Correlates of household food insecurity and low dietary diversity in rural Cambodia

Running title: Correlates of food insecurity in rural Cambodia

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ABSTRACT

The objective of this study was to identify correlates of household food insecurity and poor dietary diversity in rural Cambodia. Trained interviewers administered a survey to 900 households in four rural districts of Prey Veng Province, Cambodia. The Household Food Insecurity Access Scale (HFIAS) and Household Dietary Diversity Score (HDDS) were used to assess household food insecurity and dietary diversity. Multivariate logistic regression models were constructed to identify independent correlates of household food insecurity and poor dietary diversity (HDDS ≤3). The mean ± SD HFIAS and HDDS scores were 5.3±3.9 and 4.7±1.6, respectively. The respective prevalences of mild, moderate, and severe food insecurity were 33%, 37%, and 12%; and 23% of households had an HDDS ≤3. In multivariate analyses, several indicators of socioeconomic status, and ownership of agricultural land were associated with household food security status, although the latter association lost its significance in models that adjusted for household income. Similarly, although ownership of agricultural and homestead land was initially associated with poorer dietary diversity, income mitigated these associations. The presence of electricity and vegetable production were the only other variables that were significantly associated with both outcomes. In this rural area of Cambodia, the prevalence of any degree of household food insecurity was very high and dietary diversity was generally low. Interventions to improve food security and dietary diversity should encompass income-generating activities and be targeted toward the poorest households.

Key words: household food security, dietary diversity, Cambodia

INTRODUCTION

The prevalence of maternal and child undernutrition in Cambodia is among the highest in the region. In 2010, 40% and 11% of children under five years of age were stunted and wasted, respectively, and 19% of women of child-bearing age were classified as thin.[1] Among subgroups of low socioeconomic status and those living in rural areas, levels are even higher. Poor dietary quality and household food insecurity, which is defined as the inability of the household to secure adequate food to meet the dietary needs of all members, are known risk factors for undernutrition,[2-7] particularly in infancy and early childhood when nutrient requirements are elevated in order to support optimal growth and development. In addition to nutritional status,

household food security and dietary diversity have been associated with several health outcomes. In rural Bangladesh, Saha and colleagues reported that better food security status was associated with improved infant feeding practices between 6 and 12 months of age,[8] and greater language comprehension and expression skills at 18 months of age.[9] Nanama et al also found that chronic food insecurity resulted in altered social cohesion, adverse psychological experiences, sleep and weight loss in northern Burkina Faso.[10] Most concerning, Campbell and colleagues reported that household food insecurity was independently associated with increased neonatal and under-five mortality in rural Indonesia.[11]

Despite the high burden of undernutrition and an acceptance of the important roles of food access and dietary quality, few researchers have examined household food security or dietary diversity in rural parts of Cambodia. Knowledge of the various factors that are associated with these conditions is critically important, as it will enable interventions to be designed and targeted more effectively, which will ultimately improve nutrition and health outcomes. Given the dearth of evidence from Southeast Asia and the lack of an existing conceptual framework, we conducted an exploratory analysis to identify correlates of household food insecurity and poor dietary diversity in rural families in Prey Veng province of Cambodia.

MATERIALS AND METHODS

Study population

Data used in this analysis were obtained as part of a baseline survey of 900 households in four districts (Mesang, Kamchay Mear, Svay Anthor, and Bar Phnom) of Cambodia's Prey Veng province. The survey was conducted prior to implementation of a study that aimed to evaluate a community-based intervention to improve household food security and nutrition outcomes through an integrated homestead food production model using an environmentally sustainable approach. A listing of all villages in the province was obtained and then 90 villages, which were not already participating in any development projects, were randomly selected. Within each village, 10 households were randomly selected from those that met the following eligibility criteria: i) an adult female respondent was available; ii) household fell within the "poor" category in terms of community wealth rankings; iii) household had access to land (including homestead land) for agriculture cultivation; iv) household had sufficient access to labor to undertake the

homestead production activities; v) household had at least one child under five years of age; vi) household had land suitable for a small pond.

