Paediatrica Indonesiana

p-ISSN 0030-9311; e-ISSN 2338-476X; Vol.57, No.5(2017). p. 246-51; doi: http://dx.doi.org/10.14238/pi57.5.2017.246-51

Original Article

Effect of community-based food supplementation on improving growth of underweight children under five years of age in West Nusa Tenggara

Aman B. Pulungan, Dini A. Mirasanti

Abstract

Background The prevalence of underweight children in West Nusa Tenggara is as high as 30%. This region had the third largest number of stunted children in the country. The local government has attempted to tackle this problem by providing supplementary food to underweight children.

Objective To assess the success of the community-based food supplementation program on improving children's growth in West Nusa Tenggara.

Methods We conducted a prospective cohort study for 10 months in Paruga District Primary Health Care Unit, Bima, West Nusa Tenggara, in year 2012. Children were given supplementary food according to the Ministry of Health's guidelines, consisting of formula milk, high calorie biscuits, and a 60-day supply of eggs, estimated to be sufficient to normalize their weights, for their age and sex. A child's weight and height were measured every 3 months and the results plotted on WHO growth charts for weight-for-age, height-for-age, and weight-for-height (nutritional status). Z-score <-3 SD was classified as severely underweight, severely stunted, or severely wasted, respectively; Z-score between -2 and -3 SD was classified as underweight, stunted, or wasted, respectively; and Z–score >-2 SD was classified as normal for all three categories.

Results Twenty-five children under five years of age participated in this study. Subjects' median age was 29 months. None of the subjects had normal weight-for-age Z-score at the beginning of the study. Eighty-four percent (21/25) of the subjects were severely underweight. Only 8% (2/25) of the subjects had normal height-for-age Z-score and 88% (22/25) of them were severely stunted. However, 80% (20/25) of subjects had normal nutritional status (weight-for-height). Changes in weight-for-age Z-score varied throughout the study. The highest median score was in the tenth month of follow up (-3.82). The highest median height-for-age score and weight-for-height score were also in the last month of follow up. At the end of the study, only one subject had normal weight-for-age score (4%) and none of the subjects had normal height-for-age scores.

Conclusion The 10-month supplementary food program for under-five children in the Paruga District is not successful in improving body weight and height. **[Paediatr Indones. 2017;57:246-51; doi: http://dx.doi.org/10.14238/pi57.5.2017.246-51]**.

Keywords: *under-five children; stunting; nutritional status; community*

Stunting in children remains a global health problem.[1,2] Globally, about 1 in 4 children under 5 year-old are stunted (26% in 2011). An estimated 80% of the world's 165 million stunted children live in just 14 countries. *The World Health Assembly* has adopted a new target of reducing the number of stunted children under the age of 5 by 40% by 2025.[2] Furthermore, it has also been decided that the new target in the *Sustainable Development Goals* (SDGs) is to end stunting and wasting in

From the Department of Child Health, University of Indonesia Medical School/Dr. Cipto Mangunkusumo Hospital, Jakarta, Indonesia.

Reprint requests to: Aman Bhakti Pulungan, MD, PhD. Department of Child Health, University of Indonesia Medical School/Dr. Cipto Mangunkusumo Hospital, Jl. Diponegoro no. 71, Jakarta, Indonesia 10430. Telp. +62 21 3100669; +62816 196 9394; Fax. +62 21 3907743; Email: amanpulungan@mac.com.

children under-five by 2025.[3] In 2013, Indonesia ranked fifth largest in the number of stunted children and fourth largest for the number of underweight children, in a worldwide comparison.[1] The prevalence of underweight children in West Nusa Tenggara has been as high as 30%, and the province was ranked third highest in the number of stunted children in Indonesia.[4] However, Indonesian studies on stunting and its treatment have been limited in number.

The local government, through its primary health care units, has tried to tackle this nutrition problem. One of the programs they proposed was to give supplementary food to children whose weights were below the red line, according to the health card (*Kartu Menuju Sehat, KMS*). We aimed to evaluate the success of this intervention on improving the nutritional status of children under-five years of age in Bima, West Nusa Tenggara.

