

The Effectiveness of Counseling and Mung Bean (*Vigna radiata* L) Premix Cookies as Complementary Food to Prevent Stunting

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The Effectiveness of Counseling and Mung Bean (*Vigna radiata L*) Premix Cookies as Complementary Food to Prevent Stunting

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Abstract: Some factors that cause malnutrition in 1-2-year-old children are inadequate provisions of complementary food and early/late weaning. Appropriate complementary feeding from the age of 6 months and breastfeeding until at least the age of 2 years is considered the best feeding pattern for a child's growth and development. Education and the right food choices are needed to fulfill children's nutritional needs in this period to prevent malnutrition which can lead to stunting. This research was conducted on 52 mothers with 1-2 years old children using a quasi-experimental design by counseling and providing premix cookies that were produced using mung bean (*Vigna radiata l*) as an intervention for 3 months. Data were analyzed using the Chi-Square correlation test and T-test. This research objective was to determine the effectiveness of counseling and premix cookies as a complementary food to prevent stunting. The result shows that premix cookies were 82.14% effective in increasing the children's body weight and achieving good nutritional status, therefore preventing the incidence of stunting. This condition was also supported by the improvement of their mothers' knowledge and attitude ($p = 0.011$) in their concern about complementary feeding. Consuming the given premix cookies can fulfill children's nutritional needs: 27.69% protein, 56.59% fat, 24.04% carbohydrates and 56.89% energy. These findings conclude that mung bean premix cookies are considered effective as a complementary food in reducing the incidence of stunting.

Keywords: Stunting, complementary food, weaning, nutrition, mung bean, malnutrition.

1. INTRODUCTION

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The first thousand days of a child's life are critical for physical and intellectual growth and development. Therefore, growth and developmental disorders in children under two years old need to be addressed seriously. The lacking of food intake does not solely cause malnutrition in children aged 1-2 years old. Another factor, such as the inadequate provision of complementary food, can also be the origin of this condition. One of the threatening consequences that malnourished children can experience is failure to thrive or stunting [1-3]. Maternal factors and poor parenting, especially in the behavior and practice of feeding due to mothers' lack of knowledge, can also cause stunting. The state of stunting will cause them to experience difficulties in achieving optimal physical and cognitive development, so they are prone to infection and have low intelligence capabilities [4-9]. This situation explains that stunting will disrupt the physical and mental growth of children, while in the long-term outlook,

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stunted children will grow into unproductive human resources resulting in economic loss for each country [9, 10].

According to the latest data from Indonesian basic health research, there were increasing numbers of malnourished toddlers, from 17.9% in 2010 to 19.6% in 2013. While there were around 37.2% stunted children then, stunted growths have been a huge thing in Indonesia since 2007, with progressively increasing prevalence. Indonesia is in the fifth position for the highest prevalence of stunting in Southeast Asia. The average prevalence of stunted toddlers in Indonesia was 36.4% from 2005-2017. This condition makes stunting a major nutritional problem in Indonesia up until this now [9, 11-13].

The prevalence of stunting for a toddler in Indonesia tends to be static. Based on the results of Basic Health Research in 2018, it is known that the prevalence of stunted toddlers in Indonesia was 36.8%. In 2018, 12.8% of toddlers aged 0-23 months in Indonesia were categorized as very short, while 17.1% of children aged 0-23 months were categorized as short. This figure had increased from the previous year, when the presentation of very short toddlers was 6.9% and 13.2% for short toddlers [9, 11, 14].

Table 1. RDA for 1-3 years old children.

Energy (kcal)	Protein (g)	Fat (g)	Carbohydrate (g)	Fiber (g)	Calcium (mg)	Phosphorus (mg)	Folic Acid (mcg)
1125	26	44	155	16	650	500	160

Children's nutritional status is strongly influenced by food intake. Nutritional intake that has met the needs in accordance with the specified Recommended Dietary Allowances (RDA) indicates that the child is in good nutritional status (Table 1) [15].