Survey administration

Between July 4th and 19th, 2012, three trained survey teams administered the survey to the adult female respondent in each household. Each survey team consisted of one field supervisor, one dietary recall enumerator, four survey enumerators, and two technicians who measured anthropometry and hemoglobin concentrations of mothers and children. The survey consisted of eight modules: household information; water and sanitation; homestead food production; food consumption; maternal nutrition and health; knowledge and attitudes; household food security; and anthropometry and hemoglobin. All anthropometric measurements were performed in accordance with the Food and Nutrition Technical Assistance (FANTA) Anthropometric Indicators Measurement Guide.[12]

Outcome assessment

Household food security status was assessed using version three of FANTA's Household Food Insecurity Access Scale (HFIAS) measurement tool,[13] which has been pretested and adapted for use in Cambodia. The HFIAS is comprised of a set of nine occurrence questions, which were asked with a recall period of four weeks. If the respondent answered "yes" to an occurrence question, a follow-up question was asked to determine whether the condition occurred rarely (once or twice), sometimes (three to ten times) or often (more than ten times) in the past four weeks. Based on the respondent's reply to each question, the HFIAS score was calculated, which is a continuous measure of the degree of food insecurity in the household in the past four weeks. Finally, each household was classified into one of four categories: food secure, and mildly, moderately, or severely food insecure. For the purposes of this analysis, we combined all levels of food insecurity to create a binary variable that indicated food security vs. any degree of food insecurity.

Household dietary diversity was assessed using version two of FANTA's Household Dietary Diversity Score (HDDS) for measurement of household food access.[14] The HDDS is a continuous score that can range from 0 to 12 based on whether the household consumed each of the following 12 food groups: cereals; roots and tubers; vegetables; fruits; meat, poultry, offal; eggs;

fish and seafood; pulses/legumes/nuts; milk and milk products; oil/fats; sugar/honey; miscellaneous. Since there are no prescribed cut-offs to define a household's dietary diversity status, we used an HDDS score of ≤3 to define a low dietary diversity, which was approximately equal to the lowest quartile.

Statistical analyses

Descriptive statistics were used to summarize the background characteristics of the study population. We also used a chi-square test to assess the degree of concordance between a household's food security and dietary diversity status. Odds ratios (OR) and 95% confidence intervals (CI) for each of the potential correlates were obtained from separate logistic regression models, with household food insecurity and low dietary diversity as separate outcomes. We first ran a series of univariate models between each potential correlate and each outcome. Then we constructed multivariate models that included all correlates that were significant at *p*<0.05 in the univariate analysis. A priori, we decided to exclude household income from the primary analysis since it is arguably on the causal pathway between many socio-demographic variables and both outcomes. However, we conducted sensitivity analyses that included household income in both multivariate models and assessed its impact on the effect of the other correlates.

All analyses were performed using SAS version 9.3 (SAS Institute, Cary, NC, USA). This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the Cambodian National Ethics Committee for Health Research and the University of British Columbia Clinical Research Ethics Board. Written informed consent was obtained from all subjects.

RESULTS

Study population

A total of 900 households were surveyed in four districts of Cambodia's Prey Veng province. Respondents' mean±SD age and parity were 29.6±6.5 years and 2.3±1.6, respectively. Just over one-fifth of respondents had completed secondary school (Table 1). The vast majority of respondents had worked in the past seven days with rice or crop farming being the predominant occupation. More than half of homes had walls that were constructed out of temporary materials such as bamboo, grass or leaves and virtually all households used wood as the primary fuel for

cooking. The amount of agricultural land and homestead land owned was variable, but averaged 75313 m^2 and 1114 m^2, respectively. Nearly 90% of households owned chickens or ducks, which was more common than ownership of a fish pond, cows/buffalo, or pigs.

