Original Article

Household dietary diversity and child stunting in East Java, Indonesia

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Background and Objectives: More than one-quarter of under-five children in the developing world are stunted, and those with poor nutrient intake are at risk of irreversible cognitive impairment. The purpose of this study was to determine the relationship between dietary diversity and child stunting in an Indonesian context. **Methods and Study Design:** Dietary diversity was assessed using a maternal-reported checklist of 12 food groups, summed as a Household Dietary Diversity Score. Stunting was defined as ≤-2.0 height-for-age z-score by WHO-Anthro 2005. Trained interviewers administered the household dietary diversity questionnaire to 768 households with children aged <5 years in East Java, Indonesia. Logistic regression models were constructed to test the association between dietary diversity and child stunting. **Results:** The prevalence of child stunting was 39.4%, and the percentage of households consuming food groups high in protein and calcium, like dairy products (41%), and meat/poultry, (65%) was lower compared with other food groups. The unadjusted model revealed that higher dietary diversity scores were associated with lower likelihood of child stunting (OR=0.89; 95% CI=0.80–0.98). This relationship remained significant after adjustment for family size, maternal literacy, food expenditure, breastfeeding, energy, and protein intake (OR=0.89; 95% CI=0.80–0.99). **Conclusions:** The dietary diversity score was moderate, with consumption of dairy products and meat/poultry lowest among 12 food groups. Hence, population interventions should focus on promoting food groups currently lacking in maternal and child diet, including those rich in growth-promoting nutrients like dairy, meat/poultry. These results, from an Indonesian context, confirm the widely observed protective relationship between dietary diversity and child stunting.

Key Words: dietary diversity, child stunting, malnutrition, food pattern, Indonesia

INTRODUCTION

Childhood stunting is a major nutritional problem in developing countries.[1] Stunting is defined as height-for-age z-score below -2.0, using the current World Health Organization (WHO) standards from the Multi Growth Reference Study.[2] In 2011, around 26% of world's children under the age of five years were stunted.[2] Based on the United Nations Children's Fund (UNICEF) conceptual framework on malnutrition, nutritional status is influenced by three broad factors: food, health, and care.[3] Stunting is caused by long-term insufficient nutrient intake,[4] and frequent infections.[3] There is an association between childhood stunting and suboptimal brain development, which might impair children's cognitive ability, school performance, and potential earning when they enter the workforce.[1-3] The WHO report of a colloquium on childhood stunting highlighted the importance of the 1,000-day period (from conception to 24 months of age) when the foundation is laid for an individual's physical size, as well as their physiological and intellectual capacities in later life.[1] With detrimental effects of child stunting, many countries affiliated with The World Health Assembly have committed to achieve 40% reduction by 2025 through the Scaling up Nutrition (SUN) program.[3] Among the three groups of priority policy responses in the SUN framework are nutrition-specific intervention. This intervention has nutritional improvement as the primary goal, and should be accessible to all individuals and their households, especially from pregnancy to the first two years of life, and at times of illness or distress.[5] To prevent a lifetime of lost potential due to stunting, emphasis should be placed on the importance of providing a supportive nutritional environment through timely and appropriate complementary feeding during the first 1,000 days of life,[4-6] that involves a diverse diet.[7-10]

One method of assessing dietary quality employs the dietary diversity score.[11] The dietary diversity score (DDS) measures the sum of diverse food categories, irrespective of the amount consumed individually for the last 24 hours.[12-13] The DDS, as measured by a quantitative num-

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ber of food groups, has become a widely used method of determining variety in the diet, and by proxy, nutrient adequacy.[12] Several classification systems have evolved in determining DDS with the number of food groups varying from 7,[14] 8,[15] 9,[12-13] to 12[13] groups.

