*Available online: http://journal.ipb.ac.id/index.php/jgizipangan*
*ISSN 1978-1059 EISSN 2407-0920*
***J. Gizi Pangan, July 2023, 18(2):79-88***
*DOI: https://doi.org/10.25182/jgp.2023.18.2.79-88*

**Research Article**

# Dietary Diversity, Stunting, and the Impact of an Education Program on Parents' Knowledge and Attitudes in West Sumba, Indonesia

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**Article History:**
*Received* *29-11-2022*
*Revised* *06-03-2023*
*Accepted* *26-04-2023*
*Published* *31-07-2023*

**Keywords**:
attitude, dietary diversity, education, stunting, West Sumba

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## ABSTRACT

This pre- and post-test quasi-experimental study aimed to assess dietary diversity and its association with stunting among toddlers (13–60 months), examine the levels of knowledge and attitudes towards balanced and diverse diets among parents or caregivers, and evaluate the impact of customized flashcards and meal boxes as educational tools on parents'/caregivers' knowledge and attitudes in three selected villages in West Sumba, Indonesia. A total of 59 parents/caregivers were recruited, 30% of whom had stunted toddlers. The levels of parents'/caregivers' knowledge and attitudes were moderate. The results from the pre-test study show that Dietary Diversity Score (DDS) did not correlate with stunting status. Furthermore, neither knowledge nor attitudes was discovered to be related to DDS. The use of flashcards and meal boxes in the educational program improved the scores of knowledge ($p<0.05$) and attitudes ($p<0.05$) from the pre-test scores. There was a positive correlation between knowledge and attitudes, either before or after the education program ($r=0.362$, $p<0.05$ and $r=0.562$, $p<0.05$, respectively). To summarize, this study has the potential to be applied in other rural and remote areas.

## INTRODUCTION

Malnutrition can influence nutritional status differently for each individual (Beer *et al.* 2015). Paediatric malnutrition, also known as undernutrition, is a condition where cumulative deficiencies of energy, protein, and micronutrients are caused by a negative balance between nutrient intake and requirement. This condition imparts a detrimental impact on the human body's growth and development (Mehta *et al.* 2013). It was reported that malnutrition is related to illnesses (due to diseases or injuries), environmental factors, and social-behavioural factors (Beer *et al.* 2015). The World Health Organization (WHO) reported that in 2016, about 23% (~154.8 million) of children under five years old suffered from stunting as observed in low height-for-age z scores (below –2 standard deviations from the median height for age of reference population). Stunting in children occurs in the first 1,000 days after birth and is strongly correlated with socioeconomic status, diet, maternal nutritional status, infectious diseases, and micronutrient deficiencies (including suboptimal infant feeding practices) (Raiten & Bremer 2020). This has threatened most developing countries with the major issue of intrauterine growth retardation, particularly maternal undernutrition. Parental education has been initiated to reduce the risk of stunting in developing countries. However, the limited accessibility to execute parental education, especially in remote areas with high stunting rates, is a great hindrance in solving the issue.

Although Indonesia's stunting rate has improved, 27.7% of children under five in

Indonesia are still suffering from it. East Nusa Tenggara Province is considered to be one of the provinces with the highest stunting rates in Indonesia (38.7%). Stunting among children in East Nusa Tenggara is not only due to the lack of nutrient intake but also due to the lack of water access, climate, geographic condition, and food availability, especially protein. Culture and tradition that prioritize pride over children's nutrition also worsen this condition. Efforts to tackle stunting cannot rely on government or healthcare unit support alone. Parental education also has a significant role in suppressing the stunting rate. Mothers' role is highly linked to all the root causes of stunting and to children's nutritional status. Maternal education could reduce children's malnutrition by up to 43% in developing countries during the 1970s–1990s (Smith & Haddad 2000).

Parental education has been considered to be an effective tool and a suitable delivery strategy to prevent stunting in children. Maternal education is used as an indicator to measure the prevalence level of women with new-borns who have not completed high school (Yue *et al.* 2016). This indicator is important in children's language, cognitive, and academic development. Thus, it can be incorporated with nutritional education as an effective approach to prevent stunting. Most reports suggest that a mother's education is recognized as a fixed parameter regardless of whether many mothers (who are economically and educationally limited) attend school after their children's births (De Silva & Sumarto 2018). For instance, in Indonesia, it was reported in some studies that higher levels of maternal education reduced malnutrition levels (maternal and child double burden) in rural areas (Khaliq *et al.* 2022) and some cities in Indonesia (Mahmudiono *et al.* 2016; Mitra *et al.* 2020). Those studies highlight the importance of nutrition education among parents or caregivers to improve their awareness and knowledge, and in the long run, their attitudes and behaviours.

