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CORRELATION OF PACKAGED FORTIFIED BREAST MILK COMPLEMENTARY FOOD TO SUPPORT GROWTH OF STUNTING CHILDREN IN PANYABUNGAN JAE DISTRICT, MANDAILING NATAL DISTRICT, NORTH SUMATRA PROVINCE

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ABSTRACT

Stunting has a risk of increasing susceptibility to disease. National policy recommends complementary feeding (breast milk complementary food) from 6 months to 24 months of age. The purpose of this research was to find a correlation between the provision of fortified breast milk complementary food and the growth of stunted children in Panyabung Jae District. This intervention research used a quasi-experimental research method with pre- and post-test study designs. The research sample was children aged 6 months–2 years who suffered from stunting and were given fortified breast milk complementary food. Repeated anthropometric examinations and evaluations of dietary compliance were carried out every 2–3 months. Data analysis was performed using the independent T test, Mann Whitney, and McNemar test, with a p value < 0.05 showed significant results. In total, there were 65 children aged 6 months–2 years, and there were 24 stunted children. The majority of stunted children are women (54.2%), with mean age of 14.71 years. The research findings revealed significant differences weight and height at the final examination of stunted children (p< 0.001). The Mann-Whitney test also showed a difference weight and height gain after receiving complementary foods (p<0.001 for each). In addition, the provision of fortified breast milk complementary food resulted in a change in children's status from stunted (41.4%) to normal (1.7% left). McNemar's test also showed a significant difference in status before and after fortified complementary foods intervention for 3 months (p<0.001). There are significant differences weight and height gain in stunted children. There is a significant difference in stunting status before and after packaged fortified breast milk complementary intervention.

1. Introduction

Stunting is a condition where linear growth is hampered as a result of poor nutritional intake or repeated infections that tend to have a greater risk of contracting a disease and causing death.1 However, with development of technology and information systems, for now stunting is identified as a major global health priority with the focus of several high-profile initiatives, such as Scaling Up Nutrition, the Zero Hunger Challenge, and the Nutrition for Growth Summit [1], [2]. Stunting can be identified by accurately measuring height and weight, then plotting these results onto a growth curve. If the results show that the weight age is smaller than the height or length age (height age or length age), then it is called stunting [3].

Globally, childhood stunting declined from 39.7% in 1990 to 26.7% in 2010. This trend is expected to reach 21.8%, or 142 million, in 2020. In 2010, it was estimated that 171 million children (167 million in developing countries) were stunted [4]. Indonesia has the 5th highest incidence rate in the world (3.9%). In 2018, The incidence of stunting in Indonesia was 30.8%; when compared to 2013 (37.2%) and 2010 (35.6%), this figure showed a significant decrease or improvement [5], [6]. The prevalence of stunting in 2018 in North Sumatra was around 35%. According to data from the North Sumatra Provincial Health Office in 2017, there were 13 districts or cities included in the high prevalence category, and one of them was Mandailing Natal (39.7%), especially in Muara Batang Gadis District with 38.7% [7].

WHO global policies, UNICEF and national policies recommend exclusive breastfeeding from birth to 6 months of age, then given complementary food from the age of 6 months and continuing breastfeeding for 2 years. Most children are at risk of malnutrition because only one out of three children aged 6-24 years gets breast milk complementary food according to WHO standards [8]. Poor provision of breast milk complementary food for children aged 6-24 months is one of the factors causing growth problems and child development, both short term and long term [9].

The key aspect of parenting, especially in terms of eating patterns for children under 2 years of age, is the practice of exclusive breastfeeding and breast milk complementary food. Furthermore, feeding parenting is also manifested in feeding behavior through compliance with the amount, type, and frequency of meals. Children who are just entering the transition period between breast milk and family food do not know which food is best or which food can be eaten. Children still need the guidance of a caregiver in choosing food to support optimal growth pace [10].

Based on this background, researchers were interested in assessed the correlation between provision of packaged fortified breast milk complementary food and the growth of stunted children, especially in Panyabungan Jae District and Mandailing Natal District, North Sumatra Province.

2. MATERIAL AND METHODS

This research is interventional, using quasi-experimental research methods with pre- and post-test study designs. In this research, anthropometric measurements were used to conduct a pre-test on the stunted children group. Then the group was given an intervention which is packaged fortified breast milk complementary food. For three months, the group received a post-test in the form of anthropometric measurements and dietary compliance every two weeks.30 The research was conducted in the working area of the Panyabungan Jae District Public Health Center, Mandailing Natal Regency, North Sumatra Province. Panyabungan Jae sub-district consists of 25 sub-districts, and Panyabungan Jae sub-district has 1 health center and 1 posyandu. The research will be conducted from June 2022 to September 2022.