One of the major nutritional problems in the diets of developing countries is the lack of dietary diversity, mainly comprising plant-based food sources, but with limited intake of fruits and vegetables.[16] Dietary quality and diversity have changed; secondary data analysis in 6 developing countries showed that the trend in dietary energy availability steadily increased from 1970 to 2002.[17] Increases in dietary energy availability were likely due to the increased consumption of edible oil, and in fats as percentage of dietary consumption.[18-19]

Several studies have reported that low dietary diversity is associated with increased likelihood of child stunting,[20] and double burden of malnutrition.[21] A low DDS also has been associated cardiovascular risk,[22] dyslipidemia,[23] and higher probability of metabolic syndrome.[24] While food insecure-households have been linked with negative nutrition outcomes such as poor linear growth and child stunting,[25] the association between food insecurity and child stunting was independent with regard to dietary diversity, especially in semi-arid areas.[26] Previous studies in Southeast Asia have been mixed regarding the association between dietary diversity and child stunting. A study in a Malaysian indigenous population showed that better dietary diversity was associated with less likelihood of child stunting,[27] while a similar study in rural Cambodia showed no significant association.[28]

A study in Ethiopia revealed that the dietary diversity among school-aged children was low, and even though not statistically tested in relation to dietary diversity, the article did highlight that the school-aged children were also lacking in animal-source food (ASF) intake.[29] In Ethiopia, intake of ASF was a protective factor against stunting[30] and zinc deficiency.[31] One might argue that the low dietary diversity score was driven mainly by the lack of ASF intake that was found to have a wide array of micronutrients essential for enriching type II nutrients (the growth nutrients) such as: vitamin A, vitamin B-12, riboflavin, calcium, iron and zinc.[32] Specifically, zinc is an essential trace element with special importance in the immune system.[33] A study of Peruvian infants showed an association with poor growth when the body has a prolonged short supply of these micronutrients.[34] The immune system might also be depressed due to inability of low fat mass to secrete leptin that helps stimulate immune system.[35] Due to a weakened immune system, it is believed that children are prone to repeated bouts of infection, and thereby become stunted.[3] Therefore, sufficient intake of ASF increases fat stores and provides nutrients that are essential for growth and micronutrients that support the immune system.[29]

The prevalence of child stunting in Indonesia was 36.8%, 35.6% and 37.2% in 2007, 2010 and 2013, respectively.[36] Some have suggested that the East Java Province is a microcosm of Indonesia in terms of child health outcome achievement in Indonesia. Based on the data of Indonesia's Basic Health Research (Riskesdas), the prevalence of stunting in East Java increased from 34.8% in 2007 to 35.8% in 2010.[36] To the best of our knowledge, there is no previous study conducted in East Java specifically, or more generally within Indonesia, a country of 240 million people, to test the hypothesis that dietary diversity decreases the likelihood of child stunting. A previous study involving a population-based sample of 446,473 rural and 143,807 urban children in poor areas in Indonesia showed that higher household expenditure on animal-source and non-grain foods lowered the risk of stunting among children 0-59 months old.[37] The study of dietary diversity within an Indonesian context is specifically interesting because of the rapid nutrition transition this country is undergoing that is believed to be the result of shifted food preferences toward modern Western foods.[38] Indonesia is an archipelago country with rich natural resources that gives vast food source availability compared with previous studies related to dietary diversity and stunting in countries with limited natural resources, like those in sub-Saharan Africa.[26,39] Studies in the Southeast Asia region with relatively abundant natural resources of food, such as in Cambodia[8,28] and Malaysia,[27] only incorporated samples from rural areas, urban areas, or both with the data still producing equivocal results. To strengthen the evidence in Southeast Asian settings, our study included participants from both rural and urban settings. Even further, we incorporated different types of geographical locations from coastal to mountainous areas. With the magnitude of child stunting in Indonesia and absence of scientific evidence in an Indonesian context, we aimed to determine the relationship between dietary diversity and child stunting in East Java, Indonesia.

MATERIALS AND METHODS

A cross-sectional study was conducted in 8 districts representing both urban and rural areas, as well as coastal and mountainous regions in East Java Province, Indonesia. With an initial sample of 768 households with under-five-year-old children, 736 were included in the final analysis. The sample was determined using a multi-stage cluster random sampling following the census block from the Indonesian Buerrau of Statistics. The sampling technique was done as follows: three sub-districts were randomly selected from each district/municipality, then two villages were randomly selected from each sub-district, and finally 16 households were randomly selected in every village block. Samples were 96 households in each district/municipality. Consent was obtained from each participant in written form after information regarding the purpose of the study was explained. All identities of the participants were kept confidential.