Therefore, this study aimed to: 1) assess dietary diversity and its association with stunting among toddlers (13–60 months); 2) examine the levels of knowledge and attitudes towards balanced and diverse diets among parents or caregivers, and; 3) evaluate the implementation of flashcards and meal boxes as education tools in improving knowledge and attitudes in three villages in West Sumba, Indonesia—Weipala, Hobajangi, and Praimanakah—through an education program named "*Ibu Bisa*". The "*Ibu Bisa* (literal meaning: mothers can do)" program was committed to providing education for parents or caregivers with under-five children in stunting-prone Indonesian areas.

## METHODS

### Design, location, and time

The study was conducted using a pre-post interventional study design in three villages, namely, Weipala, Hobajangi, and Praimanakah, in West Sumba. Data collection was carried out from November to December, 2021. Ethical approval was obtained from the Health Research Ethics Committee, Faculty of Public Health, Diponegoro University, Indonesia for this study with approval number 380/EA/KEPK-FKM/2021.

### Sampling

The sampling technique used in this research was the purposive sampling technique with Slovin's formula to determine the minimum sample size required to estimate the results for the entire population (n=344), with an 88% precision level. Initially, 72 parents/caregivers with children under five were contacted and participated in this educational program. The respondents were purposively selected based on the Sumba Foundation's target group with eligibility criteria as follows: parents/caregivers who: (1) had children aged 13–60 months; (2) had introduced the children to solid foods; (3) prepared the solid foods for the children's consumption at home, and; (4) had complete anthropometric data of the children. However, ten respondents were excluded as their children were less than 12 months old, and three more respondents were excluded due to incomplete body length data. A total of 59 respondents were included in the final analysis. The exclusion process was performed to ensure that younger child age and incomplete data would not bring any potential risk of confounding factors. Informed consent was obtained, and confidentially was assured.

Children's stunting status measurement was carried out during the intervention based on secondary data (the measurement was carried out monthly by nutritionists of the Sumba Foundation). Body height was measured using a dressmaker's measuring tape during

the intervention as it was not possible to use a standardized tool, and the data was collected in a short period. Meanwhile, the Sumba Foundation was using a staturemeter for their monthly measurement. Each parent was asked to report their child's sex and date of birth to ensure a correct calculation of the child's age. A child's stunting status was categorized based on a height/length-for-age z-score according to the WHO's standard growth chart (WHO 2006). A Height/Length-for-Age Z-Score (HAZ) compares a child's height to the height of another child of the same length/height and sex. Based on HAZ, a child was classified as severely stunted (HAZ -3.00 or below), mildly stunted (HAZ between -3.00 and -2.01), normal (HAZ between -2.00 and 1.01), or tall (HAZ 1.01 or above).

**Intervention tools and nutrition education**

The intervention tools used consisted of flashcards and children's meal boxes (without food). The flashcards contain information about balanced nutrition according to the Ministry of Health of the Republic of Indonesia (MoH RI 2014). There were three selected topics for the flashcards: (1) nutrients and food sources; (2) health problems and imbalanced nutrients; and (3) the importance of physical activity and drinking adequate water. The flashcards were intended to give information about a balanced diet and food diversity to parents/caregivers. Meanwhile, each meal box has three compartments to represent a balanced nutrition guideline named "*Isi Piringku*" or My Plate for children. The purpose of the meal box introduction was to encourage parents/caregivers to practice what they learned through the flashcards and nutrition education to the children. Each parent/caregiver was expected to use one of the meal boxes in preparing a meal for their child by placing a food item in one of the three compartments of the meal box. The meal boxes were made from a silicon material (BPA-free) 7.25 x 2.25 inches in size. One meal box was distributed to one child (in this case, also to one household) and used as an educational tool about portioning size, meal plans, and food group variety.

The intervention process consisted of gathering the respondents in the village meeting hall of each village, introducing the project team and facilitators, administering a pre-test questionnaire session (30–40 minutes), measuring children's anthropometrics, distributing meal boxes and flashcards, running a nutrition education workshop (30–40 minutes), holding a discussion session (5–10 minutes), administering a post-test questionnaire session (30–40 minutes), and closing. The nutrition education was delivered by a certified nutritionist using flashcards and meal boxes through a half-day session (mini-seminar), with a flipchart aligned with the flashcard content as a supporting tool.