Methods

We conducted a prospective cohort study in the Paruga District Primary Health Care (PHC) unit, Bima, West Nusa Tenggara. Our subjects were children under five years of age whose weights were below the red line, according to the KMS curve in January 2012. The children were given supplementary food according to Ministry of Health guidelines, consisting of milk formula, high calorie biscuits, and a 60-day supply of eggs. Parents picked up the supplement from the PHC unit and were instructed to give the supplementary food to their children every day, according to the PHC personnel instructions. These supplementary foods were given until the child's weight was above the red line.

A child's weight and height was measured every 3 months and the results plotted on *WHO* growth charts for weight-for-age, height-for-age, and weight-for-height. Z-score <-3 SD was classified as severely underweight, severely stunted, or severely wasted, respectively; Z-score between -2 and -3 SD was classified as underweight, stunted, or wasted, respectively; and Z–score >-2 SD was classified as normal for all three categories. Z-score was calculated using the *WHO Anthro Application* to acquire a raw score data.

We used a consecutive sampling method to include subjects under-five years whose weights were below the red line on the *KMS* curve in January 2012. However, subjects with poor compliance were excluded from the study. Poor compliance was described as not attending one or more visit for measurement.

Nominal data are presented in numbers of case (percentage), while continuous data are presented in median (minimum-maximum). Changes in Z-score for weight-for-age, height-for-age, and weight-for-height in the first, fourth, seventh, and tenth month were analyzed using Wilcoxon signed rank test. Statistical analysis in this study was performed using *SPSS 19.0 for Windows* software. This study was approved by the Ethics Committee of Dr. Cipto Mangukusumo Hospital, Jakarta, linked to the University of Indonesia, Jakarta.

Results

There were 31 under-five children whose weights were below the red line on the KMS curve in January 2012. Six children were excluded due to poor compliance. A total of 25 children (12 boys and 13 girls) were accepted as study subjects. Subjects' median age was 29 months, ranging from 12 to 54 months. Subjects' initial median length/height in January 2012 was 77 cm, while median weight was 8.8 kg. The baseline characteristics of subjects are summarized in **Table 1**.

In January 2012, subjects' Z-scores for weight-for-age (WAZ) were -4.56 to -2.50, with median -3.35 (**Figure 1**). Three months later in April 2012, the WAZ range was probably not improved (-4.52 to -2.59). At the next three-month follow-up in July 2012, the median WAZ increased to -3.15, and the range was -4.83 to -2.30. In the last follow-up (October 2012), the median WAZ was the highest (-3.14), but unfortunately, there was a bigger discrepancy between the minimum and maximum values (-6.39 to -1.99).

In January 2012, subjects' Z-score for height-for-age (HAZ) were -6.33 to -1.66, with a median of -4.49 (**Figure 2**). The scores were even lower in April 2012 (-6.91 to -2.40), but showed slight improvement in July 2012 (-5.72 to -2.63). At the end of the study in October 2012, the HAZ showed very little improvement (-6.12 to -3.05) compared to the Z-score in January. Friedman test detected a

Table 1. Baseline characteristics of subjects

Characteristics	N=25
Gender, n	
Male	12
Female	13
Median age (range), months	29 (12-54)
Median initial weight (range), kg	8.3 (6.2-10.6)
Median initial length/height (range), cm	77.0 (60.0-84.0)
Weight (weight-for-age), n	
Normal (Z-score > -2SD)	0
Underweight (Z-score between -2 and -3 SD)	4
Severely underweight (Z-score <-3SD)	21
Stature (height-for-age), n	
Normal (Z-score >-2 SD)	2
Stunted (Z-score between -2 and -3 SD)	1
Severely stunted (Z-score <-3 SD)	22
Nutritional status (weight-for-height), n	
Normal (Z-score > -2 SD)	20
Wasted (Z-score between -2 and -3 SD)	4
Severely wasted (Z-score <-3 SD)	1