Correlates of Household Food Insecurity

The mean±SD HFIAS score was 5.2±3.9. The respective prevalences of household food security, mild food insecurity, moderate food insecurity, and severe food insecurity according to the HFIAS thresholds were 18.4%, 32.8%, 37.0%, and 11.8%. In the multivariate analysis, respondent education was inversely associated with the odds of household food insecurity (*p* for trend=0.04) (Table 2). Occupation also influenced the household's food security status. Rice/crop farmers, small business or store-owners, and 'other' types of workers were, respectively, 45%, 74% and 65% less likely to be food insecure in comparison to wage laborers (*p*=0.02). Several household and socioeconomic characteristics were also related to the likelihood of food insecurity. In homes with walls made of permanent materials, families were half as likely to be food insecure than those in which the homes were made of temporary materials (AOR=0.52; 95% CI=0.35, 0.77; *p*=0.0001). Similarly, the adjusted odds of food insecurity was nearly seventy percent lower in households that used any other fuel besides wood for cooking (AOR=0.31; 95% CI=0.11, 0.86; *p*=0.03) and more than fifty percent lower in households that had electricity (AOR=0.44; 95% CI=0.24, 0.80; *p*=0.008). The adjusted odds of food insecurity among households in which adult members usually defecated in a river, pond, bush, or open field was 1.67 times that of households where adult members defecated in an open or closed latrine (95% CI=1.11 2.53, *p*=0.01). Ownership of household possessions was inversely associated with the odds of household food insecurity (*p* for trend=0.002). Although households in the third and fourth quartiles of agricultural land ownership had a lower odds of household food insecurity (AOR=0.71 and 0.53, respectively) in comparison to households in the lowest quartile, the amount of homestead land owned by the household was not associated with its food security status. However, the quantity of vegetables produced in the past two months was inversely associated with the odds of household food insecurity (*p* for trend=0.01).

In a sensitivity analysis that included household income in the multivariate model, the adjusted odds of food insecurity was reduced in wealthier households (AOR of the wealthiest quartile vs. poorest quartile = 0.44; *p* for trend=0.0009). In these models, the previous associations with the

amount of agricultural land and number of household possessions owned by the household lost their significance.

Correlates of low dietary diversity

The mean±SD HDDS score was 4.7±1.6. The maximum HDDS score was 10 and we used a cut-off of ≤ 3 to define low dietary diversity. Of the 209 (23.2%) households that fell into this category of low dietary diversity, 181(86.6%) were food insecure. As with food insecurity, the adjusted odds of low dietary diversity were lower among households that had electricity in comparison to those who did not (AOR=0.31 (95% CI=0.13, 0.76; *p*=0.01). Similarly, the amount of agricultural land owned by the household and quantity of vegetables produced in the past two months were inversely associated with the odds of low dietary diversity (*p* for trend=0.02 and 0.0007, respectively). In addition, households that owned a greater amount of homestead land were less likely to have a low dietary diversity (*p* for trend=0.03). When household income was added to the multivariate model, it was inversely associated with the odds of low dietary diversity (AOR of the wealthiest quartile vs. poorest quartile = 0.62; *p* for trend=0.007, and the previous associations with ownership of agricultural land and homestead land were both attenuated considerably and lost their statistical significance.

DISCUSSION

In this study, we have shown that household food insecurity was a common occurrence in Prey Veng, Cambodia, where more than 80% of rural households surveyed were classified as mildly, moderately or severely food insecure. Household dietary diversity was similarly limited as reflected in the mean HDDS of 4.7 out of a possible 12. In our multivariate analysis of correlates, we revealed that indicators of socioeconomic status were strongly associated with household food security. Although our initial analysis indicated that the amount of agricultural land owned by the household was inversely associated with the odds of food insecurity, the addition of income to the multivariate model eliminated this effect. There were fewer significant socioeconomic correlates of household dietary diversity; however, income similarly mitigated the initial associations with agricultural and homestead land ownership. Besides income, the only other variables that were significantly associated with both outcomes were the presence of electricity

and the amount of vegetables produced by the household in the previous two months. To our knowledge, our findings on this topic are the first to be reported from this area of Southeast Asia.