**Data collection**

Pre-test and post-test were carried out to measure the effectiveness of the nutrition tools used in this study using questionnaires. The researcher performed the intervention and data collection with pre-test questionnaires. The questionnaires were written in Indonesian and delivered with the assistance of the Sumba Foundation's local staff. The questionnaires were developed, and the validity and reliability of the questionnaires were tested (n=30). The questionnaires were used to assess knowledge and attitudes based on the balanced nutrition guidelines from the Ministry of Health Republic of Indonesia. Based on Obilor & Amadi 2018, the questionnaires were considered valid if the Pearson correlation is within the range of $-1 < r < 1$, and the value of sig. (2-tailed) is less than 0.05 (based on the analysis results, the Pearson's significance values for the knowledge and attitudes questionnaires were 0.000 to 0.031 and 0.000 to 0.028, respectively) and highly reliable (the Cronbach's alpha values for the knowledge and attitudes questionnaires were 0.665 and 0.810, respectively) (Barbosa 2021).

The questionnaire on nutrition knowledge contains eight questions in the true or false format. Correct answers were converted into scores from 1 to 10, and the final score was classified into bad (<6 points), standard (6–8 points), or good (>8 points) (Yasmin & Madanijah 2010). The questionnaire on nutrition attitudes contain nine questions and uses Likert scales consisting of strongly disagree, disagree, agree, and strongly agree responses. The scoring was conducted using scores from 0 (very inappropriate) to 3 (very appropriate). The total score was classified into bad (<15.00 points with <56% of respondents showing appropriate attitudes), standard (15.00–20.49 points with 56–75% of respondents showing appropriate attitudes), or good (20.50–27.00 points with 76–100% of respondents showing appropriate attitudes) (Arikunto 2010).

Following the pre-intervention, calculation of dietary diversity was conducted retrospectively using a 1-week Food Frequency Questionnaire (FFQ) to generate Dietary Diversity Scores (DDS) as a measure of children's diet quality (Nachvak SM *et al.* 2017). The FFQ was used due to considerations of time restriction and shortage of trained surveyors. The parent/ caregiver respondents supplied the dietary intake frequency information of the children. Seven food groups were collected and categorized based on the WHO's infant and young child feeding guidelines (WHO *et al.* 2010), namely: 1) grains, roots, and tubers; 2) legumes and nuts; 3) dairy products (milk, yogurt, and cheese); 4) fleshy foods (meat, fish, poultry, and liver/ innards); 5) eggs; 6) vitamin-A-rich fruits and vegetables, and; 7) other fruits and vegetables. If a child consumed at least one food item from a food group during the last week, the group was assigned a score of one (1) for that child, and a score of zero (0) was assigned if none of the food items from the group was consumed. The group scores were then summed up to obtain a dietary diversity score, which ranges from zero to seven, where zero represents non-consumption of any of the food items in the food groups and seven represents the highest level of diet diversification. Minimum dietary diversity was calculated, and the dietary diversity was classified as sufficient (≥4 food groups) or insufficient (<4 food groups).

**Data analysis**

The Pearson correlation test was used to analyze the questionnaires' validity and the association between knowledge, attitudes, and DDS. The Cronbach's alpha test was used to evaluate the reliability of the questionnaires. The Wilcoxon signed-rank test was used to analyze changes in knowledge and attitudes between pre-intervention and post-intervention. The Spearman's rank correlation test was used to determine the correlation between dietary diversity and nutrition status (stunting). The dietary diversity score was captured as a continuous variable from the count of the number of food groups a child consumed before the intervention program, while nutrition status was captured as a categorical variable. Results were considered significant if $p<0.05$. All analyses were performed using Statistical Package for the Social Sciences (SPSS) software version 21.

## RESULTS AND DISCUSSION

The demographic characteristics of parents or caregivers and their children (13–60 months) are shown in Table 1. A total of 59 parents or caregivers were involved in this study with ages ranging from 13 to 60 years old. The majority of them were poorly educated, with only 5% completing college or university education. A total of 15% of the parents or caregivers never even started school. The majority of the parents or caregivers were low monthly earners (under IDR 1,000,000) and unemployed (i.e., being housewives). Meanwhile, the gender-based demographic data of under-five children (13–0 months old) show equal proportions between boys (51%) and girls (49%). The nutritional status of the children was assessed using the height-for-age parameter. Although the data show that the majority of the under-five children were normal/ healthy, this study emphasizes that around 30% of all the under-five children were severely and mildly stunted.