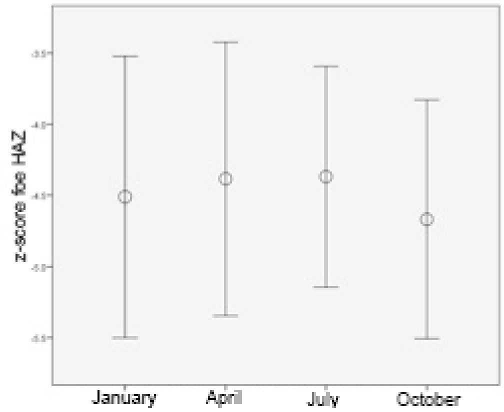

Figure 2. Height-for-age Z-score changes during 10 months of follow-up
Note: Dots upon box and whisker plot represent median value

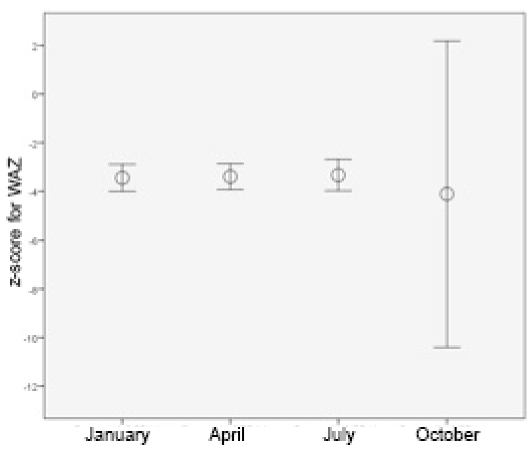

Figure 1. Weight-for-age Z-score changes during 10 months of follow-up
Note: Dots upon box and whisker plot represent median value

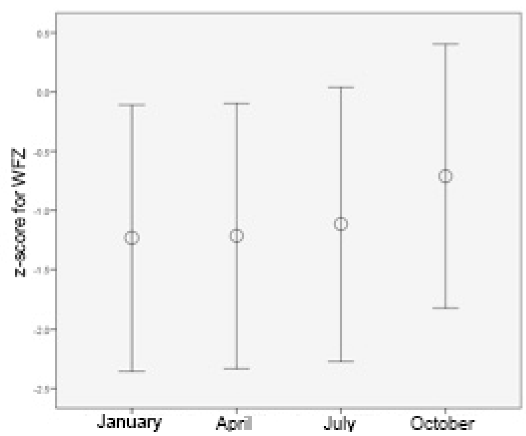

Figure 3. Weight-for-height changes during ten months of follow-up
Note: Dots upon box and whisker plot represent median value

significant difference in the months that body height measurement was done. However, Wilcoxon signed rank test revealed that only the changes between April to October 2012 (P=0.001) and July to October 2012 (P<0.001) were statistically significant. Changes in HAZ throughout the study are depicted in **Figure 2**.

As seen in **Figure 3**, the median weight-for-height Z-score (WFZ) was within normal limits (-1.40) at the beginning of our study (range -3.14 to -1.03). Three months after intervention, the median WFZ slightly decreased to -1.42 (-3.31 to -1.38). In the sixth month of follow-up, there was improvement, with median WFZ -1.11 (-4.14 to -1.01). The highest median WFZ was achieved in the tenth month of intervention [-0.70 (-3.22 to -1.63)].

Discussion

Growth stunting can be used as an indicator of nutritional status in children.[2] Moreover, stunting has diverted attention from underweight status in children,[5] and is important since it may have a deleterious impact on cognitive level and work performance.[1,2,5] Several risk factors contribute to stunting in children: nutrition, genetics, and endocrine factors.[2,5] In the first two years of life, a child's growth is very dependent to nutritional factors, thus, at that age, food security with balanced nutrition should be optimized.[5-7]

Stunting is defined as height-for-age <-2 SD for moderate, and <-3 SD for severe stunting, in children aged 0 to 59 months, from the median 2006 WHO Child Growth Standards. Stunting is caused by malnutrition. Growth faltering is defined by any decline in linear growth that crosses 2 percentiles in the growth chart.

