Dietary Diversity Score (DDS) Difference Among Preschool Children (PSC) in Rural and Urban Communities

Kim Leonard G. dela Luna
[1]University of the Philippines-Manila; [2]College of Nursing and Allied Health Sciences, Batangas State University, Philippines

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Abstract - *Individual DDS aims to reflect nutrient adequacy and have been validated for several age groups as proxy measures for nutrient adequacy. This study aims to determine if there is a significant difference in mean DDS of PSC between urban and rural communities in Occidental Mindoro, Philippines. Specifically, this study aims to determine the usual food intake of PSC among each food group. A total of four-hundred eighty (480) PSC were used as primary sampling unit. Food Agriculture Office-DDS was used in order to assess adequacy of food intake. Five (5) was used as the cut-off for diet adequacy. Mean difference and two independent population proportion was assessed using STATA software. DDS among rural communities (4.90) was lower compared to the cut-off point for adequacy; thus, it needs more priority compared to the adequacy of urban households (5.15) (p=.04). The minimum diversity score cut-off of diet adequacy among children was five (5); wherein increase in dietary score is related to dietary adequacy. Adequate dietary intake coming from varied sources was highly related to the improvement of nutritional status among children. As number of food groups increases, nutrition adequacy rating among children also increases. Furthermore, dietary intake among PSC were predominantly coming from rice-fish and vegetable combination coming from at least four to five groups. Lastly, lowest intake among food group was found in other fruits, legumes, pulses and nuts. This result would imply that there is a need to reinforce government programs which were prepared to increase the intake of the population particularly preschool children. Mean DDS among rural communities was lower compared to urban communities. Usual food patterns for both communities was combination of rice-fish and vegetable however, urban communities had higher consumption rate among food groups. Therefore, type of community must take into consideration during nutrition program planning in order to improve the diet adequacy of PSC.*

Keywords - *DDS, nutrition, preschool children*

INTRODUCTION

Dietary diversity score is associated with nutrient adequacy among adults in developed and developing countries [1]-[5]. Increase in dietary diversity improved the adequacy of a diet [3]. Several studies have shown that DDS is positively associated with the overall dietary quality, micronutrient intake of young children and household food security [6]. Dietary diversity as an indicator of household food access and consumption can be associated with other food-related information to provide a snapshot of the food and nutrition security status in a broader area. The use of dietary diversity score questionnaires is extensively included in food and nutrition surveys to give valid data on food access or quality of a diet. This is usually assessed using simple tools such as dietary diversity score, which counts the number of food groups consumed over a given reference period [7].

However, food intake across the country is affected by many factors including food availability, food insecurity, agro-ecological differences and purchasing capacity of the population. Educational levels are much higher in urban areas by which adults in household with preschoolers are much lower in rural than in urban areas which can be reflective to general population. Moreover, urban household have greater access to enhanced sanitation and piped water or public taps [8]. A more diverse range of foods is recommended to achieve adequate nutrient intake and the recommendations appear in different countries [9]. Dietary Diversity Scores (DDS) aim to reflect nutrient adequacy of an individual through the use of food groups. Researches showed that increase in an

individual diversity scores is related to increased nutrient adequacy. DDS have been positively correlated with micronutrient and macronutrient adequacy for infants and young children [10].

In the Philippines, intake of varied food sources coming from different food groups has been a recommendation for achieving adequate energy and nutrient intake across the country. Nutrition Guidelines for Filipinos highlighted the importance of consuming a varied diet, including the different food groups in the daily diet to ensure that macro- and micronutrient requirements were met in daily basis [11].