Complementary feeding is the act of giving food or drinks containing nutrients to help fulfill nutritional requirements from sources other than breast milk. Complementary feeding is needed because at the age of 6-24 months, breast milk alone is no longer sufficient enough to meet the nutritional requirements where it has known to only provides 1/2 of nutritional needs; it also decreased at the age of 12-24 months where breast milk only provides 1/3 of nutritional needs [16, 17]. In addition, the baby's development is also quite ready to receive other foods besides breast milk at this age, so complementary foods can be initiated when the baby reaches six months old [18]. Favorable gut colonization through continued breastfeeding beyond six months of age may promote tolerance and provide protective factors when complementary feeding is needed [19]. Therefore, appropriate complementary foods from the age of six months old and continuing breastfeeding until two years old are considered the best feeding patterns. Applying this feeding pattern will affect further health status and improve the children's nutritional status to prevent stunting [20-23].

Research by Nasution et al (2019) in the coastal areas of Deli Serdang and Aceh Besar in the form of counseling and complementary food processing by utilizing local food ingredients can significantly increase mothers' knowledge about complementary feeding at the level of 0.001, and 100% of babies were born with good nutritional status. Furthermore, Nasution's research (2019) concluded that the most dominant factor affecting the nutritional status of children aged 6-12 months was the pattern of complementary feeding [24].

Mothers need to understand the concept of complementary feeding so that complementary feeding can be carried out well. That is why education through counseling is needed to give the necessary knowledge related to this matter. Knowledge is also positioned as a predisposing factor for a person's behavior. If the knowledge about complementary foods is good, it is expected that the behavior towards complementary feeding is also good [25-28].

Mung bean (*Vigna radiata* L) is a plant species in the legume family widely known in tropical regions, including Indonesia. This food plant is well known and has been widely cultivated in Indonesia. In Indonesia, the mung bean ranked third as the legume food crop needed in society, after soybeans and peanuts [29].

Carbohydrates are the largest component (more than 55%) of mung bean seeds, which consist of starch, sugar, and fiber. The starch in mung beans has a very high digestibility (99.8%), which makes it a nice food ingredient for infants and toddlers whose digestive systems are not as perfect as adults. The second largest content is a protein (20-25%) with 77% digestibility. Mung beans contain 22.2 grams of protein, 345 Kcal of energy, 1.2 grams of fat, 62.9 grams of carbohydrates and various vitamins and minerals [30-32]. In addition, consuming mung bean has many benefits for health compared to other types of nuts. For example, mung bean has a very low trypsin inhibitor compared to others. Mung bean is also an important source of minerals, including calcium and phosphorus and amino acids such as leucine, arginine, isoleucine, valine, and lysine. These show that mung bean has a good potential to be used as the base ingredient in the making of premix-floured cookies as complementary foods [33, 34].

Premix flour is a kind of flour made to instill so that it becomes convenient, efficient and storable. Premix flour contains a mixture of several different types of flour [35]. In premix flour, all the necessary ingredients such as milk, fat (margarine, shortening, butter, and vegetable oil), eggs and other ingredients are already in it with the right composition. The benefits of using premix flour are: to save time in processing, uniform processed products with the same quality, and save storage space because the ingredients used in production are already contained in the resulting premix flour. Another major advantage of using premix flour is that it can provide flour by selecting various types of locally available food ingredients according to targeted nutritional needs [36-38]. Research result shows that several types of nuts, especially mung beans, can be used as an alternative ingredient as a substitute for wheat flour in making pastries, and the results were excellent [35].