In this study, a single 24-hour maternal-reported food recall data was applied to the checklist of 12 food groups proposed by FAO.[13] Presence or absence of the food groups consumed in the last 24 hours then determined the household dietary diversity score (HDDS). The score is continuous, ranging from 0 to 12, based on whether members of the household consumed any of the 12 food groups in the last 24 hours prior to the interview.[40] All the food items consumed by the participants were categorized into 12 food groups which were: staple food (rice, cereals), tubers/roots, vegetables, fruits, fish (including dried fish and seafood), meat (including poultry) egg, nuts and seeds, milk (including all dairy products), spices, oils and fats (coconut products were included), and sweets. Trained interviewers administered the HDDS to 768 household members with children aged <5 years in East Java, Indonesia. Children's weight was measured using a standardized electric scale (Camry EB6571, Guangdong China) in at least 0.1 kg increments. Standing height was measured by using Vktech Stature Meter height measure or microtoise in 0.1 cm increments. Stunting was defined as ≤-2.0 height-for-age z-score (HAZ) by WHO-Anthro 2005.

Maternal attributes and socio-demographic factors were measured using a structured face-to-face interview performed by trained interviewers. Maternal attributes included were maternal literacy, and exclusive breastfeeding status. Socio-demographic factors included total monthly expenditure, food expenditure, source of drinking water, number of under-five-year-old children, and family income.

SAS version 9.4 was used for statistical analyses. Logistic regression models were constructed to test the association between HDDS and child stunting. We developed four models of logistic regression to test our hypothesis that better dietary diversity score was a protective factor, or related to decreased likelihood of child stunting in Indonesia. The first model included only HDDS, while the second model also included family size and maternal literacy as covariates. The third model added the food expenditure variable as an estimate of food security. In the fourth and final model, we incorporated all potential covariates (family size, food expenditure, breastfeeding status, total energy intake, and protein intake) to see whether the observed association in the original model was robust. For all statistical analyses, the results were deemed significant if the obtained *p*-values were less than 0.05.

Ethical clearance

Prior to the interview and anthropometric measurement, the trained interviewers explained the purpose of the study and asked for oral informed consent from the mothers of the children. This study utilized the Food Security Survey data from the Food Security Board of East Java Province in Indonesia that was anonymous, and was approved by the Committee on Research Involving Human Subjects/Institutional Review Board (IRB) for Kansas State University, USA with proposal number 7955.

RESULTS

Household and Environmental Characteristics

The characteristics of the households were mostly consisting of a nuclear family, with total number of household members of ≤4 people (55.4%) and the main source of drinking water was a well (80%). Thirty-seven percent of households had 5 to 6 household members living under the same roof. Approximately 65% of households had only one working member of the household. Almost all households had a literate father (92.5%), indicating sufficient capability of understanding written information. The mean monthly family income was 92 USD, which was greater than the mean monthly expenditure (64 USD). Almost 47.8% of the family income was used for purchasing food.

The prevalence of child stunting was 39.4% and the mean HDDS was 9.1, a score falling between moderate and high. More than 90% of the households were consuming staple food (rice; 99.6%), vegetables (97.8%), legumes (99.0%), egg (91.5%), and sweets (91.7%) and fat/oil (99.6%). Wider variation was observed in terms of fruit (64.8%), spices (78.2%), meat/poultry (65.0%) and fish (88.0%) food group consumption. The least consumed food group was dairy products, with only 41.5% of households reporting consumption in the last 24 hours.