This procsedure is to determine the correlation between the provision of packaged fortified breast milk

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complementary food and growth in stunted children aged 6 months–2 years in Panyabungan Jae District, Mandailing Natal Regency, North Sumatra Province. To assess the accelerated growth of weight and height, we will use the WHO increment curve at 3-month intervals, which is done at the end of the monitoring.

This research employed a sequential sampling technique. The research sample was children aged 6 months–2 years who met the inclusion criteria, namely children stunted based on anthropometric examination results and willing to participate in the study, as evidenced by the consent of their parents, and were not included in the exclusion criteria, namely those suffering chronic diseases such as diabetes, hypertension, kidney failure, and congenital disease, did not follow the specified research procedure, and had an allergy to the packaged fortified breast milk complementary food given.

Weight (using ONEMED Digital Scales and GEA Medical Brand needle scales) and height (using GEA Medical Brand Stature Meter and ONEMED Infant Ruler brand) were measured and recorded in the research questionnaire. The sample group was given packaged fortified breast milk complementary (using SUN brand instant powder for ages 6–24 months, with a variety of flavors available). Every 2 weeks, an evaluation of dietary compliance and measurements of weight and height in both sample groups will be carried out; the data will be recorded and plotted on the WHO growth curve. The WHO weight and length increment curves will be used to assess a child's rate of growth in length and height.

2.1 Data analysis

Data processing was carried out using a computerized statistical processing software system with a 95% confidence interval (CI) and a significance level of p value 0.05. A univariate analysis was used to determine the distribution of sample characteristics. Data with a categorical measurement scale will be presented in terms of frequency and percentage. Data with a numerical measurement scale will be presented in terms of the mean and standard deviation if normally or median distributed, and minimum and maximum values if not normally distributed. The normality test used is Shapiro-Wilk test. The test used to assess whether there is a difference in weight change after intervention is Friedman test. The Wilcoxon test is used to determine the significance of non-parametric differences, while the Paired T-Test is used to determine the significance of parametric differences. The repeated Anova test is used to assess whether there is a difference in height change after the intervention. The test to assess the significance of height differences in stunted children after intervention is Bonferroni test. The Mann-Whitney test is used to assess differences changes in weight and height gain in stunted children after intervention. Meanwhile, the Kruskal-Wallis test was used to assess differences in the Speed of Weight Growth Index and Length Growth Index in Stunted Children after administration of packaged fortified breast milk complementary food. To assess changes in children status who experience stunting before and after administration of package fortified breast milk complementary interventions using the McNemar test.

3. FINDINGS AND DISCUSSIONS

This research found 65 children aged 6 months–2 years, of whom 29 were found to have stunting during first monitoring. However, five children were excluded because further monitoring could not be carried out. Therefore, 24 stunted children from the Panyabungan Jae District Health Center in Mandailing Natal Regency participated in this research.

Table 1. Demographic Characteristics of Research Subjects

Demographic Characteristics	**n=24**
Gender, n (%)	
Male	11 (45,8)

Female	13 (54,2)
Age, months	
Mean (SD)	14,71 (4,88)
Median (Min – Max)	16,5 (7-24)

The results of weight and height examination carried out every two weeks for 3 months.

Table 2. Changes in weight in stunted children at examinations I to VI

Exam	Body Weight, Mean (SD), kg	p	Posthoc EII	EIII	EIV	EV	EVI
EI	7,33 (1,32)	<0,001[a]	<0,001[b]	<0,001[b]	<0,001[b]	<0,001[b]	<0,001[b]
EII	7,83 (1,26)			<0,001[b]	<0,001[b]	<0,001[b]	<0,001[b]
EIII	8,28 (1,31)				<0,001[b]	<0,001[b]	<0,001[b]
EIV	8,78 (1,33)					<0,001[c]	<0,001[c]
EV	9,34 (1,38)						<0,001[c]
EVI	9,84 (1,43)						

[a]Friedman, [b]Wilcoxon, [c]Paired T

The results showed a trend of increasing body weight in the group of stunted children from the initial examination to the last examination. The lowest average body weight was in Examination I, with mean value of 7.33 kg (SD = 1.32 kg). Body weight continued to increase from the next examination until it reached the highest weight at the last examination with mean value 9.84 kg (SD = 1.43 kg). Using the Friedman test, we find that there is a significant mean difference from the initial examination to the final examination.

