Validity of Household Dietary Diversity Score as a Measure of Food Insecurity among Households in Lucena City, Quezon

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RESEARCH ARTICLE

Abstract

Background and Objective: Food security is a multifaceted issue experienced by nations worldwide. A trend currently being explored in recent studies in measuring food security at the micro level is the Dietary Diversity Score (DDS). Household Dietary Diversity Score (HDDS), a type of DDS, obtains a snapshot of the economic ability of a household, making it an effective food insecurity indicator. The objective of this study was to assess the validity of the HDDS as a tool for measuring food insecurity.

Methodology: The study employed a cross-sectional analytic design with 368 study households in Lucena City, Quezon Philippines. Household Food Insecurity Access Scale (HFIAS) and Household Mean Adequacy Ratio (HHMAR), being two of the most frequently used methods in measuring household food insecurity, were used as reference standards to assess the validity of the HDDS in identifying food insecure households. Receiver Operating Curve (ROC) Analysis was done to determine the appropriate HDDS cut-off for identifying food insecure households.

Results: The areas under the curve (AUC) obtained (0.618, 0.70, 0.701, 0.743), classified HDDS as a "fair indicator" of food insecurity. HDDS of 6 was identified as the optimal score when evaluating food insecurity with consideration of sensitivity and specificity.

Conclusion: In this study, HDDS was proven to be a valid measure of food insecurity. It shows the great potential of this quick assessment tool in identifying population-at-risk, which is crucial in the design of a timely and appropriate intervention to alleviate food insecurity and other nutrition and health-related problems which may arise.

Keywords: *Food security, Dietary Diversity Score, Nutrition, Household Dietary Diversity, Dietary Assessment*

Introduction

According to the World Health Organization (WHO), Food Security is the situation when all people at all times have access to sufficient, safe, and nutritious food to maintain a healthy and active life. Deprivation of the basic need for food may give rise to undesirable outcomes such as health problems, malnutrition, and poor developmental outcomes [1]. Food security may be measured at the macro or micro levels. At the macro level (national or regional), national food production and supplies are measured to assess national food self-sufficiency. At the micro level (individual or household), monitoring of food security is necessary to aide in targeting of interventions, policy planning, monitoring, and evaluation [2].

Traditional income and poverty measures are widely used but they do not provide clear information about food security. Even though food insecurity and hunger are primarily due to limited financial resources, it should also be considered that foods are not solely acquired using money [3]. Two of the most frequently used method of assessing food security in recent studies are the Household Mean Adequacy Ratio (HHMAR) and the Household Food Insecurity Access Scale (HFIAS).

HHMAR is a composite indicator of the energy and micronutrient adequacy of a household's diets which is obtained by computing for the average adequacy ratio for energy adequacy and the 11 micronutrients. HFIAS, on the other hand, measures the experiences of food insecurity through predicted reactions and responses that can be

captured and quantified using a standardized survey questionnaire [4].

A trend currently being explored in recent studies in measuring food security is the Dietary Diversity Score (DDS). DDS is a qualitative measure of food consumption that reflects household access to a variety of food, and is also a proxy for nutrient adequacy of individuals [5]. Dietary diversification is a recommended approach to alleviate nutritional problems resulting from food insecurity and inadequate intake of micronutrients. The use of dietary diversity scores gained popularity due to its influence on nutritional status, association with a number of improved health and nutritional outcomes, and simplicity of the data collection process [6,7]. Household Dietary Diversity Score (HDDS), specifically, shows a snapshot of the economic ability of a household, making it an effective indicator of food security.

With the promise of easier data collection and capability to be associated with health and nutritional outcome, HDDS is one of the dietary assessment tools worth exploring as a food security indicator. The main objective of this study is to validate HDDS as a food security indicator among selected households in Lucena City.

Methodology

Subjects

The study employed a cross-sectional, analytic study design. The study respondents were the person in-charge of meal preparation in Lucena City, Quezon Province.

A stratified systematic sampling design was employed in this study. All of the barangays were determined and stratified into urban and rural barangays. This stratification was necessary due to the urban/rural differentials in dietary diversity. From each stratum, sample barangays were randomly selected and a total 368 respondents were interviewed. Barangays Iba. Iyam and Dalahican were selected for the urban and rural barangays, respectively.