Dietary diversity and stunting

Looking at univariate correlations between "non-nutritional" independent variables and child stunting, only food expenditure had a significant association (*p*=0.04); while family size (*p*=0.81), source of drinking water (*p*=0.67), geographical location (*p*=0.36) and maternal literacy (*p*=0.34) were not significant. For the nutritionally related independent variables, dietary diversity (*p*=0.03) and protein intake (*p*=0.04) was significantly associated

Table 1. Mean score of individual food group consumed in household for the last 24 hours in association with child stunting

Food groups	Mean±SD	*p*-value	Unadjusted OR	95%CI	
				Lower	Upper
Dairy	0.41±0.49	0.11	1.32	0.94	1.85
Egg	0.92±0.28	0.18	0.67	0.38	1.20
Fish*	0.88±0.32	0.03	1.83	1.07	3.15
Fruit	0.65±0.48	0.19	0.78	0.55	1.13
Legumes	0.99±0.09	0.79	1.25	0.24	6.60
Meat & poultry*	0.65±0.48	0.04	0.68	0.47	0.98
Oil & fat	0.99±0.07	0.64	0.56	0.05	6.45
Spices*	0.79±0.40	0.04	0.66	0.44	0.99
Staple (rice)	0.99±0.05	0.71	0.58	0.04	9.55
Sweet	0.91±0.28	0.90	1.04	0.59	1.83
Vegetables	0.98±0.15	0.37	0.62	0.22	1.75

*Significant at α=0.05 for particular dietary diversity score of food group consumed in the last 24 hours in household with and without stunted children. The unit of the mean and standard deviation on each food groups was based on binary score (0=not consuming; 1= consuming food groups in the last 24 hours).

Table 2. Cross tabulation of fish group consumption and child stunting status

Fish groups		Child nutritional status, n (%)		Chi-squared test
		Not stunted	Stunted	
Salt-water fish	Yes	151 (21.7)	105 (15.1)	0.232
	No	279 (40.1)	160 (23.0)	
Fresh-water fish	Yes	14 (2.0)	10 (1.4)	0.717
	No	416 (59.9)	255 (36.7)	
Dried fish*	Yes	30 (4.3)	33 (4.7)	0.015
	No	400 (57.6)	232 (33.4)	

Fish group in the calculation of dietary diversity score consist of salt-water fish, fresh-water fish and dried fish.
*Consumption of dried fish was significantly different at α=0.05 between household with and without child stunting.

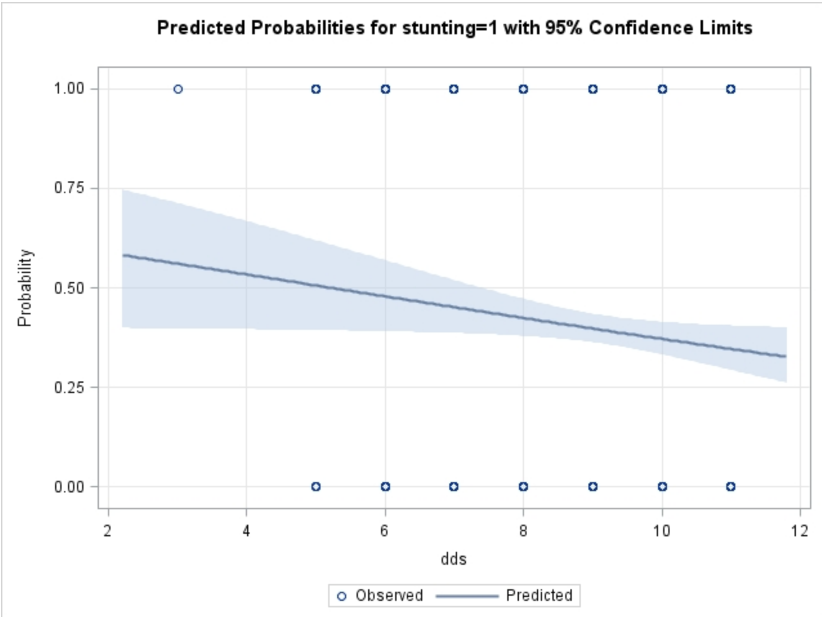

Figure 1. Predicted probability for stunting based on the final model (dietary diversity score adjusted for family size, food expenditure, breastfeeding status, total energy intake, and protein intake).

with child stunting, while breastfeeding status (p=0.71) and total energy intake was not significant (p=0.16).

