ARTICLE

Difference in the association of food security and dietary diversity with and without imposed ten grams minimum consumption

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Abstract

Background: Dietary diversity measurement is one of the simple tools to assess the quality of food consumed in population-level and endorse by many international agencies. However, there is a growing concern that the current dietary diversity measures were lacking in the sensitivity due to the omission of minimum food consumed to be considered as consuming certain food groups in the calculation of dietary diversity score. The purpose of this study is to find the difference in DDS measurement between two methods by applying a 10-grams minimum intake for all food groups and the other one, without.

Design: A cross-sectional studies involving 55 samples from two villages with different geographical characteristics.

Methods: One village represents the agricultural area; other was fishpond/coastal area. Dietary diversity was analyzed using Individual Dietary Diversity Score (IDDS) with 9 food categorizations. Dietary diversity measurement calculated based on the food recall with consideration of 10 grams minimum of food weight consumption. Mann Whitney Test used to analyze the difference between calculation of dietary diversity score with and without minimum 10-grams.

Results: There is no difference of children's dietary diversity between agriculture and fishpond family group when the dietary diversity was omitting 10 grams minimum intake (p-value=0.184), while, using 10 grams minimums intake (p=0.024), there is a difference.

Conclusions: Using 10 grams minimum had shown to strengthened the relationship between dietary diversity and adequacy. Further research is needed to find other minimum requirement in different kind of population to find differences among them.

Introduction

Food security is defined as a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. [1-3] Food security mainly associated with two pillars; availability and accessibility. Food availability concept explains about sufficient amounts of food meanwhile food accessibility explains about adequate amount of resources to obtain nutritious food. When there is no sufficient amount of food availability and lack of food access may lead to food insecurity.

Measurement food security can be done through several indicators depends on the purpose of the assessment. To obtain detailed data on household food access or individual dietary intake can be time consuming and expensive. Dietary diversity scale (DDS) is a qualitative measure of food consumption that reflects household access to a variety of foods, and is also a proxy for nutrient adequacy of the diet of individuals.[4] By using dietary diversity questionnaire represents a rapid, user-friendly and easily administered low-cost assessment tool. DDS can be measured for household (HDDS), individual (IDDS), and for women (WDDS).[4,5]

DDS represents the number of different foods or food groups consumed over a given period food. It is a proxy measure for household food access. The frequency of consumption that measured are the last 7 days prior the survey. DDS are calculated by simply sum all food or food groups that they consumed and compare to the cut off points. However, there is still no international standard to categorize the DDS cut off point. Hence, cut off points among countries are different due to the local food based dietary guidelines and nutritional policies. Some determined the cut off based on their sample internal distribution (mean, median, *etc.*). An increase in dietary diversity is associated with socio-economic status and household food security.[6–8] The higher the dietary

Significance for public health

Scarce studies in determining the minimum cut-off of dietary diversity measurement become an essential subject to be explored. Our findings emphasized the need for minimum size of portion to strengthen the result of dietary diversity measurement. This research provides important insights on how dietary diversity scores might be improved for international malnutrition early screening.

diversity score , the greater the variety shown and the better the food security status.[9]

In this study, application of 10 grams minimum and without 10 grams minimum is measured to find the difference. Kennedy *et al.* discovered that there was different result by measuring DDS with and without 10 grams minimum.[10] DDS 10 grams improved the correlation with adequate micronutrient intake to 0.44 compare to DDS which is 0.36.[5] It was indicated that the performance of dietary diversity as an indicator of adequate micronutrient intake is improved when a minimum intake for each food group can be assessed. Moreover, it was explained that DDS 10 grams were more rigorous measure of DDS because it did improve the correlation and regression model.[10] Some studies suggested dietary diversity scores might be improved by inclusion of portion size requirements.[11-13] The purpose of this study was to find the difference in DDS measurement between two methods by applying a 10-grams minimum intake for all food groups, and the other one without 10 grams minimum. The study has been conducted with children 2-5 years old in Wonokasian and Kalanganyar villages. The result of this study has been used as consideration to see the different measurement and also to see the sensitivity by using 10 grams minimum and without 10 grams minimum intakes.

Design and Methods

This was a cross-sectional study conducted in two different villages, Wonokasian and Kalanganyar, which were considered as villages with food potential. Wonokasian village has agricultural potential with various crops. Meanwhile, Kalanganyar village is famous for its largest fishpond in Sidoarjo district.

