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Research Article

An Assessment of Dietary Diversity and Nutritional Status of Preschool Children

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Abstract

Dietary diversity is gaining prominence in assessing diet adequacy of individuals and households in developing countries. Dietary diversity or food variety is not known in Tobago. This study's purpose therefore was to assess dietary diversity, food variety and its relationship to the nutritional status of preschool children. A cross-sectional descriptive study design was implemented and a structured, culturally sensitive questionnaire with a 24-hour recall procedure was used for data collection. A representative sample (n=423), stratified by parish, population density, gender and age, was recruited from public and private pre-schools. Less than half (48%) of the preschoolers met minimum dietary diversity. Approximately 33% consumed food items from 5 or more food groups and 19%had low dietary diversity scores (DDS). Mean scores were obtained for food variety (9.37 ± 2.4) and diversity (4.19 ± .83). Nutrient adequacy ratios (NAR) for eleven nutrients were calculated and correlated with DDS, food variety scores (FVS) and nutrition indices. Notable percentages (11.35%) of the children had acute malnutrition, while 10% were underweight and ~5% exhibited chronic malnutrition. NAR for various micronutrients were significantly ($p \leq 0.01$) correlated with DDS. NAR for energy moderately predicted weight-for-age (WAZ) z-scores (r=0.437, p=0.000), height-for-age (HAZ) z-scores (r=0.413, p=0.001) and weight-for-height (WHZ) z-scores (r=0.466, p=0.000). With notable levels of malnutrition and minimum dietary diversity observed among this group of preschoolers, it is important that stakeholders work collaboratively in coming up with integrated approaches to health and nutrition, in order to improve the wellbeing of its children.

Keywords: Dietary diversity; Food variety; Preschool children; Nutrition in Tobago children; Weight status

Abbreviations

FVS: Food Variety Score; DDS: Dietary Diversity Score; NAR: Nutrient Adequacy Ratio; MAR: Mean Adequacy Ratio; WHO: World Health Organization; MDD: Mean Dietary Diversity; RNI: Recommended Nutrient Intakes; WAZ: Weight for Height Z-Scores; HAZ: Height-For-Age Z-Scores; WHZ: Weight-For-Height Z-Scores; THA: Tobago House of Assembly

Introduction

Dietary diversity defined as a quantitative number of food groups is used extensively as a method for ascertaining variety and nutrient adequacy of diets [1-5]. Dietary diversity which is defined here as the number of different food groups consumed over a given reference period, has been identified as a potentially useful indicator. Nutrient rich foods from diverse diets are important elements in child feeding that supports dietary needs and adequate growth during their early years of life [6]. Further, a diverse diet, with foods from all food groups, is necessary for population groups to meet their requirements for essential nutrients. Increasing dietary diversity is a specific recommendation for children 6 months to 2 years of age [6]. Dietary diversity has been established as a significant predictor of growth, as illustrated by an analysis of Demographic and Health Survey data from children aged 6–24 months in 11 countries in Africa and Latin America [7]. In addition, dietary diversity has been linked to the pillars of food security: accessibility, availability and utilization [8]. Nutrition status is seen as an outcome of biological processes that involve adequate nutrient intakes among groups while dietary diversity ensures adequate nutrient intakes in populations [9].

Food variety (FV), defined as a simple count of food items consumed has been reported as a good indicator of nutrient adequacy of the diet [10]. Consumption of higher numbers of food items and food groups is associated with improved nutritional adequacy of the diet [10-11]. Evidence also shows that FV is associated with malnutrition and can predict a healthier diet in children [12]. Micronutrient malnutrition remains one of the largest nutrition problems worldwide [13]. Children are especially vulnerable due to their increase nutrient requirements for growth and development. The nutrient density of the diet provided to young children is often inadequate to meet their nutritional needs, as such increasing the diversity of foods provided such as meat, poultry, fish, eggs, fruits and vegetables is recommended to improve micronutrient intakes [6].