By using the follow-up test (posthoc) obtained between each observation, a significant difference in mean body weight was shown (p<0.001).

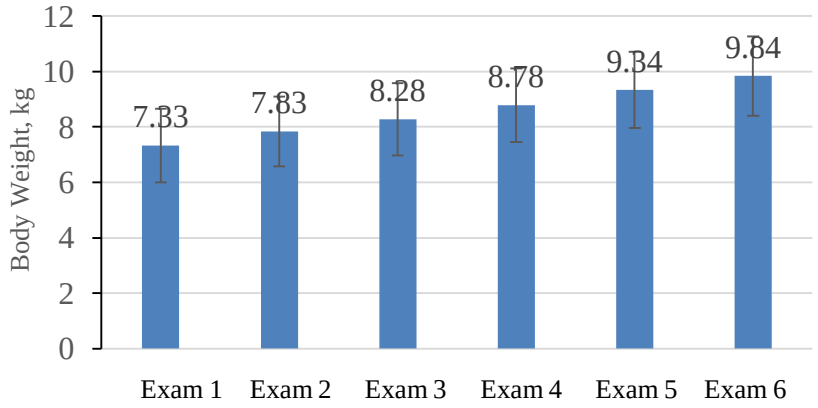

Figure 1. Graph of Error Bar Weight Differences in Stunted Children at Examinations I to VI

Table 3. Height differences in stunted children at Examination I to VI

Exam	Body Height, Mean (SD) cm	p	Posthoc[b] EII	EIII	EIV	EV	EVI
EI	70,31 (5,25)	<0,001[a]	0,016	<0,001	<0,001	<0,001	<0,001
EII	71,52 (4,9)			<0,001	<0,001	<0,001	<0,001
EIII	73,37 (5,12)				<0,001	<0,001	<0,001
EIV	74,95 (4,93)					<0,001	<0,001
EV	76,8 (4,66)						<0,001

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EVI	78,1 (4,73)

[a]Repeated Anova, [b]Bonferroni

The results of this research show that there is a trend toward increasing height in group of stunted children from the initial examination to the last examination. The lowest mean height is found in Examination I, with mean value of 70.31 cm (SD = 5.25 cm). Body height increased from the next examination until it reached the highest height at last examination with mean value of 78.1 cm (SD = 4.73 cm). Using the repeated Anova test, it was shown that there was a significant mean difference from the initial examination to the final examination ($p<0.001$). Using the follow-up test (posthoc), it was found that between each observation there was a significant difference in mean height ($p<0.05$).

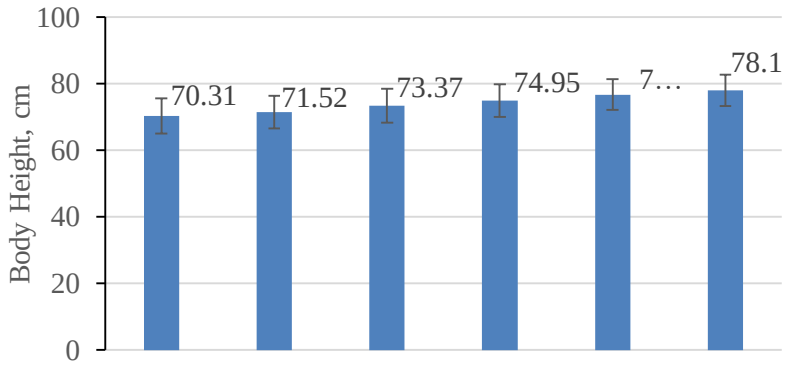

Figure 2. Graph of Error Bars for Height Differences in Stunted Children at Examinations I to VI

3.1 Differences of Weight and Height Gain in Stunted Children

Weight gain in the group of stunted children showed mean value of 2.51 kg (SD = 0.68 kg). The mean height increase in the group of stunted children was 7.79 cm (SD = 1.23 cm).

Table 4. Differences of weight and height gain in stunted children

. Variable	Mean (SD)	Median (Min – Max)
Body Weight Gain, kg	2,51 (0,68)	2,6 (0,2-3,3)
Body Height Gain, cm	7,79 (1,23)	8 (6-11)

*Mann Whitney

3.2 Differences in the Speed of Weight Growth Index and Length Growth Index in Stunted Children after Packaged Fortified Breast Milk Complementary Food Intervention.

