increased to 72.08. The statistical test results showed a value of p=0.002 <0.05, which means that at 5% alpha, there is a significant difference in the average score of knowledge about breakfast before and after nutrition counseling with e-booklet media on student mothers.

**Table 4. Average Distribution of Children's Breakfast Energy Consumption Values Before and After Counseling.**

| Variable energy | N | Mean | Std. Deviation | Average difference | *p-value* |
|---|---|---|---|---|---|
| Before counseling | 24 | 147.70 | 38.699 | 50.9 | 0.000 |
| After counseling | 24 | 198.60 | 42.718 | | |

Based on Table 4, it is known that as many as 8 children (33.3%) have consumed breakfast energy in accordance with the proportion of breakfast, namely 15-30% of daily needs before the intervention in the form of counseling with e-booklet media. Meanwhile, after the intervention, there was a change in energy intake in accordance with the proportion of breakfast of 15-30% in 18 children (75%). The average breakfast consumption score before the intervention was 147.70, while after the intervention, the average breakfast consumption

increased to 198.60. Obtaining the value of energy consumption in children was carried out using a food recall questionnaire given during the first week before the intervention (pre-test) and given again in the third week after the intervention (post-test). Based on the results of the analysis using analytical tests, the highest average student energy consumption before being given counseling with e-booklet media was 205.7 kcal, while after being given counseling with e-booklet media, the average student energy consumption increased to 298.3 kcal. Statistical test results showed a value of p=0.000 <0.05, which means that at 5% alpha, there is a significant difference in the average score of children's breakfast consumption before and after nutrition counseling with e-booklet media.

**Table 5. Average Distribution of Children's Breakfast Protein Consumption Value Before and After Counseling.**

| Variable energy | N | Mean | Std. Deviation | Average difference | *p-value* |
|---|---|---|---|---|---|
| Before counseling | 24 | 5.28 | 2.021 | 2.33 | 0.000 |
| After counseling | 24 | 7.61 | 2.539 | | |

Table 5, it is known that children's protein consumption showed that the highest protein consumption before counseling was 10.4 grams, while the protein consumption with the lowest value was 2.36 grams. The average score of breakfast protein consumption before the intervention was 5.28, while after the intervention, the average breakfast protein consumption increased to 7.61. In fulfilling protein consumption at breakfast, only a proportion of about 15-30% of daily needs is needed. In this study, 11 children (45.97%) were in accordance with protein adequacy before the intervention in the form of counseling, while after the intervention, 19 children (79.16%) were in accordance with protein adequacy.

From the results of the analysis using analytical tests, it was obtained that the average breakfast protein consumption of students before being given counseling with e-booklet media was 5.38 grams, while after being given counseling with e-booklet media, the average breakfast protein consumption of students increased to 7.73 grams. Statistical test results showed a value of p=0.000 <0.05, which means that at 5% alpha, there is a significant difference in the average score of children's breakfast protein consumption before and after nutrition counseling with e-booklet media.

According to a study conducted by Fachruddin Perdana and Hardinsyah, the ten types of food most consumed during breakfast are rice, kale, chicken eggs, fish, tempeh, instant noodles, tofu, bread, chicken meat, and biscuits; the five types of drinks most consumed during breakfast are water, tea, milk, coffee, and syrup. Foods consumed with an average of more than 5 g/day during breakfast were rice, kale, chicken eggs, fish, tempeh, and instant noodles. Beverages consumed with an average of more than 15 mL/day during breakfast were water, tea, and milk. Only 10.6% of children's breakfasts met an energy intake of >30% of the RDA(Perdana & Hardinsyah, 2013).

Breakfast can provide energy, nutrition and cognitive benefits for those who consume it regularly. However, many children and adolescents skip breakfast for various reasons, such as lack of time, appetite or awareness. Promotional media can help increase breakfast intake among children and adolescents by providing information on the physical and mental health benefits of breakfast, such as improving metabolism, concentration, memory and mood. Presenting examples of healthy, balanced and attractive breakfasts, such as ready-to-eat cereals and milk, fruits, whole grain bread, eggs or yogurt. Using idol figures, celebrities, or athletes admired by children and adolescents as models or endorsers for breakfast. Creating campaigns or programs that involve schools, families, or communities to encourage and facilitate

breakfast, such as providing free or subsidized breakfast, creating breakfast clubs, or holding breakfast contests.(Mhurchu et al., 2012; Ni Mhurchu et al., 2010; Zhou, 2020).

According to a study involving 234 adolescents aged 11-13 years, a breakfast of ready-to-eat cereal and milk compared with no breakfast had acute positive effects on cognitive function and subjective state(Adolphus et al., 2021). Promotional media can increase breakfast intake among children and adolescents. For example, a UK study found that children who watched advertisements for ready-to-eat cereals and milk were more likely to eat breakfast than those who did not (Adolphus et al., 2021). Another study in the United States found that children exposed to breakfast campaigns featuring cartoon characters were more likely to eat breakfast and choose a healthier breakfast than those who were not exposed (Laska et al., 2015). Several studies have shown that promotional media can reduce problematic social media use among children and adolescents. For example, a study in Ghana found that adolescents who were exposed to messages about the negative impacts of social media were more likely to reduce their social media use than those who were not exposed(Oduro et al., 2023). Another study in South Korea found that adolescents who were exposed to campaigns featuring famous athletes as models to reduce social media use were more likely to reduce social media use than those who were not exposed (Faris et al., 2023).

## 4. CONCLUSION

The intervention using e-booklet media significantly improved mothers' knowledge on nutrition, with the mean score increasing from 58.33 to 72.08. In addition, there was a significant increase in the mean scores of breakfast energy consumption (from 147.70 to 198.60) and protein intake (from 5.28 to 7.61) after counseling guided by the e-booklet. Statistical analysis using paired t-test showed significant differences in both maternal knowledge and students' energy and protein consumption before and after the e-booklet intervention, as evidenced by p values of 0.002, 0.000, and 0.000, respectively ($p<0.05$). This demonstrates the effectiveness of the e-booklet intervention in positively influencing mothers' knowledge and improving students' nutritional habits.As recommendations for future research, exploring long-term effects, investigating diverse demographic groups, and assessing the sustainability of post-intervention behavior change will provide valuable insights into the broader impact of such educational strategies.

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