



RESEARCH PAPER

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Increasing infants' length: the complementary feeding mixed of ripe bananas flour and soybean sprouts

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Abstract

The problem of infants' nutrition in Indonesia led this research to find out such as complementary feeding. This paper reports the used of ripe *awak* bananas, which has been since long time ago used as the baby food, and it's worth developed into complementary feeding. With a quasy- experimental non-equivalent control group design, i.e. giving the complementary feeding for three months, using samples of 75 infants of age 6 to 9 months, whom were divided into three groups. The each group was given complementary feeding: ripe *awak* bananas flour, a mixture ripe *awak* bananas flour and soy sprouts, and the complementary feeding family (control). The results showed that the average increase in length of infants who were given complementary feeding with a mixture ripe *awak* bananas flour and soy sprouts was higher than those of control groups. Additionally, the average increase in length of infants who were given the mixed ripe *awak* bananas and soy sprouts was highest among the other groups. It is concluded that the complementary feeding mixed of ripe *awak* bananas flour and soy sprouts can be used as an alternative to prevention of infants' stunting of under-five. The provision of complementary feeding interventions are formulated using ripe *awak* bananas flour and flour of soy sprouts have influence on the increase in length of infants This study has a significant contribution to help the stunted children in their growth.

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Introduction

Good nutrition, especially in the first years of life gives a lifetime benefits in health, education and productivity. Conversely, malnutrition at an early stage of the child has physical consequences such as stunting and lack of intellect quality for the long term.

Based on the results of the monitoring of the nutritional status by 2015, amounting to 29% of under five years old children in Indonesia were stunting. Although the figure is lower than the result of *Riskesdas* (National Research of Basic Health of Indonesia) in 2013; equal to 37.2%, criteria which figures stunting exceeds 20%, nonetheless Indonesia is still facing a public health problem². Ironically, in North Sumatera it showed the higher numbers than that of national level of Indonesia; found figures of about 43% and according to the 2015 results of the monitoring of the nutritional status, it was found amounted to 33.2%. From the results of the survey of the malnutrition existence study in Medan in 2011, it found the growth of disorders based on index of length for age by 43.8% in children aged 9 to 11 months.

Stunting can be prevented through the provision complementary feeding from ages 6 to 24 months of the first children's lives (Ramakrishnan, Nguyen, and Martorell, 2009). Complementary feeding with the addition of L-glutamine has increased infants' length; it is better than those of the control group who were given complementary feeding without the addition of L-glutamine (Sunaryo, 2004). Furthermore, it is said that greater number of complementary feeding consumed by infants will give 3.8 more influence on the increase in length of the infants.

Thus, improved complementary feeding should be the first priority to address the nutritional needs of infants up to the age of two years, because it plays an important role in preventing death and increasing the growth and development of children in Indonesia. Complementary feeding improvements should ideally have to be aligned with the availability of local food ingredients that are cheap and easy to obtain, as well as in accordance with the customs or culture of the local community.

The practice of giving complementary feeding form of rice porridge and ripe awak bananas is a tradition which is still applicable in most communities, but both rice porridge and ripe awak bananas and such food may have its alloy that has low protein content.

Materials and methods

This research used experimental non-equivalent control group design, i.e. the provision of complementary feeding which formulated and has been tested for nutrient content and acceptability.

Complementary feeding was given for three months with an interval of awarding two days once and the day was done twice each as much as 25 grams. Prior to the intervention, researchers offer an explanation and request the willingness of mothers who have infants ages 6-9 months to become partners for activities that are declared with the signing of in form's concern.

This study used a sample of 75 infants aged 6-9 months, they were divided into three groups: the first group was given complementary feeding ripe awak bananas flour (Formula A), the second group was given complementary feeding mixed of ripe awak bananas flour and flour of soy sprouts 2:1 (Formula B), and the third as a control group that was only based on the complementary feeding family.