Methodological differences make it challenging to directly compare our results with those from other studies both within and outside the region. However, similar studies that also employed the HFIAS reported slightly lower prevalences of household food insecurity of 69% in the Kailali district of Nepal in 2009,[15] and 78% in Ougadougou, Burkina Faso during the food price crisis in 2008.[16] The food security status of our study population also appeared more tenuous than the situation described in rural Indonesia where the mean household food insecurity score on an adapted version of the US Household Food Security Survey Module was 2.2 (out of a maximum score of 9 with higher scores indicate a greater degree of food insecurity).[11] In terms of household dietary diversity, our findings are comparable to those from Kilosa District, Tanzania where the mean HDDS was 4.[6] The household dietary diversity of our study population can also be compared to a study involving nearly 200,000 predominantly male-headed households in Bangladesh where the mean HDDS score was 10.3 out of a possible 49 based on the number of non-grain food groups the household consumed in the previous week.[17] In a different study limited to Bangladeshi children, Rah et al. defined low dietary diversity according to scores in the bottom tertile, which equated to cut-offs of <7 out of 63 for children 6-11 months of age, <15 for children 12-23 months of age, and <16 for children 24-59 months of age.[4] Interestingly, data from Cambodia's 2000 Demographic and Health Survey were included in Arimond and Ruel's depiction of child dietary diversity in eleven countries. At this time, the mean child dietary diversity score at the national-level was 2.8 on a scale ranging from 0 to 7 and 44% of children had low dietary diversity, which was defined as 0-2 food groups consumed on three or more days in the previous week.[5] Our study assessed dietary diversity at the household level and was restricted to one province in Cambodia, so it is not possible to draw inferences about changes in dietary patterns; nonetheless, our results add an additional reference point to better understand food access and consumption patterns in the country.

Although several studies have demonstrated that a household's food security status and dietary diversity are related,[18,19] our study is unique in the sense that it examined each phenomenon separately and identified some shared, but also some distinct determinants. Agricultural and homestead land ownership became non-significant after the inclusion of income in the model, indicating that richer households may be able to purchase a greater quantity and diversity of

foods. In Bangladesh, Thorne-Lyman et al have reported positive, significant correlations between dietary diversity and per capita total food and non-grain food expenditure, which are closely linked to income.[17] These authors also noted that dietary diversity was associated with indicators of socioeconomic status such as parental education, household size, area of main dwelling, and cultivable land owned by the household; however, these correlates were not examined in a multivariate model. Our findings are also similar to those reported from Mozambique where the only variables that significantly impacted calorie availability were household expenditure (reflecting household income), household size and composition, seasonality, and location.[20] In an earlier study from a rural area of northern Mozambique affected by war, Tschirley and Weber treated income and calorie consumption as separate outcomes, but demonstrated that land holdings were highly correlated with both.[21]

We observed a significant, negative association between the respondent's level of education and the odds of food insecurity in the original multivariate model and in the sensitivity analysis that controlled for income. Although a similar trend could be observed with dietary diversity, it was not statistically significant. In a multivariate analysis of data from Bangladesh, increased maternal education was protective against poor dietary diversity in children under five.[4] Clausen et al. also observed greater dietary diversity among elderly people in Botswana that had higher education levels.[22] However, in the aforementioned study from Mozambique, level of education did not impact calorie availability either when income was included or excluded from the multivariate model. It appears that the association between education, food security and dietary diversity are mixed.

There are a number of limitations to our study. Although our analysis modeled both household food insecurity and dietary diversity as outcomes, it did not include actual dietary intake of individual household members. Such data would allow a more comprehensive assessment of dietary quality and quantity and also permits the identification of differences in intra-household allocation and consumption of food. Since the adult female responded to the dietary diversity questions on behalf of the entire household, it is possible that foods consumed by other household members outside the home were not captured. That being said, several investigations have demonstrated that indicators of dietary diversity accurately predict micronutrient intake and adequacy in women and children.[23-25] Nonetheless, we are currently pursuing additional analyses to relate household food security and dietary diversity to dietary recall data and biochemical

markers of micronutrient status that were obtained from the study participants. The generalizability of our findings is also limited in a number of ways. In order to be eligible to participate in the larger study, all households were required to have some sort of access to land, so they may not represent the poorest of the poor. Furthermore, all participants resided in four rural districts of Prey Veng province, so it is not possible to generalize our findings to other parts of Cambodia. Finally, our analysis is cross-sectional in nature, which not only prohibited us from making conclusions about causation, but also prevented us from exploring the role of time-varying variables such as seasonality. We should note that our survey was administered mid-way through the rainy season, which is before the beginning of the lean season, so it is quite possible that food security conditions deteriorated further in the proceeding months.