Instrumentation and Data Collection Procedure
Household Dietary Diversity Score

In administering a DDS questionnaire, a 24-hour food recall, was done to ensure that all the foods consumed inside the home were captured [10]. In HDDS, the person responsible in the preparation of the family meals was asked about the foods consumed by all the family members inside the home. After listing of the foods consumed, the corresponding foods in the list under the appropriate food groups were underlined [6].

Dietary diversity score was then calculated by summing the number of food groups consumed in the household over the 24-hour recall period. Some of the food groups were aggregated with the premise that they provide approximately the same types of nutrients, giving a total number of 9 food groups.

Household Mean Adequacy Ratio

A household 24-hour food recall questionnaire was used in the data collection. The HHMAR for each household was calculated as the average of the energy adequacy ratio and the seven micronutrients.

The seven micronutrients (Vitamin A, Vitamin C, thiamin, riboflavin, niacin, calcium, and iron) were chosen since the FCT+ Menu Evaluation software developed by the Food and Nutrition Research Institute is limited only to these micronutrients. In each household, all requirements were summed and divided by the total number of adult-equivalents. The nutrient adequacy ratio was calculated as the ratio of nutrient intake: nutrient requirement by an adult-equivalent, truncated to one. The Philippine Dietary Reference Intake 2015 (PDRI) was used as basis of the nutrient requirements. Since household members of varying age and sex would also have different dietary intake, the PDRI of a reference adult (male, 30-49 years old) was used in computing adult equivalents of each household member [11]. The HHMAR for each household was calculated as the average of the energy, protein, and the 4 micronutrient adequacy ratios.

Household Food Insecurity Access Scale

A standardized questionnaire which consists of a list of security-related conditions which had happened in the last 30 days was used by the data collectors with the mothers or the person in-charge of preparing the family meals as respondents. HFIAS is an adaptation of the approach used to estimate the prevalence of food insecurity in the US annually [12]. The options for scoring was rarely (once or twice), sometimes (three to ten times), or often (more than 10 times). A value was assigned for each response per condition. (Never=0, Rarely=1, Sometimes=2 and Often=3) The HFIAS scores corresponded to the sum of the points which could range from 0 (food secure) to 27 (maximum food insecurity).

The HFIAS indicator categorizes households into four levels of household food which include food secure, mildly food insecure, moderately food insecure and severely food insecure [4].

Data Processing and Analysis

Statistical package for the Social Sciences (SPSS) version 16.0 was used in the study. Wilcoxon signed rank test was performed to compare the HDDS distribution of the urban and rural barangays while Shapiro-Wilk test was used to test the normality of the HHMAR, HFIAS, and HDDS. Distribution of the sample households were non-normal, thus, Spearman rank order correlation was used to determine the relationship of HDDS with HFIAS and HHMAR.

ROC analysis was done to determine whether the ability of HDDS to mimic other tools food insecurity, was affected by trade-offs between sensitivity and specificity. Sensitivity measures the ability of HDDS to identify food insecure households while specificity measures the ability of HDDS to identify the food secure households using HFIAS and HHMAR [13]. The areas under the curve (AUC) defined how valid was the HDDS as a tool to measure food insecurity using the reference standards as basis [14]. AUC equal to one denotes that the tool is an excellent predictor of food insecurity while AUC less than 0.60 denote that the tool is not a predictor.

In ROC analysis, it is required for reference standards to be dichotomous. The four categories of HFIAS were regrouped into two categories: Group 1 and Group 2. For HFIAS Group 1, those who were classified as food secure and mildly food insecure, were negative for food insecurity while those who are classified as moderately food insecure and severely food insecure were the ones positive for food insecure. For HFIAS Group 2, only those who were originally classified as food secure is negative for food insecurity while all of those who were classified as mildly food insecure, moderately food insecure, and severely food insecure were positive for food insecurity. As for HHMAR, the cut-offs 0.50 and 0.70 were used to identify food insecure households.

Ethical consideration

The researcher obtained the research clearance of the study from the University of the Philippines Research Ethics (reference no.: UPMREB 2016-152-01).

Results

A total of 368 respondents were included in the study, with 184 each from the rural and urban barangays in Lucena City. Results showed that there were more females compared to males and the age range was within 20 to 40 years old. The respondents in Iba. Iyam had a mean age of 37.2 years old with a range of 17 to 74, while the mean age of respondents in Dalahican was not far at 36.3 years old and had a range of 17 to 64. In Iba. Iyam, most of the respondents reached high school level of education while most of the respondents in Dalahican were only able to reach elementary level. Results also showed that majority of the respondents were married.