Data collection

Data was collected between 15 March and 25 May 2017. For samples, children with age 2 until 5 were selected. In total, 55 children, 30 from Wonokasian and 25 from Kalanganyar, included mothers/nannies were selected as respondents. The data taken was based on the total amount of children in Wonokasian and Kalanganyar village by using proportional random sampling methods.

Family characteristics data, such as family's food income and outcome, were gathered using interview questionnaire based. Meanwhile, children's food intake data was collected by interviewing mothers/nannies using food recall 2x24 hours. Afterwards, data was inputted into *Nutrisurvey* software to analyze the results by comparing the average food intake with Recommended Dietary Allowances (RDA). Dietary diversity was analyzed using Individual Dietary Diversity Score (IDDS) with 9 food categorizations. Dietary diversity measurement was done based on the food recall results with consideration of 10 grams minimum of food weight consumption which afterwards categorized into three separate categories; low dietary diversity with ≤3 food groups, average dietary diversity with 4-5 food groups, and high dietary diversity with ≥6 food groups. Energy Adequacy Intake (EAI) and Protein Adequacy Intake (PAI) categorized into; under (<80% RDA), adequate (80-110% RDA), and over (>110% RDA). Mann Whitney Test was used to analyze the difference between calculation of dietary diversity score with and without minimum 10-grams requirement. All data analysis was performed using SPSS, ver. 22.

Ethics

This research was approved by the Institutional Review Board (IRB) at the Faculty of Public Health, Universitas Airlangga on April 28, 2017 with reference number: 166-KEPK. In addition, this trial was approved by the Sidoarjo District Review Board (No: 072/504/404.6.5/2017) in Indonesia. We made sure that potential participants were voluntarily participate and none of their right would have been obliterated if unwilling to participate; furthermore, the confidentiality was preserved. Informed consent was obtained prior to data collection. Participants were free to withdraw from the study at any time without consequences.

Results

Family characteristics that measured were family size, paternal and maternal education, household income, and money spent on food (Table 1). In family size, there is no significant difference between agriculture and fishpond family group, while agriculture family had bigger size / amount than fishpond. Paternal and maternal education was categorized into six groups. The highest number group of paternal education in both family groups was finished senior high school. Only 1 father (3.3%) who finished university in agriculture family group, meanwhile in the fishpond family group there was no father who finished university. The same result occurred in maternal education, the highest number in both groups was finished senior high school. Household income was defined as income earned from both father and mother per month. In agriculture family group, the highest number (26.7%) was in quintile 5, with an income higher than Indonesian Rupiah (IDR) 3,000,000 per month. Meanwhile in fishpond family group, most families (28%) earned IDR 2,500,000 –3,000,000 per month. In general, money spent on food in both family groups was around IDR 1,186,000 – 1,427,000 per month, which in quintile 3. But, in the fishpond family group, 11 families (44%) spent their money on food more than IDR 1,654,500.

Dietary diversity in this study was measured using Individual Dietary Diversity Score (IDDS) with 9 food groups. Dietary diversity measured twice using different procedure. In the first measurement, it was measured by food recall 2x24 hours without minimum food consumed. Meanwhile in the second measurement, it was measured by using minimum food consumed, which 10 grams. The respondents considered to consume food if they consumed 10 grams minimum. In the first measurement, both groups had average dietary diversity results. In the second measurement, children's dietary diversity in agriculture group shows to be under meanwhile in fishpond group shows to be adequate. The Mann Whitney test showed that there is no difference of children's dietary diversity between agriculture and fishpond family group when the dietary diversity was omitting 10 grams minimum intake (p=0.184). Meanwhile, in second measurement using 10 grams minimums intake (p=0.024), which can be conclude that there is a difference of children's dietary diversity between agriculture and fishpond family group (Tables 2 and 3).

Discussion

Two different IDDS measurements using with and without 10 grams minimum consumption showed different results. By using 10 grams minimum improve IDDS sensitivity measurement. This result aligns with a review of DDS, suggesting that this index might be improved by applying a minimum portion size.[14] This minimum rule is used to exclude nutritionally less relevant foods

Table 1. Characteristic of family respondent who lived in agriculture and fishpond area at Wonokasian and Kalanganyar villages, Sidoarjo district.