In conclusion, we observed a high prevalence of household food insecurity and generally low dietary diversity in this rural area of Cambodia's Prey Veng province. Household income was strongly associated with both outcomes, likely reflecting the enhanced ability of richer households to purchase a greater quantity and diversity of food. Interventions to promote food security may be most effective if they are targeted toward the poorest households and include income-generating activities outside the agricultural sector.

CONFLICT OF INTEREST AND FUNDING DISCLOSURE

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Table 1. Background characteristics of the study population

	Mean ± SD or N (%)
Household Demographics	
Respondent's age, years	29.6 ± 6.5
Parity	2.3 ± 1.6
Highest level of schooling completed by respondent	
None	165 (18.3)
Primary school	543 (60.3)
Lower/upper secondary school or other training	192 (21.3)
Highest level of schooling completed by the youngest child's father	
None	73 (8.1)
Primary school	348 (38.7)
Lower secondary school	268 (29.8)
Upper secondary school, higher education or other training	71 (7.9)
Number of people living in the household	4.6 ± 1.5
Employment and Income	
Respondent has worked in the past 7 days	387 (92.8)
Type of work performed by respondent or other household member	
Wage laborer (working for others)	100 (11.1)
Rice/crop farmer	693 (77.0)
Small business or store	46 (5.1)
Other	61 (6.8)
Money earned from the primary occupation in the previous year, USD	268 ± 442
Housing Characteristics	
Main material of the walls of the house [a]	
Temporary materials	506 (56.2)
Permanent materials	394 (43.8)
Main fuel source for cooking	
Wood	876 (97.3)
Any other fuel (charcoal, electricity, natural gas, etc.)	24 (2.67)
Household has electricity	68 (7.56)
Main source of drinking water	
Hand pump	859 (95.4)
Other	41 (4.6)
Number of household possessions [b]	
0	155 (17.2)
1-2	622 (69.1)
3-6	123 (13.7)
Agriculture, Livestock and Food Production	
Agricultural land owned by the household, m^2	7531 ± 6885
Homestead land owned by the household, m^2	1114 ± 1230
Household owns a fish pond	468 (52.0)
Household owns cows/buffalo	467 (51.9)
Household owns pigs	397 (44.1)
Household owns chickens or ducks	795 (88.3)

[a] Permanent material include: galvanized iron/aluminum sheet, asbestos cement sheets, tile (clay or wooden), brick etc.; Temporary materials include: bamboo, thatch/grass, hay/leaves, salvaged materials etc.
[b] From a list that includes: watch, bicycle or cyclo, motorcycle or motor scooter, motorcycle cart, oxcart or horse cart, car or truck or van, CD/DVD player, boat