Evidence on dietary intake research, including FV and dietary diversity, for the island of Tobago, Republic of Trinidad and Tobago is sparse or non-existent. Data from the English-speaking Caribbean, on a whole, shows that iron deficiency anemia adversely affects young and school age children(1-16 years old) [14]. Strategies for promoting appropriate diets and healthier lifestyles for the Caribbean include,

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promoting consumption of a variety of foods [13-14]. Obesity is also a growing trend in the region and using the individual dietary diversity and FVS indicators as proxy measures of nutritional quality may provide practical and useful data that can be used to implement strategies for providing nutrition education and lifestyle disease prevention for this population. This study's purpose therefore was to assess dietary diversity, FV and its relationship to nutritional indices among Tobago preschool children.

Materials and Methods

A representative sample (n=423), stratified by parish, population distribution, gender and age, was recruited from public and private pre-schools located in Tobago, one of the southeasterly most islands of the English-speaking Caribbean. Parents or caregivers with children ages 2 to 4 years who were enrolled in a preschool program were eligible to participate in the study. Formal approval for the study was obtained from administrators of the Tobago Regional Health Administration and written consent was acquired from parents and/or caregivers of the children. The University's Institutional Review Board approved the protocol for the study. Data collection was carried out using a structured, culturally sensitive questionnaire which was pretested and modified accordingly.

Dietary 24-hour recalls were conducted with parents or caregivers of each child by trained interviewers who visited the homes of each participant. Standardized culturally-sensitive protocol with dietary aids consisting of household utensils, wax models, and picture prompts were utilized for portion sizes and quality control. Researchers carried various samples of food models and traditional cooking vessels and utensils such as spoons, cups, bowls, glasses, tin cans, empty bottles, small food containers, samples of slices of roots and tubers, and packages of commercial foods and used these to help establish portion size. Relative validity was determined by comparison with data obtained from the same participants using a food frequency questionnaire. In addition, recalls were repeated in 10% of the sample.

Anthropometric measurements including heights and weight for each participant was determined using standardized techniques [15-17]. Detailed results of all the anthropometric data are published elsewhere [18]. Anthropometric measurements were compared to age and used to determine nutritional status of the children. EPI Info 2002 version 3.5.1 software was used to compute nutrition indices and the results were interpreted according to World Health Organization (WHO) cut off points [19].

Dietary diversity (DDS) and food variety scores (FVS) which were constructed based on the recall of parents or caregivers of the child's intake within the past 24 hours using World Health Organization (WHO) country-specific adaptation guidance [20,21]. Foods were categorized into six food groups as recommended by the WHO and included: (1) staples (grains/cereals, roots and tubers), (2) legumes and nuts, (3) dairy products (milk, yogurt and cheese), (4) animal/flesh foods (eggs, meat, fish, poultry and liver/organ meats), (5) vitamin A-rich fruits and vegetables; and (6) other fruits and vegetables.

Response options were scored and one point was awarded if food item was consumed and 0 point for food items not consumed [20,21]. Dietary diversity indicator was the sum of scores in the six food groups and is therefore ranged from 0-6. FV was calculated as the number of food items consumed over a 24-hour period from a possible 45 food items [10,22]. The minimum dietary diversity (MDD) indicator is calculated based on consumption of at least four of the following six food groups: (1) staples (cereals/grains, roots and tubers); (2) legumes and nuts; (3) dairy products; (4) animal/flesh foods; (5) vitamin A-rich fruits and vegetables; and (6) other fruits and vegetables. Consumption of ≤ 3 food groups was considered as low dietary diversity, while 4 food groups is considered minimum and ≥ 5 food groups is classified as high dietary diversity [23].

Nutrient adequacy of the diet was established by calculating nutrient adequacy ratios (NAR) for 11 micronutrients and energy. NAR is defined as the intake of nutrient divided by the recommended nutrient intake (RNI) for that specific nutrient [13]. A mean adequacy ratio (MAR) was calculated as the sum of NARs for all evaluated nutrients divided by the number of nutrients evaluated, and expressed as a percentage. Pearson's correlation coefficients between FVS, DDS, and NAR were performed to establish relationships between variables at a significance level of $p \leq 0.05$. Simple regression analyses were computed to establish which nutritional indices are most significantly influenced by DDS, FVS and/or NAR. IBM® SPSS® Statistics version 22.0, 2014 was used to perform all statistical analyses.