The measurement of the length of the infants was administered at the time before and after the intervention of each month by using the length scale with a scale measuring 1 mm. During the research, the different complementary feedings were given through cooperation with the cadres of 'posyandu' (integrated community health service) in the local area for any period of 14 days of consumption accompanied by monitoring of giving complementary feeding to the infants by their mothers. Data obtained were analysed by using Kruskal Wallis test with the help of software statistical tools (SPSS).

Results

The average value of the length of infants at the time before and after the intervention, and the average

increase in the length of the infants in each group are shown in Table 1.

Table 2. Average value of the ratio of increase in length of infants after performed intervention.

The group of infants	Increases in length of infants (cm)		
	Increases in length	Median increases in length	Ratio of increases in length
Formula A	3,99 ± 0,27	4,152 ± 0,238	0,97
Formula B	4,12 ± 0,29	4,180 ± 0,915	0,99
Control	3,90 ± 0,47	4,236 ± 0,196	0,92

In Table 1, it can be seen that the complementary feeding mixed of ripe awak bananas flour with soy sprouts showed the highest increase in length of infants compared to the other two groups. The value of the ratio of increase in length of infants is calculated based on the ratio between the increase in

length of infants measurement results with the median value increase in length standards differentiated according to age and gender. Data processing results of the average value of the ratio of increase in length of infants in each group are shown in Table 2.

Table 3. Average value skor l/a index before and after the intervention.

Group of Infants	Average value Zskor L/A Indeks		
	Before Intervention	After Intervention	The changein Z score after intervention
Formula A	-0,085 ± 1,073	-0,152 ± -0,152	-0,067
Formula B	-0,424 ± 1,660	-0,374 ± 1,580	0,049
Control	-0,061 ± 1,502	-0,151 ± 1,401	-0,090

In Table 2, it can be seen that the highest average value of the ratio of length increase in the group of infants who were given complementary feeding Formula B, i.e. amounting to 0.99, subsequently followed by the group of infants who were given complementary feeding Formula A that is of 0.97.

Based on the results of normality and homogeneity test data ratio of increase in length of infants, it was assumed that the data were normally distributed ($P > 0.05$), and the variance was not homogeneous ($P < 0.05$).

Table 4. Results of the kruskal wallis test and mann whitney against the change in value of zskor l/a index after intervention.

Group of infants	The change in value of Zscore after intervention	Kruskal Wallis Test (P)	Mann Whitney Test (P)
Formula A	-0,0672		
Formula B	0,0492	0,010	-
Control	-0,0896		
Formula A vs Control			0,290
Formula B vs Control			0,028
Formula A vs Formula B			0,030

From the results of the analysis using the Kruskal Wallis test retrieved value X^2 of 12.050 and P 0.002, which means there was a difference between the

ratios of the increase in length of infants among the third group.

The results of further analysis by Mann Whitney Test against the value of the ratio of increase in length of infants among the group who were given complementary feeding Formula A or Formula B with the control group, obtained respectively P value of 0.008 and 0.003, which means the ratio of the increase in length of infants in the group given complementary feeding Formula A or Formula B differ significantly with the ratio of increase in length of infants in control group ($P < 0.05$).

The results of the analysis of the test of the difference between the ratio of the increase in length of infants of the group who were given complementary feeding Formula A with a given complementary feeding Formula B, the P value obtained of 0.099, which mean there was no difference in the ratio of the increase in length of infants in both groups.

Data average of Z score L/A index of infants before and after the interventions provision of complementary feeding is shown in Table 3. The average value of Zscore L/A index the third group of infants prior to intervention are at a position - 0.42 to -0,06.

Kruskal Wallis test analysis results in Table 4 indicate that the change in the average value of Z score L/A index among the three groups of infants differed significantly. Based on the Mann Whitney test, proving that changes in the value of Z score group infants fed Formula B is significantly different from the change in value of Z score groups of infants fed Formula A and the control groups ($P < 0,05$).