Table 2. Correlates of household food insecurity

	N	Events	Univariate		Multivariate	
			OR (95% CI)	*p*	OR (95% CI)	*p*
Household Demographics						
Respondent's age, years						
≤25	272	216	1.00	0.002	1.00	0.43
26-30	282	217	0.87 (0.58, 1.30)		0.79 (0.48, 1.31)	
31-35	195	163	1.32 (0.82, 2.13)		0.92 (0.49, 1.73)	
≥36	151	138	2.75 (1.45, 5.22)		1.60 (0.68, 3.77)	
Parity						
1	316	251	1.00	0.03	1.00	0.91
2	435	351	1.08 (0.75, 1.55)		0.89 (0.55, 1.43)	
≥4	149	132	2.01 (1.13, 3.57)		1.11 (0.50, 2.47)	
Highest level of schooling completed by respondent						
None	165	154	1.00	<0.0001	1.00	0.04
Primary school	543	437	0.29 (0.15, 0.56)		0.37 (0.18, 0.76)	
Lower/upper secondary school or other training	192	143	0.21 (0.10, 0.42)		0.35 (0.15, 0.78)	
Highest level of schooling completed by youngest child's father						
None	73	67	1.00	<0.0001	1.00	0.06
Primary school	348	298	0.84 (0.31, 2.25)		0.77 (0.29, 2.06)	
Lower secondary school	268	210	0.82 (0.30, 2.24)		0.69 (0.26, 1.86)	
Upper secondary school, higher education or other training	71	48	0.52 (0.17, 1.60)		0.43 (0.14, 1.33)	
Number of people living in the household						
≤4	476	394	1.00	0.09		
5-6	330	271	0.96 (0.66, 1.38)			
≥7	94	69	0.57 (0.34, 0.96)			
Employment and Income						
Respondent has worked in the past 7 days						
No	417	325	1.00	0.01	1.00	0.46
Yes	483	409	1.57 (1.12, 2.20)		1.42 (0.56, 3.60)	
Type of work performed by respondent or other household member						
Wage laborer (working for others)	100	92	1.00	0.002	1.00	0.02
Rice/crop farmer	693	564	0.38 (0.18, 0.80)		0.55 (0.24, 1.27)	
Small business or store	46	33	0.22 (0.08, 0.58)		0.26 (0.09, 0.79)	
Other	61	45	0.25 (0.10, 0.61)		0.35 (0.13, 1.00)	
Money earned from the primary occupation in the previous year, USD						
0	286	251	1.00	<0.0001	-----	
1-120	164	150	1.49 (0.78, 2.87)			
121- 359	230	192	0.71 (0.43, 1.16)			
≥360	220	141	0.25 (0.16, 0.39)			
Person making decisions about major household purchases						
Respondent	216	174	1.00			
Husband/Partner	78	66	1.33 (0.66, 2.68)	0.43		
Respondent and husband/partner jointly	568	466	1.10 (0.74, 1.64)	0.63		
Someone else	38	28	0.68 (0.31, 1.50)	0.34		
Housing Characteristics						
Main material of the walls of the house [a]						
Temporary materials	506	447	1.00	<0.0001	1.00	0.001
Permanent materials	394	287	0.35 (0.25, 0.50)		0.52 (0.35, 0.77)	
Main fuel source for cooking						
Wood	876	721	1.00	0.001	1.00	0.03
Any other fuel (charcoal, electricity, natural gas, etc.)	24	13	0.25 (0.11, 0.58)		0.31 (0.11, 0.86)	
Household has electricity						
No	832	692	1.00	<0.0001	1.00	0.008
Yes	68	42	0.33 (0.19, 0.55)		0.44 (0.24, 0.80)	
Main source of drinking water						

Hand pump	859	600	1.00	0.82		
Other	41	34	1.10 (0.48, 2.53)			
Place of usual defecation for adult household members						
Open or closed latrine	247	176	1.00	<0.0001	1.00	0.01
River/pond/bush/open field	653	558	2.37 (1.67, 3.37)		1.67 (1.11, 2.53)	
Number of household possessions [b]						
None	155	139	1.00	<0.0001	1.00	0.002
1-2	622	523	0.61 (0.35, 1.07)		0.90 (0.47, 1.71)	
3-6	123	72	0.16 (0.09, 0.31)		0.39 (0.19, 0.84)	
Agriculture and Food Production						
Amount of agricultural land owned by the household						
Q1 (0-2,999 m^2)	236	207	1.00	<0.0001	1.00	0.009
Q2 (3,000-4,999 m^2)	154	138	1.21 (0.63, 2.31)		1.56 (0.75, 3.23)	
Q3 (5,000-9,999m^2)	246	199	0.59 (0.36, 0.98)		0.71 (0.40, 1.28)	
Q4 (≥10,000m^2)	264	190	0.36 (0.22, 0.58)		0.53 (0.30, 0.96)	
Amount of homestead land owned by the household						
Q1 (0-449 m^2)	269	232	1.00	0.001	1.00	0.41
Q2 (3450-799 m^2)	202	170	0.85 (0.51, 1.42)		0.87 (0.49, 1.57)	
Q3 (800-1,399m^2)	218	173	0.61 (0.38, 0.99)		0.81 (0.49, 1.28)	
Q4 (≥1,400m^2)	211	159	0.49 (0.31, 0.78)		0.91 (0.51, 1.63)	
Number of different types of vegetables currently grown in the garden						
0	166	134	1.00	0.77		
1-2	176	149	1.32 (0.75, 2.31)			
3-5	383	309	1.00 (0.63, 1.58)			
≥6	175	142	1.03 (0.60, 1.76)			
Quantity of vegetables produced in the past 2 months (kg)						
0	152	130	1.00	0.0003	1.00	0.01
1-4	202	180	1.71 (1.00, 2.89)		1.52 (0.74, 3.12)	
5-9	153	122	0.82 (0.50, 1.34)		0.78 (0.39, 1.56)	
≥10	226	168	0.60 (0.40, 0.92)		0.61 (0.32, 1.16)	
How much of the home garden vegetables is consumed						
Most	524	422	1.00	0.57		
Half	24	19	0.92 (0.34, 2.52)			
Very little	34	29	1.40 (0.53, 3.71)			
Number of different type of fruits produced in the last two months						
0	105	92	1.00	0.04	1.00	0.72
1-2	253	211	0.71 (0.36, 1.39)		0.78 (0.37, 1.64)	
3-4	278	220	0.54 (0.28, 1.03)		0.91 (0.43, 1.92)	
≥5	98	77	0.52 (0.24, 1.10)		1.01 (0.41, 2.44)	
Household owns a fish pond						
No	432	361	1.00	0.14		
Yes	468	373	0.77 (0.55, 1.09)			
Number of cows/buffalo owned						
0	433	365	1.00	0.02	1.00	
1-2	259	288	0.76 (0.52, 1.09)		0.79 (0.51, 1.23)	0.37
≥3	108	81	0.56 (0.34, 0.93)		0.72 (0.38, 1.34)	
Number of pigs owned						
0	503	429	1.00	0.0002	1.00	0.42
1-2	251	200	0.68 (0.46, 1.00)		1.00 (0.63, 1.60)	
≥3	146	105	0.44 (0.29, 0.68)		0.84 (0.49, 1.43)	
Own chickens or ducks						
No	105	88	1.00	0.53		
Yes	795	646	0.84 (0.48, 1.45)			