Nasution's research (2020) using the in-depth interview method shows that it is known that most mothers complain about time constraints so that they cannot prepare nutritious complementary foods for their children. Through premix flour, mothers are expected to provide nutritious complementary foods that are also palatable for their children without time-consuming methods [39]. Mung bean and egg flour are chosen as a substitute for wheat flour based on the nutritional content, availability, and affordable price. Mung beans are an excellent source of protein. Mung bean contains relatively low fat and lots of fiber and antioxidants. It also contains various other nutrients such as calcium, iron, zinc, potassium, phosphorus, folate, vitamin A, vitamin B, vitamin C, vitamin E, vitamin K, manganese, selenium, magnesium and carbohydrates [40, 41].

Basically, the provision of bad and inadequate complementary foods occurs due to the lack of knowledge and concern of mothers about complementary feeding. Therefore, efforts through counseling are expected to increase the knowledge and concern of mothers to be able to fulfill the nutritional needs of their children by providing complementary foods in the form of premix cookies [42, 43].

2. DESIGN AND METHODS

This research was a follow-up of quasi-experimental research conducted by Nasution in 2019 using an untreated control group design with pretest and posttest, where the intervention given to the sample were mothers' counseling with booklets and complementary foods provision in the form of cookies based on local ingredients premix flour.

This study was an experimental study with a prospective cohort design conducted from February to June 2020 in Percut Sei Tuan and Cinta Rakyat Village, North Sumatera. The research data consisted of primary data collected directly through measurement, observation and interviews in control and intervention groups. The assessment was done before and after the intervention was given to ensure the effectiveness of premix cookies and to find the most dominant factor that influences children's weight gain so that it becomes important information in determining the right intervention program to overcome stunting. The data collected in this research consisted of:

1. Nutritional status of children through anthropometric measurement.
2. Response to the educational booklets and video presented through the questionnaire.
3. Respondent's characteristics include education, nutritional knowledge and income.

Samples were mothers whose children aged 1-2 years in the designed villages, selected by purposive sampling. The sample size was determined by referring to a sample size formula for the experimental study. Assuming the population size of both the intervention and control group were unknown, then the sample size was calculated using the following formula: $[(Z_{\alpha} + Z_{\beta})S_d : (X_1 - X_2)]^2$, then the required number of samples was 30 from each intervention and control group. Respondents in each control and intervention group were selected purposively to avoid significant differences in their characteristic distribution, such as educational background and occupation, that could lead to bias. Compare means showed that there is no significant characteristic difference in both groups.

The intervention was carried out through outreach by nutritional counseling supported by educational booklets and video for 3 meetings, each for 30 minutes, in a place the respondents had approved. Complementary foods in the form of premix flour cookies for children's consumption, as many as 4 pieces each day for 3 months, were distributed at the beginning of the month.

At the end of the follow-up, a total of 52 participants remained from both groups, consisting of 28 participants from the intervention group and 24 from the control group. A total of 8 participants were marked incomplete because candidates failed to complete all of the requirements for the final examination: 4 participants moved out from the research area; 2 participants were ill; 2 participants refused to complete the assessment due to childcare responsibilities.

The bivariate analysis used in this study was the Chi-Square for qualitative variables and Dependent-T Test for quantitative variables in each control and intervention group. Furthermore, the effectiveness of premix flour cookies was aided by comparing the results of data analysis between the intervention and control group using the Independent-T Test.

3. RESULT

This study was finished in around 5 months with a total follow-up period of 3 months (March to May 2020). Based on a univariate analysis of data obtained from 52 participants, the respondent characteristics of this research shown in (Table 2). The Independent T-test shows no significant difference between the intervention and control group (p-value: 0.230).

Table 2. Respondent characteristic.

Characteristic	Total	
	n	%
Age		
High risk (22>y/o>35)	11	21.2
Low risk (22-35 y/o)	41	78.8
Number of Children		
>2	16	30.8
≤ 2	36	69.2
Education		
Low	5	9.5
Mid	40	77.0
High	7	13.5
Occupation		
Unemployed	42	80.8
Employed	10	19.2
Child's Gender		
Male	28	53.8
Female	24	46.2

After being given counseling, there was a significant change in knowledge in the mean value of maternal knowledge with a p-value of 0.000, while in the control group, there was no significant change with a p-value of 0.290 (Table 3).