Assessment speed of growth index using the WHO increment curve at 3-month intervals based on gender. The speed of growth is compared in the first and last examination.

Table 5. Differences in the speed of weight index and length index in stunted children.

Variable	n (%)
Body Weight index	
$P1^{st}$-3^{rd}	1 (4,2)
$P85^{th} – 95^{th}$	1 (4,2)
$P95^{th} – 97^{th}$	0
$P97^{th} – 99^{th}$	0
$P>99^{th}$	22 (91,7)
Body Height Index	
$P25^{th} – 50^{th}$	0
$P50^{th} – 75^{th}$	0

P75th – 97th	0
P97th – 99th	0
P>99th	24 (100)

In the group of stunted children, the highest body weight growth index was p>99th, as much as 22 people (91.7%), and the highest height growth index was p>99th.

3.3 Differences in the Presence or Absence of Stunting and Changes in Nutritional Status in Stunted Children after Packaged Fortified Breast Milk Complementary Food Intervention

Table 6. Presents the results of changing stunted children to normal children, where before the intervention was carried out, all child subjects were stunted.

	Before Intervention	After Intervention	p
Stunting, n (%)			
Yes	24 (100)	1 (4,2)	<0,001*
No	0	23 (95,8)	

*Mc Nemar

After the package fortification breast milk complementary food intervention, only 1 child (4.2%) was left with stunting. The analysis results using the McNemar test showed that there was a significant difference in the proportion of children based on the presence or absence of stunting between before and after packaged fortified breast milk complementary food intervention (p 0.001).

Table 7. Differences in Nutritional Status Before and After Packaged Fortified Breast Milk Complementary Food Intervention

	Before Intervention	After Intervention	p
Nutritional Status, n (%)			
Severe malnutrition	5 (20,8)	1 (4,2)	0,011*
Malnutrition	7 (29,2)	1 (4,2)	
Adequate Nutrition	12 (50)	22 (91,7)	

*Marginal Homogeneity

Table 7. displays the nutritional status between initial examination (before the intervention) and final examination (after the intervention). At the initial examination, there were only 12 children (50%) with normal nutrition, 5 children (20.8%) with severe malnutrition, and 7 children (29.2%) with malnutrition. After packaged fortified breast milk complementary food intervention for 3 months, the number of children with normal nutrition increased dramatically to 22 cjild (91.7%), with only 1 child per family (4.2%) with poor nutritional status and malnutrition. The results of the analysis using the marginal homogeneity test showed that there were significant differences in nutritional status before and after packaged fortified breast milk complementary food intervention for 3 months (p = 0.011).

Breast milk complementary food after exclusive breastfeeding for 6 months plays an important role in the optimal growth and development of children in the first 1000 days of life. Packaged fortified breast milk complementary food involved in the growth and development of children aged 6–24 months. Therefore, this is one of the main factors in the occurrence of malnutrition in children of that age.11 Children aged 6 to 11 months are more susceptible to obtaining poor-quality dietary intake than children aged 12 to 23 months [12]. Growth disturbances can occur from birth and may continue up to 18 months of age. Failure to thrive can be caused by inadequate intake of macronutrients and micronutrients, which are often found during complementary feeding. The high rate of failure to thrive during the period of complementary feeding may

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be related to inadequate quality, quantity, and frequency of feeding [13]. The transition period from exclusive breastfeeding to complementary breastfeeding is a challenge for many mothers and is often associated with delays in food introduction and inadequate quantity and quality of food for child growth and development [12].

People in low and middle-income countries frequently have insufficient complementary feeding conditions. A study in Mongolia found that most children eat sufficiently frequently, but only half get minimal food diversity (eating from four or more food groups). This shows that the inability of children to obtain adequate nutritional intake is mainly due to inadequate dietary diversity and low consumption of nutrient-rich foods, not inadequate calorie intake [12].

Inadequately of breast milk complementary food may be caused by various factors, such as maternal education and knowledge regarding inadequate child dietary intake, mechanisms in the household space, and cultural practices regarding children's eating habits. This inadequate nutritional condition contributes to the occurrence of growth deficits. Inadequate energy and micronutrient conditions play a major role in the occurrence of stunting, infection, morbidity, and impaired cognitive development in children. Administration of packaged fortified breast milk complementary food is one of the efforts to correct nutritional deficiencies occurences [14].