**Association between dietary diversity and stunting**

Several studies suggest that a low-quality, monotonous eating habit is one of the possible risk factors for stunting (Ruel 2003; Hadi *et al.* 2022) because no single meal contains all the necessary nutrients. Table 2 presents the association between DDS and stunting among children under five. The majority of parents or caregivers (98.31%) provided a sufficient variety of diets (≥4 food groups) for their children. According to UNICEF (2012), dietary diversity is an excellent tool to assess the quality of child feeding. It ensures that children receive a variety of nutrients, both macro- and micronutrients. Meeting the suggested minimum dietary diversity can ensure that children get enough energy, protein, and other micronutrients like vitamin A, vitamin D, and iron.

The results of the correlation analysis conducted with the Spearman's rank correlation test show no significant correlation between consumption of a diverse diet and the stunting status among all respondents ($r=-0.096$, $p>0.05$), stunted toddlers ($r=-0.108$, $p>0.05$) and non-stunted toddlers ($r=0.059$, $p>0.05$). Despite the insignificance of this relationship, the results still show a negative direction among stunted children. Such an insignificant relationship between DDS

**Table 1. Socio-demographic characteristics of respondents**

| Characteristics | n (%) |
|---|---|
| Parents or caregivers' demographic | |
| Age (years) | |
| Young adults (17–30) | 26 (44.07) |
| Middle-aged-adults (31–45) | 20 (33.90) |
| Old-aged adults (above 45) | 6 (10.17) |
| Unspecified | 6 (10.17) |
| Relationship with children | |
| Father | 3 (5.08) |
| Mother | 51 (86.44) |
| Other family relatives | 5 (8.47) |
| Education level | |
| Not literate | 9 (15.25) |
| Elementary school | 26 (44.07) |
| Middle school | 7 (11.86) |
| High school | 14 (23.73) |
| College or University | 3 (5.08) |
| Monthly Income (IDR) | |
| <1,000,000 | 52 (88.14) |
| 1,000,000–2,000,000 | 3 (5.08) |
| 2,000,000–3,000,000 | 3 (5.08) |
| 3,000,000–4,000,000 | 0 (0.00) |
| >4,000,000 | 1 (1.69) |
| Occupation | |
| Unemployed (or housewife) | 47 (79.66) |
| Labour | 8 (13.56) |
| Private sector employee | 2 (3.39) |
| Unspecified | 2 (3.39) |
| Children's demographic and nutrition status | |
| Age | |
| 13–23 months | 11 (18.64) |
| 2–5 years | 48 (81.36) |
| Gender | |
| Boys | 30 (50.85) |
| Girls | 29 (49.15) |
| Nutrition status (based on HAZ) | |
| Severely stunting | 15 (25.42) |
| Mild stunting | 3 (5.08) |
| Normal | 40 (67.80) |
| Tall | 1 (1.69) |

Stunted based on height-for-age Z-score (HAZ) Severely stunting: HAZ<-3.00; Mild stunting -3.00≤HAZ< -2.01; Normal: -2.01≤ HAZ<1.01; Tall HAZ>1.01 SD IDR: Indonesian rupiah

and stunting might be caused by the similar types of foods consumed by the two groups although the eating frequencies and total food intake levels might be different.

Although most of the respondents had already met the minimum dietary diversity score, it remains unclear why West Sumba has such a high prevalence of stunted children under the age of five. A further analysis was performed to assess the proportion of children in terms of food groups consumed before the education program. Table 3 shows that no toddlers consumed milk or dairy products daily. Milk is a good source of proteins, omega-3, vitamins, and minerals, which are important to reduce the risk of stunting (Sjarif *et al.* 2019). The majority of the toddlers (i.e., the toddlers of ≥60% of total respondents) consumed rice and cassava as staple foods (i.e., sources of carbohydrates). Plant-based proteins were mostly consumed from mung beans, tofu, and Indonesian tempeh, while animal-based proteins were mostly consumed from eggs and chicken. Mung beans are highly consumed since they are among the crops that grow easily in West Sumba. Only 46% of the toddlers consumed fish. The majority of the children consumed moringa leaves (*Moringa oleifera*) to reduce stunting (Putra *et al.* 2021), but they still had a limited access to fruit and vegetable choices. Moringa leaves were readily available and growing wildly in their surrounding.