Preschool age is one of the most vulnerable developmental periods during the growth and development among children. Philippines is one of the nations in the globe where a significant number of children were undernourished. The prevalence of underweight, stunting, iron deficiency anemia and vitamin A deficiency was still remaining as a significant public health problem. These problematic issues are linked to the adequacy of the diet among this age group. The mean energy intake among PSC was 997 kcal/ day which was below the Estimated Energy Requirement (EER), wherein a large number consumed a low proportion of energy from total fat. Inadequate intakes were found for iron, calcium, vitamin C, folate, zinc, thiamine, riboflavin and vitamin A. Refined rice, fish, vegetables, sugar-sweetened products and cow's milk were the usual consumption of this age group [12].

Urban-rural gradient influences the differences in terms of dietary pattern and intake. The relationship between food production should be evaluated across the entire rural, peri-urban and urban system because neither are no longer solely the domain between communities [13], [14]. Different studies already explored the dietary diversity of the population in different agro-ecological conditions however, there are limited studies focused on comparing the dietary diversity differences in the Philippines. The main objective of this study was to identify significant differences between Mean Dietary Diversity Score (MDDS) of preschool children between rural and urban communities in Occidental Mindoro. Specifically, this study aims to determine the MDDS of preschool children in urban and rural communities. Lastly, the study aims to identify what food groups are usually consumed in each two different community settings.

Study Setting

Occidental Mindoro was used as study setting. It is an island province under the Region IV-B (MIMAROPA) which mainly consists of agricultural lands. The target population of this study were preschool children currently enrolled in Barangay Day Care centers. It was selected as setting because results of NNS showed that MIMAROPA is one among other regions with highest prevalence of food insecurity [19]. Several studies conformed that higher food insecurity level lowers the capacity of the household to have lower food intake and less diverse diet compared to food secured households. Majority of the community dwellers rely on farming, fishing and other non-professional services.

METHODS

Research Design

This study used analytical cross-sectional study design to establish the Mean Dietary Diversity Score (MDDS) in each community classification. Open Epi was used to calculate for minimum sample size requirement using 80% power. A total of 480 (240 from urban and 240 from rural communities) preschool children were selected through multi-stage stratified random sampling technique.

Sampling Technique

Three (3) out of eleven municipalities in Occidental Mindoro were selected through simple random sampling to maximize the resources. After the municipalities were selected, barangay was stratified into urban and rural barangays. The stratification was based on Philippine Standard of Geographic Code (PSGC) of the Philippine Statistics Authority [15]. After the barangays were classified, equal allocation was given to each barangay to obtain the minimum sample size requirement. Final selection of preschool children was through systematic random sampling. The conduct of this study was approved by Review Ethics Board of the University of the Philippines.

Respondent of the Study

The mother of selected PSC served as proxy measures. In order to select participants, the following inclusion criteria were used: a household with at least (1) preschool child studying in Barangay Day Care Center. However, if there were two preschool children in the household and both of them were drawn during sampling; the youngest child was selected. However, those preschool children who suffered acute and chronic diseases for the last three (3) months were automatically excluded in this research. Moreover, children with diagnosed physical and mental disability

were excluded. Furthermore, mother or preschool children who didn't completed the evaluation were also excluded. Lastly, children who were sick during data collection process were also excluded.

Research Questionnaire

Dietary Diversity Score (DDS) questionnaire of the Food Agriculture Office (FAO) was used to gather data with regards to the usual intake of the preschool child. A 1-day 24-hour food recall has been used to serve as reference for DDS [16]. Individual DDS aim to reflect nutrient adequacy. Studies in different age groups have shown that increase in individual dietary diversity score is related to increased nutrient adequacy of the diet [17], [18].