Results

Diversity by food groups

A mean DDS of 4.19 ± .83 (range 1 to 6) was obtained. Majority (48.23%) of the preschool children consumed food items from 4 food groups in the preceding 24 hours of the survey thus indicating aMDD in this population. A smaller percent of the sample, 19.15%, consumed ≤ 3 food groups therefore indicating low dietary diversity. Only 6.15% (n=26) of the participants consumed a diversified diet from the six food groups; while 26% (n=112) consumed food items from five food groups. Fruits, vegetables and legumes were the food groups least consumed by the preschoolers. More than half (58.67%) ate zero servings of vegetables; 50.59% consumed zero fruits, and 70.3% did not consume legumes over the 24-hour period. Food groups such as staples, dairy products and animal flesh foods were highly consumed by most of the participants.

Food variety score

Findings from this study indicated that the highest number of food items consumed by this population within the previous 24-hour period was seventeen. Six to12 food items were consumed by most (83.69%) of the children. A mean FVS of 9.37 ± 2.45 (range 2 to 17) was obtained. Food items consumed frequently by many of the children included boiled dumplings made from cassava, wheat or cornmeal flour, saltine crackers, rice, dasheen, sweet potatoes, yams, green bananas, plantains, sweetened beverages, juice drinks, hamburgers, hotdogs, corned beef, salted pigtail, fresh fish/seafood, eggs, sweet biscuits(cookies, filled and unfilled varieties), commercially and locally made milk-based drinks, callaloo, pumpkin, cucumbers, christophene, tomatoes, carrots, oranges, mangoes, grapes, and apples. Further descriptive analysis on items consumed revealed that most preschoolers (99%) consumed grains, roots and tubers, fish (92%), vitamin A-rich plant foods (80%), eggs (76%), dairy (≥ 60%), foods cooked in fats and oils (99.8%) and fatty-meats

46%. Food-groups less frequently consumed were fruits (50.5%), vegetables (50.67%), and legumes (70.3%).

Nutrient adequacy ratio

Nutrient Adequacy Ratios (NAR) for 11 nutrients was calculated. Significant relationships were found between NARs (%) for energy and several nutrients. NAR for energy showed significant moderately strong relationships with thiamin (r=.679; p=0.00), zinc (r=.657; p=0.00), calcium (r=.655; p=0.00), niacin (r=.564; p=0.00), riboflavin (r=.507; p=0.00) and folate (r=.502; p=0.00). A moderate relationship was found for vitamin B_6 (r=.416; p=0.00), vitamin A (r =.459; p = 0.00) and iron (r =.416; p =0.00). Weaker relationships were found for energy and vitamin C (r=.212) and B_{12} (r=.188).

Nutritional status

Anthropometric characteristics of the sample were summarized and the z-scores used to determine nutrition status of the group. Data showed that the majority (≥ 50%) of the preschoolers were within normal/average height-for-age, weight-for-age and weight-for-height nutritional status. A distribution of the children by age and normal nutrition status is shown in Table 1. Smaller percentages of the participants were skewed towards being underweight, overweight, wasted and stunted or tall using standard nutrition indices.

Height-for-age (stunting/chronic malnutrition)

Findings indicated that stunting levels were low. Most of the children were of average (≥ median) height-for-age; 3.5% were found to be -1SD below the median and 2.4% were ≥ -2SD below the median, thus indicating stunting/chronic malnutrition.

Weight-for-age (Underweight)

Findings on underweight malnutrition (≥ -2 SD) were identified in 5.2% of the preschoolers. A further 5.7% of the sample were identified as being at risk of underweight (-1SD). Most of the children were found to be average weight for age (see Table 1).

Weight for height (Wasting/Acute malnutrition)

Wasting was the highest form of malnutrition observed in this study and is shown in Table 2. Results indicated that 11.35% of the children were wasted and 12.8% were below average or 1SD below the median weight for height.