**Parents' or caregiver's knowledge and attitudes**

Balanced nutrition knowledge is the level of information the parents or caregivers possessed about the balanced diet for toddlers based on the "*Isi Piringku*" or My Plate guideline from the Ministry of Health of the Republic of Indonesia and the functions of macronutrients and micronutrients to support children's development, especially in preventing stunting. The lowest score for overall parents or caregivers during pre-intervention was 2.5, the highest was 10.00, and the mean was 6.11±1.92 (moderate level). After the education program intervention, the lowest knowledge score achieved was 1.25, the highest was 10.00, and the mean was 7.18±1.83 (moderate level) (Table 4). Individual socio-demographic characteristics, including age and education level, were possible factors affecting their learning process. The higher the level of schooling a person has, Septamarini *et al.* (2019)

**Table 2. Bivariate correlation analysis of the association between dietary diversity and stunting**

| | All respondents (n=59) | | | Stunted toddlers (HAZ<-2.01 SD; n=18) | | | Non-stunted toddlers (HAZ≥2.01 SD; n=41) | | |
|---|---|---|---|---|---|---|---|---|---|
| DDS | n (%) | r | *p* | n (%) | r | *p* | n (%) | r | *p* |
| 0 | 0 (0.00) | | | 0 (0.00) | | | 0 (0.00) | | |
| 1 | 0 (0.00) | | | 0 (0.00) | | | 0 (0.00) | | |
| 2 | 0 (0.00) | | | 0 (0.00) | | | 0 (0.00) | | |
| 3 | 1 (1.69) | -0.096 | 0.469 | 0 (0.00) | -0.108 | 0.668 | 1 (1.69) | 0.059 | 0.715 |
| 4 | 0 (0.00) | | | 0 (0.00) | | | 0 (0.00) | | |
| 5 | 5 (8.47) | | | 1 (1.69) | | | 4 (6.78) | | |
| 6 | 53 (89.83) | | | 17 (28.81) | | | 36 (61.02) | | |
| 7 | 0 (0.00) | | | 0 (0.00) | | | 0 (0.00) | | |
| Minimum dietary diversity | | | | | | | | | |
| Yes (≥4 food groups) | 58 (98.31) | | | 18 (30.51) | | | 40 (67.80) | | |
| No (<4 food groups) | 1 (1.69) | | | 0 (0.00) | | | 1 (1.69) | | |

*p<0.05; **p<0.01; ***p<0.001 using Spearman's Rank Correlation at 95% confidence level; n: number of respondents HAZ: Height-for-Age Z-score; DDS: Dietary Diversity Score

claims, the more information he/she will learn, increasing his/her level of knowledge. Age will also impact a person's capacity for understanding and perspective on the information presented to him/her (Yuwanti *et al.* 2021). In this study, there were a broad variety of education levels and ages among the respondents.

In addition, this study also measured the parents' or caregivers' attitudes regarding the choice of varied food sources based on balanced nutrition for toddlers. The lowest attitude score during pre-intervention was 9.00, the highest was 27.00, and the mean was 17.34±4.21 (moderate level). After the education program intervention, the lowest attitude score achieved was 12.00, the highest was 27.00, and the mean was 18.75±4.26 (moderate level). There was a significant improvement in both the mean score of knowledge (difference: 1.07±1.77 point with $p<0.05$) and the mean score of attitudes (difference: 1.41±4.32 point with $p<0.05$) after the intervention program.

Knowledge in the context of nutrition refers to the awareness of practices and concepts related to nutrition and health, such as adequate food intake, diet-related diseases, foods representing major sources of nutrients, and dietary guidelines and recommendations (Spronk *et al.* 2014; Ong *et al.* 2021). Good knowledge is the foundation of a good attitude. In our opinion, adequate knowledge and a positive attitude towards a balanced and diverse diet can encourage parents or caregivers to provide foods in terms of both quantity and quality to affect the food consumption of their children.

**The association between knowledge, attitudes, and dietary diversity**

The relationship between parents' or caregivers' knowledge, attitudes, and dietary diversity is shown in Table 5. There was a low positive correlation between knowledge and attitudes during the pre-intervention ($r=0.362$, $p<0.05$). After the education program, the strength of the correlation between knowledge and attitudes increased ($r=0.562$, $p<0.05$). Finally, there was no significant correlation both between

**Table 3. Proportion (%) of toddlers in terms of their food consumption**

| Category | Food item | % of toddlers consumed food item |
|---|---|---|
| Grains roots and tubers | Rice | 92 |
| | Cassava | 83 |
| | Corn | 56 |
| | Sweet potato | 7 |
| Legumes and nuts | Mung beans | 97 |
| | Tofu | 86 |
| | Tempeh | 81 |
| | Soybeans | 12 |
| Dairy product | Dairy product | 0 |
| Flesh foods | Chicken | 90 |
| | Fish | 46 |
| | Pork | 24 |
| | Buffalo | 12 |
| | Beef | 8 |
| Eggs | Eggs | 97 |
| Vitamin a rich fruits and vegetables | Papaya | 97 |
| | Moringa leaves | 95 |
| | Cassava leaves | 80 |
| | Papaya leaf | 76 |
| | Water spinach | 54 |
| | Spinach | 51 |
| | Chinese cabbage | 24 |
| | Mango | 24 |
| | Watermelon | 2 |
| Other fruits and vegetables | Banana fruit | 93 |
| | Tomatoes | 51 |
| | Banana blossom | 29 |
| | Eggplant | 29 |
| | Yardlong bean | 25 |
| | Papaya flower | 20 |
| | Chayote | 15 |
| | Cucumber | 14 |
| | Pineapple | 10 |
| | Cabbage | 3 |
| | Jackfruit | 3 |