Binary logistic regression involving all food groups as independent variables and child stunting as dependent variables showed only consumption of fish (p=0.03), spices (p=0.04) and meat/poultry (p=0.04) were statistically significant (Table 1). Fish consumption consisted of fresh-water fish, salt-water fish, as well as dried fish. In the last 24 hours, the mean consumption of salt-water fish (27.9 g, SE=1.3) and dried fish (7.7 g, SE=0.6) was higher, compared with fresh-water fish (3.6 g, SE=0.4). As shown in Table 2, the chi-squared test within each type of fish consumption and child stunting showed a significant association only for dried fish (p=0.02). The odds ratio of overall fish group consumption was 1.83 (95% CI=1.07–3.15) indicating fish consumption was a risk factor for child stunting. In contrast, the odds ratio of both spices and meat/poultry group showed inverse associations with child stunting. The odds ratio of spices consumption was 0.66 (95% CI=0.44–0.99), while meat or poultry consumption was 0.68 (95% CI=0.47–0.98).

All four models in the logistic regression consistently showed significant associations between HDDS and child stunting. The first model used dietary diversity score as a predictive variable, and binary response of stunting or not stunted. There was a significant protective association between DDS and child stunting with OR=0.89 (95% CI=0.80–0.98). The results of the final model showed that the significant association between HDDS and child stunting persisted across models. The final model showed that HDDS was inversely associated with child stunting with OR=0.89 (95% CI=0.80–0.99). This means that with a one-point increase in household dietary diversity score, the likelihood of child stunting was decreased by more than 10% (Figure 1).

Subsequent logistic regression was performed to stratify our final model with breastfeeding status as: exclusively breastfed (until 4 months), partially breastfed, and not breastfed (Table 3). The results showed only among non-breastfed children that the association between HDDS and child stunting remained statically significant (OR=0.88; 95% CI=0.078-0.99) adjusted for family size, food expenditure, total energy intake and total protein intake.

DISCUSSION

The objective of the current study was to determine the relationship between dietary diversity and child stunting

Table 3. Logistic regression coefficients of predictive power of variables included in the model for child stunting by breastfeeding status

Variable	Exclusively breastfed (until 4 months) (n=62)				Partially breastfed (n=144)				Not breastfed (n=530)			
	p-value	OR	95% CI		*p*-value	OR	95% CI		*p*-value	OR	95% CI	
			Lower	Upper			Lower	Upper			Lower	Upper
HDDS	0.91	1.02	0.67	1.55	0.43	0.90	0.70	1.17	0.04	0.88*	0.78	0.99
family size	0.46	1.62	0.45	5.89	0.57	1.26	0.57	2.76	0.36	0.84	0.59	1.22
food expenditure	0.85	1.15	0.29	4.47	0.25	1.61	0.71	3.61	0.48	1.15	0.79	1.67
Energy intake	0.28	1.00	0.99	1.01	0.29	1.00	1.00	1.00	0.74	1.00	0.99	1.00
Protein Intake	0.97	0.99	0.76	1.30	0.13	0.97	0.93	1.01	0.34	0.99	0.98	1.01

*HDDS (Household Dietary Diversity Score) significantly associated with child stunting at $\alpha=0.05$ only for non-breastfed children in a logistic regression model involving independent variables (family size, food expenditure, total energy intake and total protein intake).

in an Indonesian context. Our study confirmed the hypothesis that dietary diversity, as measured using household dietary diversity score, was a protective factor for child stunting. We found a significant protective association between household consumption of meat/poultry and child stunting. The proportion of food groups that were rich in growth-promoting nutrients such as animal protein was low, with only less than 65.0% of households consuming meat/poultry in the last 24 hours. This association aligns with the results of study conducted in Cambodia that showed children who consumed animal source food were less likely to be stunted.[8] A previous study in Indonesia highlighted the association between higher proportions of total household expenditure on animal foods with decreased likelihood of child stunting.[41] The protective effect of meat consumption was also confirmed in a study focused on infants and toddlers in four diverse low-income countries.[42]