Relationship between dietary diversity, food variety score and nutritional status

There was a positive and significant correlation between DDS and FVS (r=.413; p ≤ .001). Mean Adequacy Ratio (MAR) positively correlated with FVS (r=.202; p ≤ .001) and DDS(r=.134; p ≤ .01). Table 3 shows correlation coefficients between NARs and DDS. Other findings indicated that DDS and FVS were not significantly (p≥0 0.5) correlated with any of the nutritional indices. Table 4 shows a breakdown of the nutritional indices and the DDS. The NAR for energy significantly and moderately predicted weight-for-age (WAZ) z-scores (r=0.437; p=0.000), height-for-age (HAZ) z-scores (r=0.413; p=0.001) and weight-for-height (WHZ) z-scores (r=0.466; p= 0.000).

Table 1: Distribution of children enrolled in the study by age with normal/average (median) height-for age, weight-for-age and weight-for-height.

Age in Years	Height for Age n (%)	Weight for Age n (%)	Weight for Height n (%)
2	77 (18.2)	71 (16.78)	61 (14.42)
3	80 (18.91)	104 (24.59)	104 (24.59)
4	92 (21.75)	89 (21.04)	82 (19.39)
Total	249 (58.86)	264 (62.41)	247 (58.40)

Table 2: Distribution of children enrolled in the study by age and classified as stunted (≤ -2 SD), underweight (≤ -2 SD), or wasted (≤ -2 SD).

Age in Years	Short/Stunted n (%)	Underweight n (%)	Wasted n (%)
2	3(0.71)	3(0.71)	12(2.84)
3	0(0.0)	8(1.89)	16(3.78)
4	7(1.65)	11(2.60)	20(4.73)
Total	10(2.4)	22(5.2)	48(11.35)

Table 3: Correlation coefficient between nutrient adequacy ratio and total dietary diversity score.

Nutrient Adequacy Ratio	Correlation coefficient (r) with dietary diversity score
Vitamin C	.150; p=0.001
Vitamin A	.136; p=0.003
Vitamin B_6	.280; p = 0.000
Vitamin B_{12}	.009; p=.840*
Thiamin	.080;p=.083*
Riboflavin	.058;p=.212*
Niacin	.081;p=.079*
Folate	.248;p=0.000
Calcium	.001;p=.986*
Iron	.141;p=0.001
Zinc	.050;p=.282*
Mean Adequacy Ratio	.134;p=0.01

*DDS was not significantly (P ≥0.05) correlated with the NAR of these nutrients.

Table 4: Dietary Diversity Scores by Categories and Weight Classification of Preschool Children.

Weight Status	Low DDS n (%)	Minimum DDS n (%)	High DDS n (%)	Total (%)
Underweight	5 (1.18)	13(3.07)	7 (1.65)	5.9
At Risk for underweight	10 (2.36)	11(2.60)	7 (1.65)	6.61
Normal Weight	44(10.40)	134(31.69)	93(21.99)	64.08
Overweight	13(3.07)	32 (7.57)	19(4.49)	15.13
Obese	9(2.13)	14 (3.31)	12(2.84)	8.28

Discussion

Dietary diversity consists of the total number of foods groups that contribute to the overall diet of an individual over a reference period [14] however; dietary diversity is a better predictor of diet quality than that based on individual food items [22]. Consuming a diet that consists of a wide range of food items has been shown to increase intake of energy and micronutrients in developing countries [2,23]. Findings from this study showed that positive correlations exist between DDS and FVS of Tobago preschoolers. Other studies have reported similar results in children, adolescents and adults [2-5,10]. DDS is a simple approach that can be used to estimate nutrient adequacy of this population in future studies. In this study and as previously documented by others there was a significant and positive correlation between NAR of most nutrients and DDS [5,23-25]. Fruits, vegetables and legumes were the least likely food groups to be consumed as such some micronutrients were lower than RNI.

FVS which are reflected as a simple count of food items consumed were found to be low overall. A total of 17 different food items was noted and most of the preschoolers consumed between 6 and 12 food items within that previous 24-hour of the survey.