Table 3. Changes in nutritional knowledge after the intervention.

Group	Maternal Knowledge		Total	p-value
	Not Good	Good		
Control	16	8	24	0.011
Intervention	8	20	28	

Likewise, changes in mothers' attitudes in the intervention group showed changes in the mean value that increased significantly. This change in attitude can also be seen in the intervention group; there was a significant change in attitude with a p-value of 0.011 compared to the control group (Table 4).

Table 4. Changes in nutritional attitude after the intervention.

Group	Maternal Attitude		Total	p-value
	Not Good	Good		
Control	14	10	24	0.011
Intervention	6	22	28	

The children liked using premix flour in the form of cookies, so the amount given could be spent according to the target. The ingredients used in the manufacture of premix flour are 400 grams of unsalted butter, 225 grams of refined sugar, 24 grams of wheat flour, 15 grams of tapioca flour, 275 grams of mung beans flour, 30 grams of egg-white flour, 15 grams of egg yolk flour and 0.2 grams of sodium bicarbonate. From laboratory analysis, the nutritional composition of the premix cookies can be shown in (Table 5). Consuming every 4 pieces of the premix cookies (every 10 grams) contributes to the daily nutritional intake for children, as described in (Table 6).

Table 5. The nutritional content of premix flour cookies.

Nutritional Content	/100 grams	/piece (20 grams)
Protein (grams)	9	1.8
Fat (grams)	30	6.0
Carbohydrate (grams)	56	9.3
Energy (kcal)	800	160

Provision of premix cookies as a complementary food for children aged 1-2 years shows a positive result (p-value 0.004), which is a significant positive change compared to children who are not given premix cookies (Table 7).

Improvement in the complementary feeding pattern of children of 1-2 years old will positively affect the nutritional status of children. The nutritional status was categorized based on National Center for Health Statistics/World Health

Table 6. Contribution of cookies to meeting the nutritional needs of children.

Nutritional Content	Total	Needs	Percentage (%)
Protein (grams)	7.2	26.0	27.69
Fat (grams)	24.9	44	56.59
Carbohydrate (grams)	37.3	155	24.06
Energy (kcal)	640.0	1125	56.89

Organization (NCHS/WHO) Child Growth Standards. Children with "Good" nutritional status were measured by weight/age and height/age in ≥ -2 deviation standard. Children whose weight/age and height/age were in < -2 deviation standard are categorized as "Not Good."

Table 7. Changes in complementary feeding for children based on categories after the intervention.

Group	Complementary Feeding		Total	p-value
	Not Good	Good		
Control	14	10	24	0.004
Intervention	5	23	28	

The statistical analysis shows that 82.14% of children who consume 4 pieces of premix cookies/day appear to be in good nutritional status (Table 8). It shows that the provision of 40 grams of premix cookies (4 pieces per day) is effective in realizing good nutritional status in children aged 1-2 years. This means there is a chance to obtain a good nutritional status in the intervention group 1.77 times compared to children in the control group (without counseling and premix cookies).

Table 8. Changes in nutritional status of children based on category after the intervention.

Group	Nutritional Status		Total	p-value
	Not Good	Good		
Control	11	13	24	0.039
Intervention	5	23	28	

The data presented previously shows that intervention with education about complementary feeding given to mothers has increased knowledge and build positive attitudes about the importance of preparing good complementary foods that children like. Furthermore, a mother's knowledge and a good attitude about complementary feeding can realize good complementary feeding for children aged 1-2 years. Based on the nutritional composition contained in complementary foods in the form of premix cookies, it is expected to meet the nutritional needs of children, including 27.69% of protein, 56.59% of fat, 24.06% of carbohydrates and 56.89%

of energy, to increase their nutritional status. This condition is certainly a big hope in preventing children from stunting.