Household Dietary Diversity Score

Based on the distribution of HDDS of study households, most of the households in Iba. Iyam have scores of 8 or 7 while households in Dalahican have scores of 4 or 5. Overall, most of the study households have dietary diversity scores of 7 or 8. According to the DDS per food group, the top 3 most consumed food groups in Iba. Iyam include starchy staples, spices, condiments, and beverages, and oils and fats. Likewise, the most consumed food groups in Dalahican also include the starchy staples, spices, condiments, and beverages, and lastly, the fish and sea foods. Dalahican is a coastal barangay, thus, fish is a main part of a household's daily meal.

Results of the study show that Iba Iyam has a significantly higher mean HDDS at 7.4 as compared to the mean HDDS of Dalahican which is 5.6 (p value < 0.001; 95% CI). Overall, the mean HDDS of the study households is 6.5. The distribution of the HDDS scores of Iba. Iyam and Dalahican were also significantly different (p value < 0.001; 95% CI) based on the results obtained from the Wilcoxon signed rank test.

Household Mean Adequacy Ratio (HHMAR)

Table 1 presents the energy adequacy, nutrient adequacies, and HHMAR of study households in the sample barangays. The household mean adequacy ratio (HHMAR) and mean nutrient adequacy ratio (NAR) of energy, protein, calcium, iron, Vitamin A, riboflavin, niacin, and Vitamin C. In Iba. Iyam the HHMAR and the mean NARs of all the nutrients except for protein are significantly higher as compared to Dalahican (95% CI). The nutrients with the highest mean adequacy ratios in Iba. Iyam include protein (0.64), energy (0.60), and riboflavin (0.53). On the other hand, nutrients

with the highest adequacy ratios in Dalahican include protein (0.6), thiamin (0.38), and riboflavin (0.36)

Household Food Insecurity Access Scale (HFIAS)

Table 2 presents the HFIAS category results of Iba. Iyam and Dalahican. Results of the study show that in Iba. Iyam, 6.5% of the households were food secure, 40.2% were mildly food insecure, 33.2% were moderately food insecure, and 20.1% were severely food insecure. In Dalahican, 2.2% were food secure, 7.6% were mildly food insecure, 35.9% were moderately food insecure, and 54.3% were severely food insecure. Using chi-square, results show that the HFIAS categories of the two barangays were significantly different at 95% CI.

Prevalence of Food Insecurity

Table 3 shows the food security status of study households using HHMAR and HFIAS. Those above the given cut-off points were classified as food secure while those below the cut-off points were identified as food insecure. At HHMAR 0.50 cut-off, 62% were classified as food insecure in Iba. Iyam which was significantly lower as compared to the 85.3% in Dalahican. As for the HHMAR 0.70 cut-off, 80.4% were identified as food insecure in Iba. Iyam which is also significantly lower compared to the 96.7% in Dalahican. For both HFIAS groupings, prevalence of food insecurity in Dalahican was higher as compared to Iba. Iyam. Validity of HDDS as food insecurity indicator

Table 4 presents the areas under the curve obtained from performing receiver operator characteristics (ROC) analysis which evaluates the sensitivity and specificity of HDDS using HHMAR and HFIAS as reference standards. For HFIAS Group 1, the Area under the curve (AUC) 0.70 indicates that HDDS is a fairly good tool to measure food insecurity. However, the AUC for HFIAS Group 2 was lower at 0.618, which denotes that HDDS is not a very favorable instrument. Using HHMAR 0.50 as reference standard, the AUC obtained was 0.743 which classifies HDDS as a fairly good measurement tool. Similarly, the AUC for HHMAR 0.70 which was 0.738 also classifies HDDS as a fairly good instrument for the measurement of food insecurity at the micro level.

The HDDS scores are directly proportional to sensitivity and inversely proportional to specificity. Figures 1 to 4 shows the specificity and sensitivity balance using the reference standards to determine the optimal cut-off point of HDDS which may be used to indicate food insecure households.