Discussion

The discussion of this paper exposes the results of the treatments with the complementary feeding. The results showed the average value of the increase in length on the infant groups intervened with the awarding of the complementary feeding mixed of ripe awak banana flour and soy sprouts (4.12 cm) higher than that of group that intervened with the complementary feeding mixed of ripe awak bananas flour without soy sprouts (3.99 cm) or control group (3.90 cm).

The length of infants in the group given the complementary feeding mixed of ripe awak bananas flour and soy sprouts appear to be lower than the other two groups at the time prior to the intervention. Likewise, if it is seen from the average value of the ratio of the increase in length of infants after the intervention, it turns on a group of infants who were given the complementary feeding formula B was taller than the other two groups namely of 0.99, in the group given complementary feeding without soy sprouts 0.97 and 0.92 in the control group.

Based on this, it can be argued that the complementary feeding mixed of ripe awak bananas flour and soy sprouts has a significant influence on the increase in length of infants. The complementary feeding mixed of ripe awak bananas flour without soy sprouts and complementary feeding family showed a positive value. Compare with the previous studies, the research of Riviera and Ruel (1997) in Guatemala showed impaired toddler growth of 19-34% in the first 0-3 months of life, 12-19% at age 3-6 months, 12-25% at age 6-9 months and 40-80% at the age of 9-12 months. Research results of Prahesti (2001) in Semarang, found a growth disorder occurring around the age of 6-12 months. However, the results of this analysis demonstrated through Kruskal Wallis statistical tests that showed significant differences among the three groups of infants ($P < 0.05$), and showed that giving complementary feeding mixed of ripe awak bananas flour and soy sprouts give better effect (value $P 0.003$) than that of the complementary feeding mixed of ripe awak bananas flour without soy sprouts ($P 0.008$) against the ratio increase in length of infants, the highest average value of the ratio of length increase in the group of infants who were given complementary feeding Formula B, i.e. amounting to 0.99, subsequently followed by the group of infants who were given complementary feeding Formula A that is of 0.97.

If it is paid attentionally, the results of the analysis on the growth of infants based on the value of the Z-score index L/A. It would be postulated that the average value of Z score on the group of infants who were given complementary feeding mixed of ripe

awak bananas flour and soy sprouts experienced a rise of -0.42 to -0.37 or going on a hike of 0.05. In contrast, the group of infants who were given complementary feeding mixed of ripe awak bananas without soy flour or in the control group, even though the infant's length increased showed the value of Z score decreased respectively by 0.07 (from -0.09 into -0.15) and 0.09 (from -0.06 into -0.15).

Based on the above calculations, it can be explained that the value of the Z-score index length/age on the group of infants who were given the complementary feeding ripe awak bananas flour mix with soy sprouts have a tendency to approach zero point while the Z score index length/age on the group of infants who were given complementary feeding ripe awak bananas flour without soy sprouts or infants control group have a tendency away from zero point that would eventually lead to stunting.

The results of this study in accordance with the concept that has been said by Dewey and Adu-Afarwuah (2008) that the quality of the complementary feeding may modify the relationship between the quantity of complementary feeding and linear growth. In this case can be expressed that modification of complementary feeding mixed of ripe awak bananas flour with soy sprouts can improve the quality of complementary feeding.

The quality of the complementary feeding may modify the relationship between the quantity of complementary feeding and linear growth (Ramakrishnan, Nguyen, and Martorell. 2009). In this case it states that the modification of complementary feeding mixed of ripe awak bananas flour with soy sprouts would improve the quality of complementary feeding.

Probing from the aspect of nutrient composition, the complementary feeding mixed of ripe awak bananas flour with soy sprouts contains nutrients (Formula A) better than that of the complementary feeding mixed of ripe banana flour without soy sprouts (Formula B), especially the composition of proteins and amino acids.

Additionally, based on acceptance test against infants do before interventions, by observing the infants' responses when fed the complementary feeding show good acceptance of responses. Thus in turn it affects the quantity of nutrients consumed by infants.