Data Gathering Procedure

In order to measure the variable of interest, individual DDS was used to evaluate the dietary intake and pattern of PSC. The constructed DDS was based on the Food Agriculture Office (FAO) guidelines by which the following steps were used:

1. A one-day 24-hour food recall was administered among mothers or caregivers regarding the food consumed by the child for the past 24 hours. This one-day 24-hour food recall served as a reference intake in the DDS checklist [16].
2. After the respondent have recalled all the foods and beverages consumed, the researcher underlined the corresponding foods in the list under the appropriate food group and "1" was written in the column next to the food group if at least one food in this group had been underlined [16].
3. Probing for snacks, special meals and added food (i.e. oil, sugar and condiments) eaten between main meal given to the child was also done. If mixed dish was eaten, the researcher asked about and underlined all the ingredients of the dish.
4. Zero "0" was written in the right-hand column of the questionnaire when it was certain that no foods in that group were eaten.
5. The scores at the right-hand column were tabulated and summed at the end of the scoresheet in order to determine the Individual DDS of the preschool child [16].
6. A determined cut-off points where the child can be defined as having a greater or less risk of inadequate micronutrient intake can have a potential impact in immediate nutritional assessment, continued monitoring of micronutrient intake and diversity.

Data Statistical Analysis

Data were coded accordingly using the coding manual set before the conduct of the study. Microsoft Excel was used during data encoding and editing to ensure the accuracy and completeness of data. Stata software was used to analyze the data using the test difference for two means using α=0.05 as level of significance in order determine significant difference in Mean Dietary Diversity Score between two areas.

RESULTS AND DISCUSSION

Description of the Participants

The mean age of preschool children from rural area (53.07 ± 8.52 months) was slightly higher compared to urban area (52.09 ± 7.75 months). In terms of the household size, both urban and rural community have almost same number of family members sharing in the same pot. Majority of the households both urban (67%) and rural (70%) communities had a monthly income of <PHP. 6, 000.00. Mostly (45%) of the fathers from rural communities were farmers while majority of the fathers (26%) from urban communities were skilled workers which includes but not limited to welder, driver, technician and other related jobs. In a study related to the operationalization of dietary diversity, it was found out that the demographic structure of household size was about the same in rural and urban areas [20].

Agriculture is an important employment source for rural people because it requires a high demand for low-skill labor intensive jobs [21]. In this study, majority of the fathers from rural communities were farmers. This is in relation with the record that almost 80% of the population including children was involved in farming and agriculture related work [12]. Meanwhile, most of the fathers from urban communities were skilled workers which includes but not limited to welder, driver, technician and other related jobs. This can be explained by the changes in the working pattern in the province that can explain the difference in terms of employment between two communities. Shift in employment within the food system when gradient of urbanization was included, fewer people works in agriculture sector and more working in transport, wholesaling, retailing, food processing and vending [23].

Unemployment for both rural and urban communities were recorded at 10%. The recorded unemployment rate in the Philippines was 5.8% [24] was lower compared to the estimate produced by this

study for unemployment for both rural and urban communities which was recorded at 10%.

Meanwhile in terms of the occupation of mothers for both rural and urban community, majority of the mothers were housewives (76% and 75% respectively). The remaining percentage mostly engage in non-permanent work and jobs such as housemaids, contractual employees of some private companies and vendor. Lastly in terms of the government support given such as the Conditional Cash Transfer (CCT) and Mangyan/ Minority Conditional Cash Transfer (MCCT), the rural household has higher (35%) coverage compared to urban communities with only 22% of coverage.

Dietary Diversity Score in Rural and Urban Communities

Findings of this study suggest that the DDS of rural communities across the province was 4.90. Majority of the children's diet in rural areas was composed of rice-meat-fat-fruit and vegetable combination. Results showed that all (100%) of the preschool children in rural communities included in the study consumed the first group that includes cereals, tubers, grains and products. Most (89%) of the preschool children was getting their protein intake from flesh meats, seafood, internal organ and its product. Primarily, the method of cooking that has been used was frying and sautéing because it was evident to the result of this study which revealed that 82% of the preschool children consumed oils and fats.

Alarmingly, almost half (38%) of the population were not consuming vitamin A rich fruits and products even though that there were enough spaces by which the households can plant their own sources of food. Furthermore, the least food group that preschool child consumed at rural communities were dairy products (44%); eggs (42%); legumes; pulses and nuts (19%) and other fruits which were not included in Vitamin A-rich fruits and vegetables.