[a] Permanent material include: galvanized iron/aluminum sheet, asbestos cement sheets, tile (clay or wooden), brick etc.; Temporary materials include: bamboo, thatch/grass, hay/leaves, salvaged materials etc.
[b] From a list that includes: watch, bicycle or cyclo, motorcycle or motor scooter, motorcycle cart, oxcart or horse cart, car or truck or van, CD/DVD player, boat

Table 3. Correlates of low household dietary diversity

	N	Events	Univariate		Multivariate	
			OR (95% CI)	*p*	OR (95% CI)	*p*
Household Demographics						
Respondent's age, years						
≤25	272	54	1.00	0.21		
26-30	282	72	1.38 (0.93, 2.07)			
31-35	195	43	1.14 (0.73, 1.79)			
≥36	151	40	1.46 (0.91, 2.32)			
Parity						
1	316	70	1.00	0.27		
2	435	98	1.02 (0.72, 1.45)			
≥4	149	41	1.33 (0.85, 2.09)			
Highest level of schooling completed by respondent	165	52	1.00	0.004	1.00	
None	543	122	0.63 (0.43, 0.93)		0.77 (0.51, 1.16)	0.07
Primary school	192	35	0.48 (0.30, 0.79)		0.61 (0.36, 1.02)	
Lower/upper secondary school or other training						
Highest level of schooling completed by youngest child's father						
None	73	18	1.00	0.19		
Primary school	348	85	0.99 (0.55, 1.77)			
Lower secondary school	268	51	0.72 (0.39, 1.33)			
Upper secondary school, higher education or other training	71	15	0.82 (0.38, 1.79)			
Number of people living in the household						
≤4	476	116	1.00	0.61		
5-6	330	70	0.84 (0.60, 1.68)			
≥7	94	23	1.01 (0.60, 1.68)			
Employment and Income						
Respondent has worked in the past 7 days						
No	417	99	1.00	0.73		
Yes	483	110	0.95 (0.60, 1.29)			
Type of work performed by respondent or other household member						
Wage laborer (working for others)	1006	32	1.00	0.65		
Rice/crop farmer	93	150	0.59 (0.37, 0.93)			
Small business or store	46	10	0.59 (0.26, 1.34)			
Other	61	17	0.82 (0.41, 1.65)			
Money earned from the primary occupation in the previous year, USD						
0	286	86	1.00	<0.0001	---	
1-120	164	46	0.91 (0.59, 1.39)			
121- 359	230	42	0.52 (0.34, 0.79)			
≥360	220	35	0.44 (0.28, 0.68)			
Person making decisions about major household purchases						
Respondent	216	45	1.00			
Husband/Partner	78	20	1.31 (0.72, 2.40)	0.38		
Respondent &and husband/partner jointly	568	136	1.20 (0.82, 1.75)	0.36		
Someone else	38	8	1.01 (0.44, 2.36)	0.98		
Housing Characteristics						
Main material of the walls of the house [a]						
Temporary materials	506	132	1.00	0.02	1.00	0.24
Permanent materials	394	77	0.69 (0.50, 0.95)		0.81 (0.58, 1.15)	
Main fuel source for cooking						
Wood			1.00	0.83		
Any other fuel (charcoal, electricity, natural gas, etc.)	876 / 24	203 / 6	1.11 (0.43 1.81)			
Household has electricity						
No	832	203	1.00	0.006	1.00	0.01
Yes	68	6	0.30 (0.13, 0.70)		0.31 (0.13, 0.76)	
Main source of drinking water						