knowledge and DDS and between attitudes and DDS during the pre-intervention period.

Knowledge is substantial for parents to provide sufficient care to their children. A previous study reported that knowledgeable mothers will provide more nutritious foods for their children and thus can maintain their children's nutritional status based on HAZ (Simanjuntak *et al.* 2019). Attitude is one of the factors that can encourage one to take certain actions. Parents' or caregivers' knowledge and attitude levels regarding a balanced diet based on the "*Isi Piringku*" or My Plate guideline for toddlers improved significantly after the education program. The improvement of knowledge was followed by the improvement of attitudes. Therefore, the application of educational flashcards and toddler meal boxes also significantly strengthened the positive correlation between parents' or caregiver's knowledge and attitudes.

The parent's or caregivers' practice in providing a variety of foods for their children prior to the intervention program was analyzed. Although there were no significant correlations between DDS and knowledge ($r=0.021$, $p>0.05$) and between DDS and attitudes ($r=-0.011$, $p>0.05$), dietary diversity was found to be a potential protective factor against stunting. The negative correlation between DDS and stunting was observed in all respondents and stunted toddlers ($p>0.05$), but it was negligible among non-stunted toddlers. Moreover, there were several studies reporting the importance of dietary diversity to prevent stunting among children under five (Khamis *et al.* 2019; Rah *et al.* 2010; Wali *et al.* 2020).

## CONCLUSION

In sum, over 98% of the parents or caregivers involved in this study had provided at least four food groups. However, none of the toddlers consumed milk and dairy products. There was no correlation between dietary diversity and stunting status among all respondents ($r= -0.096$, $p>0.05$), stunted children ($r=-0.108$, $p>0.05$), and non-stunted children ($r=0.059$, $p>0.05$) at a 95% confidence level. The results of the examination of parent's/caregivers' levels of knowledge and attitudes towards a balanced and diverse diet show that, on average, the parents'/caregivers; knowledge and attitudes were at moderate levels. The application of educational flashcards and

**Table 4. Distribution of respondent based on knowledge and attitude category**

| Variable | | Category | n (%) | Mean±SD | Lowest score | Highest score | Change score | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Mean±SD | *p* |
| Knowledge level[1] | Pre-intervention | Low | 20 (33.90) | | | | | |
| | | Moderate | 30 (50.85) | 6.11±1.92 | 2.50 | 10.00 | | |
| | | High | 9 (15.25) | | | | | |
| | | | | | | | 1.07±1.77 | 0.000*** |
| | Post-intervention | Low | 13 (22.03) | | | | | |
| | | Moderate | 26 (44.07) | 7.18±1.83 | 1.25 | 10.00 | | |
| | | High | 20 (33.90) | | | | | |
| Attitude level[2] | Pre-intervention | Low | 18 (30.51) | | | | | |
| | | Moderate | 28 (47.46) | 17.34±4.21 | 9.00 | 27.00 | | |
| | | High | 13 (22.03) | | | | | |
| | | | | | | | 1.41±4.32 | 0.029* |
| | Post-intervention | Low | 12 (20.34) | | | | | |
| | | Moderate | 29 (49.15) | 18.75±4.26 | 12.00 | 27.00 | | |
| | | High | 18 (30.51) | | | | | |

[1]Knowledge c ategory based on total score (Low: <6; Moderate: 6–8; High: >8); [2]Attitude category based on total score (Low: Less than or equal to 14.59; Moderate: Between 15.00–20.49; High: More than or equal to 20.5) n: number of respondents; SD: Standard Deviation; *p<0.05; **p<0.01; ***p<0.001 using Wilcoxon signed rank test at 95% confidence level

**Table 5. Pearson's correlation coefficient analysis between knowledge, attitude, and dietary diversity attributes**

| Variable (metric) | Pearson's r | *p* |
|---|---|---|
| Pre-Intervention | | |
| Knowledge–Attitude | 0.362** | 0.005 |
| Knowledge–Dietary diversity | 0.021 | 0.872 |
| Attitude–Dietary diversity | -0.011 | 0.933 |
| Post-Intervention | | |
| Knowledge–Attitude | 0.562*** | <0.000 |

*p<0.05; **p<0.01; ***p<0.001 using pearson correlation at 95% confidence level

toddler meal boxes could significantly improve parents' or caregivers' knowledge (p<0.05) and attitudes (p<0.05) in rural areas. These intervention tools increased not only the levels of knowledge and attitudes but also the strength of the positive correlation between two parameters (pre-test vs post-test: r=0.362, p<0.05 vs r=0.562, p<0.05).