HFIAS group 1, the intersecting lines of sensitivity and specificity between the scores of 6 and 7. HDDS 6 was selected as it gives a sensitivity of 58% and a specificity of 73%. The cut-off 6 was able to provide a higher specificity as compared to 7. Specificity is prioritized in instances when prevalence of the outcome of concern is high, which is the case of Lucena City wherein at least 70% of the selected households were food insecure. As for HFIAS Group 2, HDDS 7 was selected as the best cut-off point since it provides the best balance for sensitivity (68%) and specificity (56%).

For HHMAR at 0.50, 6 was selected as the best cut-off score for HDDS as it provides a sensitivity of 58% and a specificity of 76%. The score selected for HHMAR .70 was also 6. However, the sensitivity is slightly lower at 53% and the specificity is higher at 81% as compared to HHMAR 0.70.

Discussion

Very few local studies have specifically addressed the association between dietary diversity and food security. However, studying the association would be reasonable as people tend to diversify their diets as income increases, mainly because greater variety makes diets generally makes diets generally more palatable, pleasant and nutrient-dense. Data from the 8th FNRI NNS shows that as socioeconomic status increases, the proportion of households meeting the Estimated Average Requirement (EAR) of nutrients also increased except for the green leafy and yellow vegetables where both the mean intake and percent of households consuming decreases with wealth quintile [15].

Household Dietary Diversity Score

The mean HDDS of all the study households was 6.5. Iba Iyam has a more diverse diet as its mean HDDS was significantly higher as compared to Dalahican. Similarly, the HDDS distribution of Iba. Iyam and Dalahican were significantly different from each other.

Results of a study in Koutiala Mali on household level food variety score and HDDS is somehow similar as they were able to obtain HDDS 6.7 for the urban barangay and 6.1 for the rural barangay [16].

The relatively low DDS was due to the low consumption of the selected households from food groups such as roots and tubers, fruits, eggs, nuts and legumes. It could also be

Table 1. *Energy adequacy, nutrient adequacies, and HHMAR of study households in Iba. Iyam and Dalahican, June 2016, n=368*

	Iba. Iyam (n=184	Dalahican (n=184)	pvalue	Total n=368
Energy	0.60 ± 0.27	0.47 ± 0.19	< 0.001*	0.54 ± 0.22
Protein	0.64 ± 0.24	0.60 ± 0.24	0.122	0.62 ± 0.24
Calcium	0.34 ± 0.21	0.28 ± 0.18	0.003*	0.31 ± 0.20
Iron	0.49 ± 0.22	0.35 ± 0.18	< 0.001*	0.42 ± 0.21
Vitamin A	0.43 ± 0.32	0.21 ± 0.22	< 0.001*	0.32 ± 0.30
Thiamin	0.52 ± 0.27	0.38 ± 0.24	< 0.001*	0.45 ± 0.27
Riboflavin	0.53 ± 0.25	0.36 ± 0.18	< 0.001*	0.45 ± 0.23
Niacin	0.05 ± 0.04	0.03 ± 0.02	< 0.001*	0.40 ± 0.03
Vitamin C	0.37 ± 0.31	0.13 ± 0.20	< 0.001*	0.25 ± 0.29
HHMAR	0.48 ± 0.23	0.33 ± 0.17	< 0.001*	0.40 ± 0.22

Ratio± SD
** significant at 0.005level*

Table 2. *HFIAS category results of study households in Iba. Iyam and Dalahican, June 2016, n=368*

HFIAS Category	Iba. Iyam (Urban)	Dalahican (Rural)	Total
Food Secure	12 (6.5)	4 (2.2)	16 (4.3)
Mildly food insecure	74 (40.2)	14 (7.6)	88 (23.9)
Moderately food insecure	61(33.2)	66 (35.9)	127 (34.5)
Severely food insecure	37 (20.1)	100 (54.3)	137 (37.2)
p value*		< 0.001	

**Pearson Chi-square*

Table 3. *Food security status of study households using HHMAR and HFIAS, June 2016, n=368*

	Iba. Iyam (n=184)	Dalahican (n=184)	Total n=368
HHMAR 0.50			
Above (food secure)	70 (38.0)	27(14.7)	97 (26.4)
Below (food insecure)	114 (62.0)	157 (85.3)	271(73.6)
HHMAR 0.70			
Above (food secure)	36 (19.6)	6 (3.3)	42(11.4)
Below (food insecure)	148 (80.4)	178 (96.7)	326(88.6)
HFIAS Group 1			
FS + mildly FI(food secure)	86 (46.7)	18 (9.8)	104(28.3)
Moderately FI + Severely FI(food insecure)	98 (53.3)	166 (90.2)	264(71.7)
HFIAS Group 2			
FS (food secure)	12 (6.5)	4 (2.2)	16(4.3)
Mildly FI + Moderately FI + Severely FI(food insecure)	172 (93.5)	180 (97.8)	352(95.7)

frequency(percentage)