According to UNICEF, undernutrition is an effect caused by two basic problems: illness and inadequate food intake. Those two basic problems result from lack of clean water and sanitation, household food insecurity, and/or lack of health care facilities.[2] Our subjects were underweight from the beginning of the study, as reflected by their low WAZ. This condition was probably due to all of the causes mentioned above.

Body weight was not dramatically increased throughout the study, as shown by number of subjects who had normal weight-for-age Z-scores. At the end of our study, only one subject had WAZ >-2 SD. This slow progression might have been caused by inadequate food intake, infection, HIV/AIDS, and/or psychological problems. Intervention by the PHC was considered to be adequate in quality and quantity. The food supplementation consisted of eggs, high calorie biscuits, and milk formula. However, we did not monitor how the parents gave the supplementary food to the children day by day. The presence of illness and psychological problems also were not noted in our study.

A similar study was conducted in Senegal in under-three children. The study found increased body weight and reduced number of malnutrition cases. Interventions provided were body weight measurement, as well as supplementation of vitamin A and iron. The Senegal study also found that children born from a mother who received nutritional education during pregnancy had better nutritional status than those born to mothers who did not receive nutritional education.[8] As such, we recommend that to our PHC officers add maternal education to their routine program.

We also observed that our subjects had low HAZ: 4% (1/25) stunted and 88% (22/25) severely stunted. Waterlow and Schurch stated that one etiology of stunting is chronic malnutrition.[9] According to Li *et al.* failure to treat acute malnutrition during pregnancy and through the first two years of life will lead to stunting.[10] If the child is already two years old, like most of our subjects, catch-up growth could occur during puberty or a secondary growth spurt. However, a systematic review by Dewey *et al.*[11] showed that supplementary feeding did not improve height-for-age Z-score.[12]

Body height data is very important for determining a child's nutritional status. A mere use of body weight data is not reliable since it is easily influenced by many factors. Our subjects were diagnosed as underweight (Z-score between -2 and -3SD), thus they were given supplementary food for 60 days until their weight was considered normal according to their current age and sex. If body height was taken into account in determining their nutritional status, 20 subjects (80%) had good nutritional status. However, only one of them had normal body height, according to age and sex.

Z-scores were slightly lower when measured using the WHO standard (**Figure 2**). The CDC chart shows shorter children, compared to the WHO chart.8 Therefore, the WHO chart yields lower Z-scores, thus explaining the higher stunting rate based on the WHO standard. Although the Z-score results were different, the interpretation of the data still showed that subjects were stunted, by either chart. Another disadvantage of the WHO standard is that the chart increases the disease burden up to two-fold, compared to the CDC standard.[8]

The supplementary food program was unsuccessful in improving our subjects' growth. **Figures 1** and **2** show that both median weight and height did not improve during the 10 months of follow-up. Although some changes between the months were statistically significant, the finding is clinically important since it indicates that our subjects failed to catch up to normal growth.

Nutrition-specific intervention recommended by UNICEF includes maternal nutrition therapy, in order to reduce low birth weight in newborns.[2,3] Low birth weight babies tend to be stunted in adult life.[3,5] Other recommendations are promotion of exclusive breastfeeding, introduction of supplementary food starting from 6 months of age, micronutrient supplementation, sanitation, and access to healthcare providers.[3,6] This nutrition-specific therapy should be given from pregnancy through the first 2 years of life, but is not necessary afterwards.[3] Bhutta *et al.* reported that food supplementation with or without maternal education could improve height-for-age Z-scores up to 0.41 points (0.05-0.76).[13] Their intervention successfully reduced stunting due to malnutrition by 36% for children under-three. We did not provide maternal nutritional education, so this recommendation should be taken into consideration. We recommend training of medical personnel who work in rural areas to use the appropriate chart, in order to analyze the growth trend in one specific area. Serial measurement of body height and weight for every child in one district is mandatory. All data should be carefully recorded to allow for comparison to prior and future data, so we can assess the nutritional status of the area's population.

Based on above results, food supplementation was not successful in improving children's growth. Several possible contributing factors could include household food insecurity, poverty, chronic disease, as well as poor hygiene and sanitation.[5,6] Those factors were not examined in this study. In addition, a child's potential height should be determined to assess whether the child is growing according to his genetic potential.