Another food group that showed a significant association with child stunting was fish consumption. The effect size of fish group consumption was not aligned with previous studies where fish consumption was negatively associated with child stunting.[43] We hypothesize that due to the high proportion of dried fish consumption in the present study population, our results were masked by socioeconomic status (SES) of the household. The cheap price of dried fish, compared with freshwater fish, might explain this significant relationship. Our chi-squared analysis within each type of fish consumption also supported our hypothesis where only dried fish was significantly associated with child stunting. In rural areas of Indonesia, consumption of small whole fish with bones, which are readily available sources of Fe, calcium, Zn and vitamin A, is often limited because of economic constraints.[44] Similarly, we posit that household spice consumption showing a protective effect toward child stunting was actually an indication of SES. That is, higher SES households were likely to include spices in their meal, compared with lower SES households.

Our first logistic regression model showed a significant unadjusted association between HDDS and child stunting. This relationship remained significant in the final model, after adjustment for family size, food expenditure, breastfeeding status, total energy intake, and protein intake. A similar study using 12 food groups via HDDS in Cambodia showed no significant association, despite a lower mean HDDS score, compared with our study.[28] This difference may be due to the study setting in rural Cambodia that was more homogeneous than our study, which incorporated both urban and rural areas, as well as coastal and mountainous regions. Our study showed similar results to another study in Cambodia where stunting was negatively associated with dietary diversity.[8] That study, however, used a measure of 6 food items from seven food groups, according to the WHO's infant and young child feeding (IYCF) model.[45] The study by Darapheak et al used data from the Cambodia Demographic and Health Survey (CDHS) in 2005,[8] which, in terms of population, is more representative than the McDonald et al study.[28] Our results were also in accord with a study in a Malaysian setting that showed a negative association between HDDS based on 15 food groups and HAZ.[27] Outside Southeast Asian countries, significant associations between better HDDS and decreased likelihood of child stunting also have been reported in Bangladesh,[46] and Ethiopia.[39]

The strength of association between HDDS and child stunting in our study was relatively small (OR=0.89; 95% CI=0.80–0.99) compared with the previous study in Bangladesh for children aged 24-59 months (OR=0.69; 95% CI=0.66–0.73),[46] but slightly greater than the study from Cambodia (OR=0.95; 95% CI=0.91–0.99).[8] Unfortunately, the odds ratio from the study Malaysian population was not available for comparison.[27] Relative similarity in the strength of association between study in Cambodia,[8] and our study might be attributable to the fact that both studies incorporated rural and urban settings, while studies in Bangladesh,[46] were based on rural population only. Rural settings had lower HDDS compared with urban settings, as food availability in urban sites were more abundant and diverse.[29] Subsequent logistic regression with stratification of breastfeeding status showed that the protective effect of HDDS was only true for non-breastfed children (OR=0.88; 95% CI=0.08–0.99). This finding might be related to the evidence that children who were still breastfed were more likely to have limited diversity.[46]

The mean household dietary diversity score was 9.1, which can be considered medium to high diversity. This was almost twofold higher than a similar study using HDDS based on 12 food groups conducted in a rural Cambodian population with mean HDDS score of only 4.7.[28] In the present study, six food groups were consumed by more than 90% of the households: rice, vegetables, legumes, egg, sweets and fat/oil. Rice is a staple food of Indonesians that supplies around 70% of total energy. Fat/oil was presumably used for cooking methods such as frying. Rice and oil are a poor source of protein, which promotes child growth and prevents stunting. Legumes were also widely consumed, and are rich in plant protein, but may have lower bioavailability compared with animal protein. Hence, the ability of legumes to support child growth might not be as robust.