Table 4. *Validity of HDDS based on HFIAS and HHMAR as reference standards, June 2016, n=368*

Reference standard	ROC analysis Area under the curve (AUC)*
HFIAS Group 1	0.701
HFIAS Group 2	0.618
HHMAR 0.50	0.743
HHMAR 0.70	0.738

AUC 0.9-1 = excellent indicator; 0.8-0.9= good indicator; 0.7-0.8= fair indicator; 0.6-0.7=poor indicator

observed that the most consumed food groups were the Filipino staples, fats and oils, meat, fish and seafood. A 100% consumption of starchy staples among all the households was obviously due to the fact that white rice is a part of the daily diet. This is also true for country as a whole. According to the 8th National Nutrition Survey, rice is the most consumed food item by Filipinos.

Mean score for fish and seafood were both high in the two barangays but relatively higher in Dalahican since it is a coastal community. On the other hand, consumption for the organ meat and flesh meat was higher in Iba. Iyam because these were readily available in nearby markets and most households purchase cooked meat-based viands in carinderias.

Results of the study are somehow consistent with the results of the 8th NNS [15]. When it comes to urban and rural differences in household dietary diversity, urban households had higher intake of meat and products, poultry, milk and milk products and beverages than their rural counterparts. On the other hand, rural households had higher intake of rice and products, corn and products, fish and products and vegetables.

Household Mean Adequacy Ratio

Household mean adequacy ratio of all the households was only 55%. This is significantly lower as compared to the 75% cut-off for a diet to be considered adequate. Protein NAR is slightly higher due to the usual consumption of protein-rich food groups such as meats and seafood. It could also be observed the very low NAR for Vitamin A and Vitamin C which may be attributed to the low consumption of fruits and vegetables. Low consumption of certain food groups resulting to low adequacies of some nutrients may be attributed to factors such as socio-economic status, food availability, and personal preferences.

In 8th NNS data, data showed that rice and rice products were the principal source of energy (55.3%), protein (36.7%), iron (30.7%), thiamin (34.2%), and niacin (42.8%). Aside from rice, protein in the Filipino diet was highly contributed by fish and products (19.4%), meat and products (13.8%), and poultry (7.4%). Vitamin A was contributed mainly by meat and products (25.4%), poultry (23.4%) and vegetables (14.8%). The highest contributor for calcium was fish and products (24.3%). Vitamin C was mainly supplied by vegetables (58.8%) and fruits (16.6%).

Household Food Insecurity Access Scale

HFIAS table showed that Iba. Iyam and Dalahican have significantly different HFIAS results. In Iba. Iyam, most of the households were classified as mildly food insecure and moderately food insecure. On the other hand, most of the households in Dalahican were classified as moderately food insecure and severely food insecure.

Higher proportion of food insecurity in Dalahican could be explained by the higher purchasing power of households in its urban counterpart, Iba. Iyam. The mean household income of Dalahican was significantly lower as compared to Iba Iyam. Since Dalahican is a coastal community, sources of income were mostly concentrated on fishing or fish-processing. On the other hand, since Iba. Iyam is an urban barangay, residents have more access to higher-paying jobs.

Prevalence of Food Insecurity

Based on the results, HHMAR 0.50 and HFIAS Group 1 were able to classify 73.6% and 71.7% food insecure households, respectively. HHMAR 0.70 and HFIAS Group 2 were more restrictive, thus classifying more food insecure households at 88.6% and 95.7%, respectively. Prevalence of food insecurity among the selected households as identified by the reference standards were unusually high, given that Lucena City is a highly-urbanized city. This is for the reason that although systematic sampling was used, the selected barangays were those identified as depressed areas. Test for normality was done using the Shapiro-Wilk test and the resulting curve was shown to be leaning more on the left, indicating that most of the selected households were of lower socio-economic status.