Effective feeding in the early stages of life has a positive impact on children's growth and development. Providing inadequate nutritional intake can cause growth not in accordance with the growth curve and can result in malnutrition. The provision of complementary foods for breastfeeding has a high risk of causing deficiencies in the early stages of life, especially in the first 1000 days. Fortification is commonly used in food to increase nutritional content during childhood and has the potential to improve child growth and development. In a study in Mexico, micronutrient supplementation for 12 months was reported to improve children's growth and cognitive development. This can be seen based on positive effect on the child's growth curve in the first 24 months of life [13].

Providing fortification is one of the interventions to improve micronutrient malnutrition with poor growth and development in children. Fortification is an additional nutrient in food that meets the need to increase nutrients intake therefore meets the adequacy rate according to the population [13]. In Bangladesh, research by [14] on 5449 children found that feeding children aged 9–18 months did not meet their micronutrient needs according to their age. Out of 16 micronutrients, only 5 components are adequately consumed by >60% of children at 18 months of age. With the addition of fortification, there is a significant micronutrients increase.

The results of this study also showed a significant effect of complementary feeding fortification on children's weight and height. The twenty-four child subjects obtained had almost the same percentage of boys and girls. Six measurements were taken on children with stunting, and a significant increase was obtained in each measurement. At the beginning of the study, the mean body weight was found to be 7.33 (1.32) kg, while at the end of the sixth examination was 9.84 (1.43) kg. This shows that the provision of fortification to stunted children who receive breast milk complementary food plays a significant role in increasing the weight of stunted children. Similar results were also found for the height of the group of stunted children. A significant increase in height was obtained from a mean value of 70.31 (5.25) cm on the first examination to 78.1 (4.73) cm on the sixth examination. For the speed of growth, it was found that in stunted children, the highest speed index for weight growth was p> 99 years, totaling 22 people (91.7%), and the overall height growth index was p> 99 years after the intervention. These findings indicate that

there is a significant effect of providing fortification in stunted children.

In their study on the effect of iron fortification milk on child growth and nutritional status, [15] discovered that administration of fortified milk to children proved effective as additional nutrition when intake from the diet obtained was insufficient. Similar findings were obtained in the study of [16], who discovered improvements in cognitive and physical performance after drinking fortified milk. [13] conducted a systematic review of the effect of fortifying food on the growth and development of children who were receiving complementary food. It was found that there was a positive correlation between food fortification and child growth during the complementary feeding period.

Fortification can significantly boost inadequate nutritional intake. However, fortification does not replace the breast milk complementary food consumed. The success of providing breast milk complementary food fortification in this study was proven by an increase in the number of children with normal height and normal nutritional status. In this research, before the intervention, all child subjects were stunted. After the complementary feeding intervention with package fortification, only 1 child (4.2%) was left with stunting. The results of the analysis using the McNemar test showed that there was a significant difference in the proportion of children based on the presence or absence of stunting between before and after fortified breast milk complementary food intervention ($p<0.001$). Based on nutritional status, at the beginning of the research, 12 children had normal nutrition, 7 were malnourished, and 5 were severely malnourished. Last measurement after the intervention, it was found that the number of children with normal nutrition had increased to 22 people, while there was only 1 child with malnutrition and bad nutrition. These findings highlight the significance of packaged fortified breast milk complementary food in improving the nutritional status of malnourished children. [14] found that fortification can improve linear growth and reduce stunting incidence. Therefore, providing fortification is one of the most important things to do to improve the nutritional status and children growth.

The drawback of this research is that stunted children are enforced based on age because their weight (Weight Age) is smaller than their age, height, or length (Height Age or Length Age), which can only describe the cause of stunting as inadequate nutritional disorders. Stunted children in this research did not undergo various tests to evaluated endocrine, metabolic, and infectious diseases (both laboratory and radiological). In this research, demographic and social data were obtained based on questionnaires filled out by parents, which are subjective in the results of the study, so that research bias can occured. Research on the relationship between packaged fortified breast milk complementary food intervention to children's growth, particularly in stunted children was limited. Therefore, the advantage of this research was provide an overview of correlation between the provision of packaged fortified breast milk complementary food and growth in stunted children. This research found that providing packaged fortified breast milk complementary can reduce stunting rates and improve nutritional status in stunted children.

4. CONCLUSION

There are significant differences weight and height gain in stunted children. There is a significant difference in stunting status before and after packaged fortified breast milk complementary intervention.

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