Another food group that was highly consumed was vegetables. Vegetables are nutrient dense with a lot of vitamins and micro-minerals essential for health. In Indonesia, however, cooking methods such as boiling and steaming vegetables might diminish some of valuable water-soluble vitamins when eaten. Fruits, as well as vegetables, are generally nutrient dense, particularly rich in vitamins and minerals that help maintain body metabolism. In our study, only 64.8% of households consumed fruit in the last 24 hours, and this was not a significant predictor of child stunting. The least commonly consumed food group was dairy products, at 41.5% of the households. Dairy products are a prime source of calcium that is essential for bone development and growth. Besides animal protein, dairy's growth-stimulating effect is believed to be insulin-like growth factor 1 (IGF-1) contained in these foods.[47] A case-control study in Iran found significantly lower mean dairy intake of stunted children than their normal counterparts.[48] In our study, however, we did not find a significant relationship between dairy products and stunting.

The prevalence of child stunting in the current study was 39.4% which was slightly higher than the national prevalence. Since the prevalence of child stunting was way above 5%, it was less likely that the observed stunting was due to "healthy shortness" where child's shortness was attributable solely due to inherited genes and not because of inadequate nutrition or repeated bouts of infection.[49] Maternal short stature has been associated with child stunting,[50-52] and lends weight to the healthy shortness narrative. Unfortunately, we did not measure maternal height to test this hypothesis in our study.

In our study, food expenditure was significantly associated with child stunting, while other non-nutritionally related factors such as family size, the source of drinking water and geographical location were not significantly related. Our results conflicted with the study in rural Armenia that showed the association between non-nutritional factors particularly family size with child stunting.[53] Unsafe source of drinking water was a risk factor for child stunting in Tanzania,[51] but not in our study. We believe our results were affected by the fact that the majority of participants acquired drinking water from a well. Differences in ecological settings and geographical areas seem to be reflected in different dietary diversity, be it in rural[28] or urban[10,54] settings, as well as in arid and semi-arid area.[55] However, we failed to see an association between geographical locations and child stunting in our study.

The strength of our study includes the implementation of the census block method to capture better representation of diverse geographical areas in East Java Province including rural and urban setting. Further, we incorporated different types of geographical locations from coastal, agricultural low-lands, to mountainous areas. Furthermore, the final logistic regression model was used to adjust for several covariates known to have confounding effect on the association between dietary diversity and child stunting, lending credence to the observed associations. Last, this study was administered by trained-interviewers in a manner that maternal literacy would not affect any of the outcomes.

Some limitations should be noted for the interpretation of our findings. This study was cross-sectional, so it does not allow us to infer any causal relationship. The fact that the HDDS calculation was based on a single 24-hours dietary food recall is less robust compared with repeated recalls, even for the common dietary measure of total energy.[56] Some of food groups rich in growth promoting nutrients that have greater daily variation than energy intake might be misreported in a single measure. These include protein,[57] zinc, iron, and calcium.[58] Our HDDS was measured based on maternal 24-hours dietary food recall, which may have lower agreement with child's dietary diversity for food groups rich in micronutrients (e.g., dairy, meat/poultry, and fruits and vegetables).[59] Although we did not go to the extent of making a refined assessment of HDDS to include "quantity" of at least 15 gr/day for a food group to be considered "consumed", we did base our assessment on a 24-hour dietary recall. Hence, we were able to take into account the effect of potential nutritional confounders such as total energy intake and total protein intake. A more rigorous study, using randomized controlled trial or prospective cohort study design, should be implemented to confirm protective properties of dietary diversity and child stunting. Subsequent logistic regression stratified by breastfeeding status showed that the protective association between HDDS and child stunting was only significant among non-breastfed children. It should be considered that stunting is a multifactorial disorder affected not only by dietary factors, but also genetics, birth weight, and metabolic conditions.

Conclusion

In the scarcity of evidence in Indonesian setting, our study added more weight to the hypothesis that better dietary diversity was associated with decreased likelihood of child stunting. These results confirm the widely observed protective relationship between dietary diversity and child stunting. Hence, population interventions should focus on promoting food groups currently lacking in maternal and child diets, including those rich in growth-promoting nutrients such as dairy, poultry, and meat.

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AUTHOR DISCLOSURES

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