No	Variable	Agro-ecology			
		Agriculture		Fishpond	
		n	%	n	%
1	Family size				
	Small	16	53.3	15	60
	Average	14	46.7	9	36
	Big	0	0	1	4
	Total	30	100	25	100
2	Paternal Education				
	Finished primary school	3	10	1	4
	Finished secondary school	7	23.3	9	36
	Finished senior high school	19	63.3	15	60
	Finished university	1	3.3	0	0
	Total	30	100	25	100
3	Maternal Education				
	Finished primary school	2	6.7	0	0
	Finished secondary school	9	30	2	8
	Finished senior high school	16	53.3	22	69.1
	Finished university	3	10	1	4
	Total	30	100	25	100
4	Household Income (in IDR)				
	Quintile 1 (<1,620,000)	4	13.3	3	12
	Quintile 2 (1,620,001 – 2,000,000)	7	23.3	6	24
	Quintile 3 (2,000,001 – 2,500,000)	6	20	6	24
	Quintile 4 (2,500,001 – 3,000,000)	5	16.7	7	28
	Quintile 5 (>3,000,000)	8	26.7	3	12
	Total	30	100	25	100
5	Spending for Food (in IDR)				
	Quintile 1 (<1,052,000)	6	20	2	8
	Quintile 2 (1,052,001 – 1,186,000)	7	23.3	1	4
	Quintile 3 (1,186,001 – 1,427,000)	7	23.3	6	24
	Quintile 4 (1,427,001 – 1,654,500)	6	20	5	20
	Quintile 5 (>1,654,500)	4	26.7	11	44
	Total	30	100	25	100

Table 2. Distribution of children's dietary diversity without 10 grams minimum intake.

No	Dietary Diversity	Groups			
		Agriculture		Fishpond	
		n	%	n	%
1	Under	10	33.3	4	16
2	Adequate	14	46.7	14	56
3	High	6	20	7	28
	Total	30	100	25	100

Table 3. Distribution of children's dietary diversity with 10 grams minimum intake.

No	Dietary Diversity	Groups			
		Agriculture		Fishpond	
		n	%	n	%
1	Under	18	60	7	28
2	Adequate	10	33.3	15	60
3	High	2	6.7	3	12
	Total	30	100	25	100

used as condiments or seasonings from the total score.[15] Another study also used 10 grams minimum to determine DDS cut-off points.[10] They assumed by using DDS and DDS 10 grams is a potential measurement for use as indicators of micronutrient adequacy of the diet. This study also consistent with Daniels *et al.*, who discovered that correlations in DDS 10 grams were higher, indicating the 10 grams minimum improved score performances.[11] Portion requirements should be high enough to screen out the noise in the score, but low enough to retain sensitivity to nutritionally significant intakes.[11]

Ten grams minimum in DDS helps to eliminate the insignificant tiny amounts of food. As DDS counts any amount of intake from every food group. This may lead the less nutrition value to overshadow the actual nutritious intake. A study suggested that applying a 10 grams minimum portion requirement could improve a score's sensitivity to nutrient adequacy.[16] Adding a minimum portion requirement further strengthened the relationship between dietary diversity and adequacy. Another study determines the sensitivity and specificity of 10 grams minimum using the ROC curves.[11] It tested the ability of both diversity scores to detect the prevalence of low and high mean nutrient adequacy intake (MPA) using a sensitivity/specificity analysis. In detecting low adequate intake, the 10 grams score had higher sensitivity but lower specificity. Meanwhile, in high adequate intake, the 10 grams score had lower sensitivity but higher specificity.

There were some limitations in this study, including the small sample size with limited variation in participants' ethnicity. However, with randomization in the study design, we believed that potential selection bias from ethnicity could be minimized. Our research provides valuable insights into how dietary diversity scores might be improved using 10 grams minimum intake as a better measure for global malnutrition. Early screening tools are relatively compared to the current FAO guidelines without minimum intake restriction.[4]

Conclusions

In conclusion, the IDDS measurement between two methods by applying a 10-grams minimum intake for all food groups and the other one, without 10 grams minimum showed significantly different results. Using 10 grams minimum had shown to strengthen the relationship between dietary diversity and adequacy. In addition, 10 grams minimum improved dietary diversity score because it eliminates less nutritional food. It is suggested for scientific practice and future researcher measuring dietary diversity should use 10 grams minimum intake rather than the present or absent in certain food intake. Further research is needed to find other minimum requirement in a different kind of population in order to find differences among them.

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Availability of data and materials: The data used to support the findings of this study are available from the corresponding author on reasonable request.

Significance for public health: Scarce studies in determining the minimum cut-off of dietary diversity measurement become an essential subject to be explored. Our findings emphasized the need for minimum size of portion to strengthen the result of dietary diversity measurement. This research provides important insights on how dietary diversity scores might be improved for international malnutrition early screening.

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