## ACKNOWLEDGEMENT

This work was fully funded by *Badan Riset dan Inovasi Nasional* (BRIN) throughout the scheme of the Flagship *Program of Prioritas Riset Nasional* (PRN) [grant number: 005/E4.1/AK.04.PRN/2021]. We give our deepest gratitude

to all study participants, communities (Nutriolab and the Sumba Foundation), partners (*SMK* Plus Kasimo Tambolaka and Sibero Project UNDIP), POKJA Stunting NTT, and our home universities, Soegijapranata Catholic University and Diponegoro University, Semarang, Central Java. Our thanks also go to data collectors and external collaborators (Zenia Adiwijaya and Claudia Adiwijaya) for their outstanding contributions.

## DECLARATION OF CONFLICT OF INTERESTS

The authors have no conflict of interest.

## REFERENCES

Arikunto S. 2010. Prosedur Penelitian: Suatu Pendekatan Praktik. Jakarta (ID): Rineka Cipta.

Barbosa EY. 2021. A neurodidactic model for teaching elementary EFL students in a college context. English Language Teaching 14(3):42–58. https://doi.org/10.5539/elt.v14n3p42

Beer SS, Juarez MD, Vega MW, Canada NL. 2015. Pediatric malnutrition. Nutr Clin Pract 30(5):609–624. https://doi.org/10.1177/0884533615600423

De Silva I, Sumarto S. 2018. Child malnutrition in Indonesia: Can education, sanitation and healthcare augment the role of income? J Int Dev 30(5):837–864. https://doi.org/10.1002/jid.3365

Hadi AJ, Antoni A, Dongoran IM, Ahmad H. 2022. Analysis model of toddlers Ffactor as stunting risk predisposition factor due to covid 19 in stunting locus village area of Indonesia. J Pharm Negat Results 14(1):6–10. https://doi.org/10.47750/pnr.2022.14.01.002

Khaliq A, Wraith D, Miller Y, Nambiar S. 2022. Association of infant feeding indicators and infant feeding practices with coexisting forms of malnutrition in children under six months of age. Nutrients 14(20):4242. https://doi.org/10.3390/nu14204242

Khamis AG, Mwanri AW, Ntwenya JE, Kreppel K. 2019. The influence of dietary diversity on the nutritional status of children between 6 and 23 months of age in Tanzania. BMC Pediatr 19(1):1–9. https://doi.org/10.1186/s12887-019-1897-5

[MoH RI] Ministry of Health Republic of Indonesia. 2014. Balanced Nutrition Guidelines - Indonesia. Jakarta (ID): MoH RI.

Mahmudiono T, Nindya TS, Andrias DR, Megatsari H, Rosenkranz, RR. 2016. The effectiveness of nutrition education for overweight/obese mothers with stunted children (NEO-MOM) in reducing the double burden of malnutrition in Indonesia: study protocol for a randomized controlled trial. BMC Public Health 16(1):1–11. https://doi.org/10.1186/s12889-016-3155-1

Mehta NM, Corkins MR, Lyman B, Malone A, Goday PS, Carney L (Nieman), Monczka JL, Plogsted SW, Schwenk WF, The American Society for Parental and Enteral Nutrition. 2013. Defining pediatric malnutrition: A paradigm shift toward etiology-related definitions. J Parenter Enter Nutr 37(4):460–481. https://doi.org/10.1177/0148607113479972

Mitra M, Susmaneli H, Septiani W, Nurlisis N. 2020. Effect of nutritional education on improving mother's knowledge and nutritional status of malnourished toddlers in Pekanbaru City Indonesia. Int J Sci Basic Appl Res 53(2):244–253.