Validity of HDDS as food insecurity indicator

HHMAR is one of the measurement tools used as a reference standard in evaluating food insecurity at the micro level. In this study, results of spearman correlation show that HDDS is positively correlated with HHMAR at 0.001significance level. This means that HHMAR increases as HDDS increases. Similarly, individual NARs for energy, iron, Vitamin A, Riboflavin, Niacin and Vitamin C are positively correlated with HDDS at 0.001 level. A study in an urban west-african setting also showed positive association of the Index-Member HDDS and MAR using spearman correlation [17]. Another study on dietary diversity in relation to other household food security indicators also observed an inverse correlation between dietary diversity [18]. A study among South African children

have also shown a high correlation between Mean Adequacy Ratio (MAR) with Dietary Diversity Score [19].

HFIAS is a measurement tool which involves questions on experiences and coping mechanisms on hunger. Aside from HHMAR, HFIAS was also used as a reference standard to test whether HDDS could be a good indicator of food insecurity among vulnerable households. Results of the spearman correlation were able to observe a strong negative correlation between HDDS and HFIAS. An inverse association could be explained by higher HFIAS indicating food insecurity and high HDDS denoting a food secure household. A similar result was obtained by a study on dietary diversity in relation to other food security indicators, households with HDDS less than 4 had fewer assets, experienced more food shortages and had a higher HFIAS score[18].

The strong correlation of HDDS with both HHMAR and HFIAS was also reflected in the results of the ROC analysis. HDDS was generally shown to be a fairly good indicator of food insecurity when both were used as the reference standards. The main objective of this study is to assess if the HDDS is a valid tool for measuring food insecurity at the micro level. In order to achieve this, sensitivity and specificity were tested using ROC analysis to determine the most appropriate HDDS cut-off points to approximate food insecurity measurement.

The HDDS with the best combination of sensitivity and specificity levels was selected to identify as many food insecure households as really food insecure (high sensitivity), but at the same time being able to identify households which are food secure (high specificity). In the selection of the optimal cut-off score, it was considered that sensitivity and specificity must be above 50%. The decision on whether to prioritize a higher sensitivity or specificity depends on the purpose of the measurement tool and the prevalence of the outcome being measured. Based on the results of the study, a high prevalence of food insecurity in Lucena City. Since food insecure households could easily be detected, a cut-off score with higher sensitivity may be selected to maximize the potential to identify the households who are not food insecure. Since there was a high prevalence of food insecurity in Lucena City, HDDS 6 was selected as the best cut-off score. Thus, households with scores less than 6 would be classified as food insecure while those with scores equal to or higher than 6 would be classified as food secure when using HDDS as a measurement tool.

A study conducted in Bangladesh obtained a slightly lower mean HDDS of 4.9 but also showed association with other food insecurity indicators such as total food expenditures and total household expenditures. The findings of the study suggested that the HDDS score can serve as a useful tool for assessing food security status, particularly in situations where rapid assessments are undertaken following disasters or where it is impossible to administer lengthy questionnaires [8]. A study in Ghana looked into household food insecurity as a factor affecting the nutritional status of preschool children wherein results showed that low HDDS was significantly associated with chronic malnutrition [20]. Similarly, an evaluation study of DDS for assessment of micronutrient intake and food security in developing countries showed that DDS is an acceptable indicator of micronutrient intake [21].

Conclusion

HDDS was identified as a fair indicator of food insecurity at the micro level in this study, hence, it may be used as substitute or alternative for more complicated methods of food insecurity assessment such as HFIAS and HHMAR. This would be most useful during screening, monitoring, evaluation, and rapid assessments especially in resource poor settings. With this, interventions could be immediately given and sufficient amount of resources may be allocated to those who are at risk. Another rapid assessment tool with high specificity may be used in conjunction with the HDDS to minimize those who are falsely identifies as food insecure.

However, although HDDS was able to show a potential as a measurement tool for food insecurity, it should be considered that the results are only limited to Lucena City and to other cities/municipalities with similar characteristics.

In future studies, when HDDS will be used as a tool to measure food insecurity and resources are adequate, it may be prudent to use it in conjunction with other information pertaining to food access and conduct it in other types of communities such as urban-depressed, geographically isolated and depressed areas (GIDA), agro-ecological areas and conflict-affected areas to test the applicability of the tool. Seasonal variability may also be taken into consideration if time and budget allows by gathering data in varying seasons.

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