In relation to this, the dietary diversity score of preschool children in urban communities was 5.15. The score was higher compared from rural communities. It also showed that all of the children were consuming rice, cereals, tubers and grain. Rice served as the staple food for both communities. Compared to rural areas, preschool children in urban communities shared the same characteristic of dietary diversity. The diet composition of the preschool children in urban community is also a combination of rice-meat-fat-fruit and vegetable combination.

Consistently, the result of dietary diversity in urban community showed same results. The protein sources of children from the urban communities were also flesh meats, seafood, internal organ and its product. Furthermore, it shared the same characteristic that the least food groups consumed by preschool children in urban communities that includes dairy products (49%); eggs (20%); legumes; pulses and nuts (20%) and other fruits which were not included in Vitamin A-rich fruits and vegetables.

However, if percentage between groups were being compared between two groups all of food items were consistently higher in urban areas compares to the rural areas. Biggest advantage of urban areas compared in rural communities in terms of food consumption were found in the following food groups: eggs, dairy, vitamin A rich fruits and vegetables.

Table 1. Per cent of children consuming specific food groups based on DDS in Occidental Mindoro, 2016

Food Groups	Rural n=240 n(%)	Urban n=240 n(%)
Cereals, tubers, grains and products	240(100)	240(100)
Vitamin A rich fruits and vegetables	142(59)	157(65)
Other vegetables	117(49)	115(48)
Oils and Fats	197(82)	206(86)
Other fruits	17 (7)	22(9)
Flesh meats, seafood, internal organ and its product	213(89)	216(90)
Dairy products	105(44)	117(49)
Eggs	100(42)	116(48)
Legumes, pulses and nuts	45(19)	48(20)

Based on the results in Table 1. this study, the mean DDS of preschool children was 5.03 which were close to the findings of the research conducted in the Philippines that found out that the DDS of was nearly five (4.9) out of 9 groups. This study found out that the diet of the Filipino children is based on different combinations of rice, meat or fish, oils, vegetables and fruits [25]. In general, based on the set cut-off points Filipino children were receiving an adequate and diverse food intake. The result of the study was higher compared in Cambodia which suggested that the HDDS score was 4.7 ± 1.6 [26]. Difference in the result between studies can be attributed to the seasonal variations between geographical settings. Food supply and food security was greatly affected by food security status. Nevertheless, this determinant should be

considered in order to improve the dietary adequacy of the population [27].

The increase in dietary score was related to nutrient adequacy. However, this present study didn't explore the adequacy of the dietary intake of preschool children. In order to support this evidence, nutrients with the lowest adequacy ratios were iron, calcium and zinc however, nutrients with lowest nutrient adequacy ratio were riboflavin, calcium, vitamin A and vitamin C in the Philippines. Similar to the Kenya study using 50^{th} percentile of Mean Probability of Adequate Intake (MPA) together with the study in the Philippines found the best cut-off to maximize sensitivity and specificity is a DDS of 5 [25].

Differences in Dietary Diversity Score between the Two Communities

Disparities between food supplies, access to health and other indicators of health and nutrition status between two communities was already explored by many researches. Urban communities tend to have a better access in different government programs, better education and career opportunities [28], [30]. In relation to this, result of this study shows that the urban mean DDS was significantly different from rural communities (p=.04; α=0.05). Moreover, the MDDS of urban communities was higher compared to rural MDDS. Compared to urban diets, rural diets were more concentrated on grains and vegetables, and exhibit less consumption of fruit, meat and dairy products. These latter commodities are predominantly subject to spoilage and characterized by higher prices, higher storage costs, or both. In this study, the diet tends to be low in food items like legs, legumes and nuts for both groups. Predominantly, the food diversity of both rural and urban communities in this study had a small difference.