4. DISCUSSION

Complementary feeding counseling increased mothers' nutritional knowledge, increasing mothers' awareness of the importance of meeting the nutritional needs of their children. This will trigger participants' willingness to provide complementary food introduced in this research intervention, such as mung bean premix cookies. Using mung beans as a local food ingredient at a relatively low price can effectively improve children's nutritional status, so it is a potential alternative to overcome stunting.

This study's findings are in accordance with previous research by Nasution counseling and complementary food processing demonstration by utilizing local food ingredients can significantly increase mothers' knowledge about complementary feeding. Furthermore, in that research, it was stated that the complementary feeding pattern was the most dominant factor affecting the nutritional status of children aged 6-12 months [24]. Nutritional status improvement of participants' children is most likely achieved by their better understanding of complementary feeding and nutritious food provision. Each piece of mung bean premix cookie is expected to provide 1.8 grams of protein, 6.0 grams of fat, and 9.3 grams of carbohydrates and fulfill 160 kcal of daily energy requirement. This result fits the latest experts' findings on mung beans' nutritional value. In addition to mung beans being an excellent source of carbohydrates, protein and energy, they also contain various vitamins and minerals such as calcium, iron, zinc, potassium, phosphorus, folate, vitamin A, vitamin B, vitamin C, vitamin E, vitamin K, manganese, selenium and magnesium that has not been described specifically in this study [30-32].

The results of this study are expected to be implemented in other areas because of the high interest of mothers in attending facilitated meetings like counseling with others they considered experienced in child care and nutrition. Their interest can be used to convey information to overcome many health problems.

However, the follow-up period of this research is relatively short, so we haven't been able to evaluate the implementation sustainability of complementary feeding according to the intervention given, and also the creation and motivation of mothers to modify mung beans as other forms of complementary food.

CONCLUSION

1. Counseling about complementary feeding to mothers can increase their knowledge, attitudes and concern in providing nutritious complementary foods for their children.
2. Mung bean premix cookies as complementary foods for children aged 1-2 years can effectively help them to achieve good nutritional status and avoid stunting.

Significance for Public Health

Stunting is one major nutritional problem for children that still need a lot of attention. In Indonesia, the prevalence of children with stunted growth has remained high. This research was obtained to prevent child's stunting by providing them with simple, delectable, high-nutrient food in the form of premix cookies made from local ingredients as a complementary food.

Authors' Contribution

Conception and design of the study: Z Nasution; acquisition of data: Z Nasution, I Nurhayati, Mahdiyah; analysis and/or interpretation of data: Z Nasution, Mahdiyah.

Drafting the manuscript: Z Nasution, I Nurhayati, Mahdiyah; revising the manuscript critically for important intellectual content: I Nurhayati, Mahdiyah.

Approval of the version of the manuscript to be published: Z Nasution, I Nurhayati, Mahdiyah;

LIST OF ABBREVIATIONS

g	=	Grams
Kcal	=	Kilocalories
mcg	=	Micrograms
mg	=	Milligrams
n	=	Numbers
NCHS/WHO	=	National Center for Health Statistics/World Health Organization
P-value	=	Probability value
RDA	=	Recommended Dietary Allowances
STROBE	=	Strengthening the Reporting of Observational studies in Epidemiology

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This research has been conducted under the authorization of the Ethics Committee of Health Polytechnic of Ministry of Health Medan, Indonesia (Approval no. 01.287/KEPK/POLTEKKES KEMENKES MEDAN 2020).

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All procedures performed in studies involving human participants were followed in accordance with the ethical standards of the institutional and/or research committee and with the 1975 Declaration of Helsinki, as revised in 2013.

CONSENT FOR PUBLICATION

All of the participants in this research have given their consent for the information gathered to be published anonymously.

STANDARD OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The data support the findings of this study are available within the article.

FUNDING

None.

CONFLICT OF INTEREST

The author(s) declare no conflict of interest, financial or otherwise.

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