Malnutrition in terms of wasting, underweight and stunting among preschool children is of concern in Tobago. The Economic Commission for Latin America and the Caribbean (ECLAC) reported

a 5.9% underweight prevalence for children under age 5 years in Trinidad and Tobago [26]. In this study the smaller of the two islands, Tobago, showed that 5.2% of the under-five children were underweight and a further 5.7% were at risk for becoming underweight. This is cause for concern and should trigger intervention. Similarly, chronic under-nutrition (stunting) in Trinidad and Tobago was reported as 3.6% and findings in this study revealed stunting at 2.4% and an additional 3.5% below average height for age.

The observed levels of stunting, wasting and underweight found in this group suggest that there may be a number of contributing factors. One major notion points to food insecurity. Data on food insecurity for both islands are scare however; one study reported food insecurity was common among the participants of the larger island, Trinidad, and that people who were food insecure showed an increased relative risk of underweight than individuals who were food secured [27]. The authors [27] also noted that food insecure individuals were infrequently consuming fruits and/or vegetables and salads and recommended future research across the lifespan. More research on food insecurity, food choices and nutritional indices is needed so as to provide a deeper understanding on major contributors of malnutrition for this population. It is evident, that there is a definite need for increase monitoring and surveillance of under-five children for stunting, underweight and wasting in Tobago.

Although this study found no statistically significant relationship between DDS, FVS and nutritional indicators, there is evidence of stunting, underweight and wasting among the children of the island. A lower prevalence of stunting (2.4%) was found in this study compared to the 13.7 % reported by the United Nations for the Caribbean region [26]. Underweight prevalence in the Caribbean is reported to be at 8.7%. Finding is this study showed that 5.2% of the island's children are underweight and although its prevalence is below reported data for the Caribbean region, 5.2% warrants surveillance. Documented prevalence of wasting in the Caribbean is 2.9% [28]; however the prevalence of wasting observed in this study is almost 4 times what is recorded for the Caribbean region. This is much higher than the expected prevalence of between 2-3% and the overall global prevalence of 9.4% [28].

In this study three levels were defined for DDS to determine the proportion of participants scoring low (1-3 food groups), minimum (4 food groups) or high (>5 food groups) DDS and the distribution of DDS was compared to the nutritional status of the children. Although dietary diversity assessments of populations have been reported to range from 3 to 6 [3,21,29], different numbers of food groups and scoring systems have been used in different countries to assess dietary diversity, making it challenging to compare DDS between countries. However, Ekesa et al. [29] used 6 food groups and categorized participants in a similar manner.

Older studies have shown significant association between dietary diversity and nutritional indicators in preschool children [30,31]; however in this study, no associations were found between nutritional indices and dietary diversity. Similar findings were reported in more recent studies conducted in Africa [30,29].

Mean FVS was found to be a 9 which is an indication of dietary variety. DDS was found to be a 4.16 which is an indication that improvement is needed in the number of food groups consumed. Low dietary diversity can impact micronutrient adequacy in children. NAR for energy was a moderate predictor of nutrition indicators (WAZ, WHZ and HAZ); as such this simple method can be used as a proxy for determining diet quality and nutrient adequacy in this population.

Conclusion

Our study aimed to assess nutrient adequacy using a simple method called dietary diversity. Less than half of the children met minimum diversity, but acute and chronic malnutrition were also observed. In addition, high fat meats, fats, oils, roots, and tubers, sweet biscuits and fruit drinks were the more predominant food items consumed; while fruits and vegetables were less commonly favored. This trend can pose significant challenges with micronutrient malnutrition and in the long run affect growth parameters. It should also be noted that although this sample showed 2.4% with chronic under-nutrition, a further 3.5% were at risk for stunting and this warrants greater surveillance and monitoring systems. To this end, stakeholders can mitigate the potential for greater increases in malnutrition by working collaboratively in coming up with integrated approaches to preventative health.

This study did not address food insecurity; however there is evidence to suggest that food insecurity may play a role in the underweight status of Trinidad adults [27]. It is important to note that because the data on food insecurity [27] excluded inhabitants of Tobago, more research is needed to verify those findings as well as to show associations with nutritional indices among the Tobago population.