Yet another reason for the failure of the food program, was that our subjects' short stature may not have been due to malnutrition. Normal nutritional status (WHZ >-2SD) was observed in 80% of subjects, so chronic malnutrition was not the cause of our subjects' short stature. Our subjects may have originally had other problems, not undernutrition. Normal genetic variations should be considered. Unfortunately, data on our subjects' body height since birth were not available. Since our subjects were probably short due to factors other than malnutrition such as history of low birth weight or genetic predisposition, the recommendations we can draw from this study are to measure children's height and weight regularly every 3-6 months, and to assess other confounding variables. Physicians then can determine whether the child is short due to genetic variations or other pathologic conditions, before deciding to give any nutritional intervention. The weaknesses of our study were the small sample size, short duration of observation, as well as a lack of data on birth weight, birth length, and parents' heights. Furthermore, future studies should include close monitoring on how the supplementary food is being optimally given to the needing child.

In conclusion, the 10-month supplementary food program given is not successful in improving body weight and height of children under-five in Paruga District. Most of our subjects are short due to factors other than malnutrition, and 80% of the subjects have normal nutritional status since the beginning of the study. Our main recommendation from this study is to measure body height regularly and ensure that all supplementary food is successfully delivered only for the underweight child.

Conflict of Interest

None declared.

References

1. UNICEF. Issue briefs : maternal and child nutrition. Jakarta: UNICEF Indonesia; 2012. p.2.
2. UNICEF. Improving child nutrition: the achievable imperative for global progress. New York: UNICEF; 2013. p. 1-114.
3. Inter-Agency and Expert Group on SDG Indicators (IAEG-SDGs). Final list of proposed Sustainable Development Goal indicators. Report number : E/CN.3/2016/2/Rev.1. 2016. p. 3.
4. Basic Health Research (Riset Kesehatan Dasar) 2013. Jakarta: Kementerian Kesehatan RI; 2013. p 212-3.
5. Adair LS, Fall CH, Osmond C, Stein AD, Martorell R, Ramirez-Zea M, *et al.* Associations of linear growth and relative weight gain during early life with adult health and

human capital in countries of low and middle income: findings from five birth cohort studies. Lancet. 2013; 382: 525-34.

6. Cohen P, Rogol AD, Deal CL, Saenger P, Reiter EO, Ross JL, *et al*. Consensus statement on the diagnosis and treatment of children with idiopathic short stature: a summary of the Growth Hormone Research Society, the Lawson Wilkins Pediatric Endocrine Society, and the European Society for Paediatric Endocrinology Workshop. J Clin Endocrinol Metab. 2008 ;93: 4210-7.
7. Grantham-McGregor S, Cheung YB, Cueto S, Glewwe P, Richter L, Strupp B, *et al*. Developmental potential in the first 5 years for children in developing countries. Lancet. 2007; 369: 60-70.
8. Alderman H, Ndiaye B, Linnemayr S, Ka A, Roxk C, *et al*. Effectiveness of a community-based intervention to improve nutrition in young children in Senegal: a difference in difference analysis. Public Health Nutrition. 2008; 12: 667–73.
9. Waterlow JC, Schurch B. Causes and mechanisms of linear growth retardation. Eur J Clin Nutr. 1994; 48: S1-S216.
10. Li H, Stein AD, Barnhart HX, Ramakhrishnan U, Martorell R. Associations between prenatal and postnatal growth and adult body size composition. Am J Clin Nutr. 2003; 77: 1498-505.
11. Dewey KG, Adu-Afarwuah S. Systematic review of the efficacy and effeciveness of complimentary feeding interventions in developing countries. Matern Child Nutr. 2008; 4: 24-85.
12. Ruel MT, Alderman H, The Maternal and Child Nutrition Study Group. Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition? Lancet. 2013; 382: 536-51.
13. Bhutta ZA, Ahmed T, Black RE, Cousens S, Dewey K, Giugliani E, *et al.* What works? Interventions for maternal and child undernutrition and survival. Lancet. 2008; 371:417-40.