Nachvak SM, Abdollahzad H, Mostafai R, Moradi S, Pasdar Y, Rezaei M, Esksndari S. 2017. Dietary diversity score and its related factors among employees of Kermanshah University of Medical Sciences. Clin Nutr Res 6(4):247–255. https://doi.org/10.7762/cnr.2017.6.4.247

Obilor EI, Amadi EC. 2018. Test for significance of pearson's correlation coefficient. Int. J. Innov Math Stat Energy Policy 6(1):11–23

Ong RHS, Chow WL, Cheong M, Lim GH, Xie W, Baggs G, Huynh DTT, Oh HC, How CH, Tan NC *et al.* 2021. Associations between socio-demographics, nutrition knowledge, nutrition competencies and attitudes in community-dwelling healthy older adults in Singapore: Findings from the SHIELD study. J Health Popul Nutr 40:52. https://doi.org/10.1186/s41043-021-00277-4

Putra AIYD, Setiawan NBW, Sanjiwani MID, Wahyuniari IAI, Indrayani AW. 2021. Nutrigenomic and biomolecular aspect of Moringa oleifera leaf powder as

supplementation for stunting children. J Trop Biodivers Biotechnol 6:60113. https://doi.org/10.22146/jtbb.60113

Rah JH, Akhter N, Semba RD, Pee S de, Bloem MW, Campbell AA, Moench-Pfanner R, Sun K, Badham J, Kraemer K. 2010. Low dietary diversity is a predictor of child stunting in rural Bangladesh. Eur J Clin Nutr 64:1393–1398. https://doi.org/10.1038/ejcn.2010.171

Raiten DJ, Bremer AA. 2020. Exploring the nutritional ecology of stunting: New approaches to an old problem. Nutrients 12(2):371. https://doi.org/10.3390/nu12020371

Ruel MT. 2003. Operationalizing dietary: A review of measurement issues and research priorities. J Nutr 133:11. https://doi.org/10.1093/jn/133.11.3911S

Septamarini RG, Widyastuti N, Purwanti R. 2019. Hubungan pengetahuan dan sikap responsive feeding dengan kejadian stunting pada baduta usia 6–24 bulan di wilayah kerja puskesmas bandarharjo, Semarang. J Nutr 8(1):17–21. https://doi.org/10.14710/jnc.v8i1.23808

Simanjuntak BY, Haya M, Suryani D, Khomsan A, Ahmad CA. 2019. Maternal knowledge, attitude, and practices about traditional food feeding with stunting and wasting of toddlers in farmer families. Kesmas Natl Public Heal J 14(2):58–64. https://doi.org/10.21109/kesmas.v14i2.2712

Sjarif DR, Yuliarti K, Iskandar WJ. 2019. Daily consumption of growing-up milk is associated with less stunting among Indonesian toddlers. Med J Indones 28(1):70–76. https://doi.org/10.13181/mji.v28i1.2607

Smith LC, Haddad L. 2000. Explaining Child Malnutrition in Developing Countries: A Cross-country Analysis. Washington DC (USA): IFRI.

Spronk I, Kullen C, Burdon C, O'Connor H. 2014. Relationship between nutrition knowledge and dietary intake. Br J Nutr 111(10):1713–1726. https://doi.org/10.1017/S0007114514000087

[UNICEF] United Nations Children's Fund. 2012. Programming Guide: Infant and Young Child Feeding. New York (USA): UNICEF.

[WHO] World Health Organization. 2006. Physical Status and the use and Interpretation of Anthropometry. Reports of WHO Expert Committee. Technical Report Series: No. 854. Switzerland (CH): WHO.

[WHO] World Health Organization. 2010. Indicators for Assessing Infant and Young Child Feeding Practices: Part 2 Measurement. Switzerland (CH): WHO.

Wali N, Agho KE, Renzaho AM. 2020. Factors associated with stunting among children under 5 years in five South Asian countries (2014–2018): Analysis of demographic health surveys. Nutrients 12(12):3875. https://doi.org/10.3390/nu12123875

Yasmin G, Madanijah S. 2010. Perilaku penjaja pangan jajanan anak sekolah terkait gizi dan keamanan pangan di Jakarta dan Sukabumi. J Gizi Pangan 5(3):148–157. https://doi.org/10.25182/jgp.2010.5.3.148-157

Yue A, Marsh L, Zhou H, Medina A, Luo R, Shi Y, Zhang L, Kenny K, Rozelle S. 2016. Nutritional deficiencies, the absence of information and caregiver shortcomings: A qualitative analysis of infant feeding practices in rural China. Plos One 11:e0153385. https://doi.org/10.1371/journal.pone.0153385

Yuwanti Y, Mulyaningrum FM, Susanti MM. 2021. Faktor-Faktor yang mempengaruhi stunting pada balita di Kabupaten Grobogan. J Kesehat Masy Cendikia Utama 10(1):74. https://doi.org/10.31596/jcu.v10i1.704