Table 2. Mean Dietary Diversity Score (MDDS) of PSC between urban and rural communities in Occidental Mindoro, 2016

Type of Community	Mean Diversity Score	p- value
Urban communities	5.15	
Rural communities	4.90	0.04

In the Philippines, a cut-off of ≥5 food groups were used to evaluate adequacy because it was found out that the best cut-off points to maximize the specificity and sensitivity of the DDS was five (5) [22]. This established the cut-off point of five (5) which can already reflect the adequacy of micronutrients. A determined cut-off points where the child can be defined as having a greater or less risk of inadequate micronutrient intake can have a potential impact in immediate nutritional assessment, continued monitoring of micronutrient intake and diversity.

In the study conducted in Mozambique, urban dwellers tend to purchase (83%) their food, while those living in the rural areas likely to rely on growing and gathering of foods or receiving it from the social assistance programs [25],[31]. In another study, caloric expenditure elasticity is higher in urban than in rural areas (0.14 compared to 0.12), which suggests that a city dweller is more likely to spend more on food from income than a rural dweller [32]. Food diversity is associated with the nutritional status of preschool children. High dietary diversity was associated for an improved nutritional status and low dietary diversity score was associated to undernutrition in both developing and developed countries [33]-[34].

In this recent study, differences found in dietary diversity score can be explained by the food availability and accessibility gradient of food security. Food security is a vast gradient of dietary diversity wherein communities with higher prevalence of food insecurity can be suffering from limited food availability and accessibility. In the study conducted in the United Kingdom, levels of food insecurity were lower in urban areas compared with rural and peri-urban; wherein peri-urban households were being most affected. Meanwhile, existence of higher food insecurity level can lead to fewer food groups' consumption among family member in a household [13]-[14].

Research studies suggested that the child nutritional status is undoubtedly better in urban areas and it is consistent with other researches [33]-[35]. Mean height-for-age z-scores in particular is significantly higher in urban areas and differences as a large or greater than 0.5 of z-score are common, especially in countries of South Asia. Weight-for-height scores is also generally higher in the urban areas, but the differences are of a much smaller magnitude than for height-for-age and many are not statistically significant [8].

Limitation of the Study

Even though that this research intends to identify the significant difference in MDDS between rural and urban communities, it was affected by some systematic bias and confounding variables [36]. The 24-hour food recall was affected by recall bias and social desirability. Mothers tend to forget the food that their children

consumed for the past day. Furthermore, mother may report inappropriate serving sizes and portion during the 24-hour food recall. Moreover, this study might be affected by different confounding variables that can distort the true prevalence of the community setting [17]. In order, to reduce the effects of this systematic bias, training and orientation was conducted by the primary investigator among data collectors.

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of this study, it was noted that the MDDS was significantly different between the two communities. MDDS in urban communities was higher compared to rural communities. Moreover, food patterns for both communities shares common characteristics by which the usual food intake includes a combination of rice-fish-fat and vegetable; however higher consumption was found among urban communities except for other vitamin A rich vegetables which was higher in rural counterparts. Variation in the food intake might be due to difference in food availability and accessibility of the household.

Result of this study implies that the agro-ecological differences of community affects the food intake of the population especially vulnerable groups like preschool children. Thus, rural communities need more priority in terms of anti-hunger mitigation and nutrition programs which are directed among preschool children. These findings can also imply that rural dwellers need more assistance in terms of improving their food security status and adequacy of diet through different nutrition specific and sensitive programs. Furthermore, some food groups that were not usually consumed in both communities must be prioritized and targeted by the government. This should be done to government agencies involve in food production introduced it to the community for production and consumption.

Therefore, the government must conduct studies that can assess the effectiveness of such programs in solving hunger and improving dietary diversity among preschool children. This must take into considerations that children rural communities are closely to experience food security and dietary inadequacy thus needs better access for government services. Moreover, future researcher must explore other proximal determinants of dietary diversity such as intra-household resource allocation, coping mechanism of caregivers in response to food insecurity, maternal behaviors. This can also include other potential mechanism by which these influential factors have their effects on food and nutrition security.

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