In addition, the ripe awak bananas flour and flour of soy sprouts each contains inulin, fructooligo saccharides (FOS) and galactooligo saccharides (GOS) which can act as a prebiotic. Components prebiotics contained in the complementary feeding increase the absorption of some minerals in baby's digestive tract and may also serve to avoid the babies from disorders of infectious diseases, especially diseases of digestive disorders that often occur in infancy, so it will simultaneously affect the infants' growth is mainly the length of baby.

Age babies between 6 to 12 months is still in a period of growth which is exceptionally fast, so in case of insufficient intake of nutrients— specially nutrients needed to support the growth process such as protein that contains a number of essential amino acids— during this period will quickly affect the infant's growth. In society at large, giving the complementary feeding is still based on the experience of the community tradition from the past such as the provision of rice porridge, bananas ('awak' bananas and 'barangan' bananas or 'chicken' bananas), a mixture of rice mushy with awak bananas, rice steamed with or without a mixture of vegetables or side dishes (Formula C), and complementary feeding manufacturer. It often happens, when babies are given the complementary feeding, the frequency of breastfeeding is reduced. Because the mothers' understanding in society about the solid foods can make the babies sleep in peace, not fast hungry and rarely fussy, so that the mothers have much more time do other household routine works.

As a matter of fact a lot of going on, babies who were given complementary feeding family physically have relatively normal body weight even tend to be fat at first, but it is not always the case with the length of infants which a linear growth. It would be possible, when monitoring the growth of the baby in growth

monitoring is done to weight gain alone without being accompanied by monitoring the increase in body length. Such conditions will remain a factor causing the high prevalence of stunting in children under five in Indonesia. Nutritional deficiencies during the period of 1000 days of life of children can reduce the ability to fight and survive the disease can interfere with their social and mental capacities (UNICEF, 2009). Stunting associated with developmental problems and is often is irreversible. A child who is stunted is likely to experience poor health and poor performance throughout its life. The findings are then used as the basis of many discussions of strategy overcoming the problem of nutrition, health and economies around the world, especially for poor countries and emerging (UNICEF-WFP-WHO, 2010).

The influence of the giving of the complementary feeding towards the growth and development of the brain and cognitive function is believed to be a positive impact. Energy-rich foods i.e. granting of 682 KJ and 11.5 g protein during prenatal and 24 months postnatal shows a test score, numerical knowledge, reading and language skills taller than those who received low-energy food that is of 246 KJ (Pollitt *et al*, 1993). The administration of L-glutamine in the formulation of complementary feeding in infants 6 months for 3 months affect the profile of immunity and the length of infants is better than infants given complementary feeding formula without L-glutamine and complementary feeding control (Sunaryo, 2004).

Referring to the results of these studies, which describes the role of L-glutamine to the immune profile and the length of infants, it can be argued that the provision of complementary feeding interventions are formulated using ripe awak bananas flour and flour of soy sprouts have influence on the increase in length of infants. Because of the results of the analysis of amino acid composition that has been done on previous research showing the content of L-glutamine is the most (2.65%) among the amino acid composition of the other, while the complementary feeding ripe awak bananas flour amounting to 1.32%. A longitudinal study about the growth of babies who were given complementary feeding manufacturer

(blended food) and non-manufacturer (local food) in the Gowa conducted by the complementary feeding manufacturer which was given to poor families can fix the increase in weight and length (Baso, 2007).

Conclusion

This research gives some conclusions as followings:

The increase in length of infants in the experimental group, who were given the complementary feeding mixed of ripe awak bananas flour with soy sprouts (Formula A) for three months was better than that of control one (the increase in the length of the infants was given complementary feeding mixed of ripe awak bananas flour without soy sprouts or the complementary feeding family; Formula C).

The increase in length of infants in experimental group is indicated in the value of the Z-score index length for age. This finding showed the Formula A prevents the growth disorders in the form of stunting in infancy. The modification of complementary feeding mixed of ripe awak bananas flour with soy sprouts improved the quality of complementary feeding.

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