Evidence on nutrition education and food access and/or availability programs have been shown to effectively improve dietary diversity and overall nutrition in populations [32,33]. As such one recommendation is for researchers, collaborators and stakeholders to include nutrition education as part of the public health initiative to promote consumption of fruits and vegetables in the community. In addition, most of the island's preschool children participate in the national school lunch program and one way to increase diversity, access or availability of foods to children is for providers to add variety including more fruits and vegetable options to school lunches. Also a structured and diverse meal planning program will aid the initiative and provide improved nutrient quality to preschoolers via the school lunch program. A continuous monitoring and evaluation system need to be implemented in the island. More research is also needed to identify contributing factors of malnutrition. Additionally, the Tobago House of Assembly (THA), the administrative body responsible for Governance in Tobago, through its Division of Agriculture needs to encourage families to grow more of its own food (fruits and vegetables) e.g peas, beans and other legumes, tomatoes, lettuce and other crops in their home gardens as this will surely help increase the variety of fresh fruit and vegetables available to the population.

The authors offer the following long-term recommendations that may help not only with food variety, but also malnutrition on the island:

- Launching and sustaining a proper nutrition education

program in both the schools and in the community districts.

- The initiation and supporting through the agriculture extension service, a program for all homes to engage in home gardening for the production of fresh vegetables and fruits.
- The THA to commence the production of a variety of local fruits and vegetables on state lands in Tobago for the consumption of its people.
- The promotion and sustaining of an island healthy program which encourages not only exercise but also healthy eating.

References

1. Arsenault JE, Yakes EA, Islam MM, Hossain MB, Ahmed T, Hotz C, et al. Very low adequacy of micronutrient intakes by young children and women in rural Bangladesh is primarily explained by low food intake and limited diversity. J Nutr. 2013; 143: 197-203.
2. Moursi MM, Arimond M, Dewey KG, Trèche S, Ruel MT, Delpeuch F, et al. Dietary diversity is a good predictor of the micronutrient density of the diet of 6- to 23-month-old children in Madagascar. J Nutr. 2008; 138: 2448-2453.
3. Oldewage-Theron WH, Kruger R. Food variety and dietary diversity as indicators of the dietary adequacy and health status of an elderly population in Sharpeville, South Africa. J Nutr Elder. 2008; 27: 101-133.
4. Nguyen PH, Avula R, Ruel MT, Saha KK, Ali D, Tran LM, et al. Maternal and child dietary diversity are associated in Bangladesh, Vietnam, and Ethiopia. J Nutr. 2013; 143: 1176-1183.
5. Rathnayake KM, Madushani P, Silva K. Use of dietary diversity score as a proxy indicator of nutrient adequacy of rural elderly people in Sri Lanka. BMC Res Notes. 2012; 5: 469.
6. Pan American Health Organization: Guiding principles for complementary feeding of the breastfed child. Washington, DC, PAHO. 2003.
7. Arimond M, Ruel MT. Dietary diversity is associated with child nutritional status: evidence from 11 demographic and health surveys. J Nutr. 2004; 134: 2579-2585.
8. Hillbruner C, Egan R. Seasonality, household food security, and nutritional status in Dinajpur, Bangladesh. Food Nutr Bull. 2008; 29: 221-231.
9. Bernal Rivas J, Lorenzana Albert P. [Dietary diversity and associated factors among beneficiaries of 77 child care centers: Central Regional, Venezuela]. Arch Latinoam Nutr. 2003; 53: 52-58.
10. Hatløy A, Torheim LE, Oshaug A. Food variety--a good indicator of nutritional adequacy of the diet? A case study from an urban area in Mali, West Africa. Eur J Clin Nutr. 1998; 52: 891-898.
11. Torheim LE, Ouattara F, Diarra MM, Thiam FD, Barikmo I, Hatløy A, et al. Nutrient adequacy and dietary diversity in rural Mali: association and determinants. Eur J Clin Nutr. 2004; 58: 594-604.
12. Saibul N, Shariff ZM, Lin KG, Kandiah M, Ghani NA, Rahman HA. Food variety score is associated with dual burden of malnutrition in Orang Asli (Malaysian indigenous peoples) households: implications for health promotion. Asia Pac J Clin Nutr. 2009; 18: 412-422.
13. World Health Organization (WHO). World health Report 2002. Geneva: WHO. 2002.
14. Food and Agriculture Organization (FAO) of the United Nation. A manual for the English Speaking Caribbean. Developing food-based dietary guidelines. FAO. 2007.
15. Lohmann TG, Roche AF, Martorell R. Anthropometric standardization: Reference Manual Champaign, IL: Human Kinetics. 1988.
16. United Nations. How to weigh and measure children: Assessing the nutritional status of young children in household surveys. New York. 1986.
17. Frisancho AR. Anthropometric standards for the assessment of growth and nutritional status. Ann Arbor. University of Michigan Press. 1990.
18. Sealey-Potts C. Growth status and child feeding practices in Tobago. Germany. LAP Lambert Academic Publishing. 2014.
19. WHO and UNICEF. WHO child growth standards and the identification of severe acute malnutrition in infants and children. 2009.
20. WHO. Indicators for assessing infant and young child feeding practices. Part II: measurement. Geneva: WHO Press. 2009.
21. Food and Nutrition Technical Assistance. Food and Nutrition Technical Assistance (FANTA) Project. Working Group on Infant and Young child feeding Indicators. Developing and validating simple indicators of dietary quality and energy intake of infants and young children in developing countries: summary of findings from analysis of 10 data sets. Washington: Academy for Educational Development. 2006.
22. Steyn NP, Nel JH, Nantel G, Kennedy G, Labadarios D. Food variety and dietary diversity scores in children: are they good indicators of dietary adequacy? Public Health Nutr. 2006; 9: 644-650.
23. FANTA. Increased number of different foods or food groups consumed. Measuring household food consumption: A technical guide. FANTA, AED. 2004.
24. Steyn NP, Nel J, Labadarios D, Maunder EM, Kruger HS. Which dietary diversity indicator is best to assess micronutrient adequacy in children 1 to 9 y? Nutrition. 2014; 30: 55-60.
25. Mirmiran P, Azadbakht L, Esmaillzadeh A, Azizi F. Dietary diversity score in adolescents - a good indicator of the nutritional adequacy of diets: Tehran lipid and glucose study. Asia Pac J Clin Nutr. 2004; 13: 56-60.
26. Martinez R, Fernandez A. Child malnutrition in Latin America and the Caribbean. Economic Commission for Latin America and the Caribbean (ECLAC), United Nations Children Economic Fund (UNICEF). Challenges. 2006; 2: 1-12.
27. Gulliford MC, Mahabir D, Rocke B. Food insecurity, food choices, and body mass index in adults: nutrition transition in Trinidad and Tobago. Int J Epidemiol. 2003; 32: 508-516.
28. ACC/SCN. Nutrition throughout the life cycle. 4th report on the Worlds Nutrition Situation; Nutrition throughout the lifecycle. United Nations, Standing Committee on Nutrition Geneva. 2000: 6-11.
29. Ekessa BN, Blomme G, Garming H. Dietary diversity and nutritional status of preschool children from MUSA-Dependent households in Gitega (Burundi) and Butembo (democratic Republic of Congo). African J Food Agri Nutr Dev (AJFAND). 2011; 11: 4896-4911.
30. Onyango A, Koski KG, Tucker KL. Food diversity versus breastfeeding choice in determining anthropometric status in rural Kenyan toddlers. Int J Epidemiol. 1998; 27: 484-489.
31. Ruel MT. Is Diversity an indicator of food security or dietary quality? A review of measurement issues and research needs. FCND Discussion paper No. 140, Int Food Policy Research Institute, Washington, DC. 2002.
32. Sarrafzadegan N, Azadbakht L, Mohammadifard N, Esmaillzadeh A, Safavi M, Sajadi F, et al. Do lifestyle interventions affect dietary diversity score in the general population? Public Health Nutr. 2009; 12: 1924-1930.
33. Lachat VR, De Meulenaer B, Menten J, Hytvregts LF, Van Camp J, Roberfroid D, et al. Availability of free fruits and vegetables at canteen lunch improves lunch and daily nutritional profiles: a randomized controlled trial. Br J Nutr. 2009; 2: 1-8.

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