Hand pump	859	199	1.00	0.86		
Other	41	10	1.07 (0.52, 2.22)			
Place of usual defecation for adult household members						
Open or closed latrine	247	49	1.00			
River/pond/bush/open field	653	160	1.31 (0.92, 1.88)			
Number of household possessions [b]						
None	155	44	1.00	0.006	1.00	0.56
1-2	62	148	0.79 (0.53, 1.17)		1.07 (0.70, 1.63)	
3-6	123	17	0.41 (0.22, 0.75)		0.76 (0.38, 1.49)	
Agriculture and Food Production						
Amount of agricultural land owned by the household						
Q1 (0-2,999 m^2)	236	68	1.00	0.0002	1.00	0.02
Q2 (3,000-4,999 m^2)	154	31	0.90 (0.57, 1.41)		0.83 (0.51, 1.34)	
Q3 (5,000-9,999m^2)	246	63	0.85 (0.57, 1.27)		0.95 (0.62, 1.45)	
Q4 (≥10,000m^2)	264	37	0.40 (0.26, 0.63)		0.51 (0.31, 0.82)	
Amount of homestead land owned by the household						
Q1 (0-449 m^2)	269	79	1.00	0.0002	1.00	0.03
Q2 (3450-799 m^2)	202	53	0.86 (0.57, 1.29)		0.93 (0.60, 1.43)	
Q3 (800-1,399m^2)	218	43	0.59 (0.39, 0.90)		0.71 (0.45, 1.12)	
Q4 (≥1,400m^2)	211	34	0.46 (0.29, 0.73)		0.62 (0.38, 1.02)	
Quantity of vegetables produced in the past 2 months (kg)						
0	152	59	1.00	<0.0001	1.00	0.0007
1-4	202	39	0.49 (0.32, 0.74)		0.36 (0.22, 0.60)	
5-9	153	28	0.46 (0.29, 0.73)		0.40 (0.23, 0.70)	
≥10	226	37	0.40 (0.26, 0.61)		0.36 (0.21, 0.61)	
How much of the home garden vegetables is consumed						
Most	524	90	1.00	0.07		
Half	24	3	0.69 (0.20, 2.35)			
Very little	34	11	2.31 (1.09, 4.90)			
Number of different type of fruits produced in the last two months						
0	105	30	1.00	0.03	1.00	0.81
1-2	253	57	0.73 (0.43, 1.22)		0.90 (0.52, 1.55)	
3-4	278	62	0.72 (0.43, 1.19)		1.16 (0.66, 2.04)	
≥5	98	14	0.42 (0.21, 0.85)		0.81 (0.37, 1.74)	
Household owns a fish pond						
No	432	111	1.00	0.09		
Yes	468	98	0.77 (0.56, 1.04)			
Number of cows/buffalo owned						
0	433	109	1.00	0.07		
1-2	359	82	0.88 (0.63, 1.22)			
≥3	108	18	0.59 (0.34, 1.03)			
Number of pigs owned						
0	503	127	1.00	0.09		
1-2	251	54	0.81 (0.57, 1.67)			
≥3	146	28	0.70 (0.44, 1.11)			
Own chickens or ducks						
No	105	31	1.00	0.11		
Yes	795	178	0.69 (0.44, 1.08)			

[a] Permanent material include: galvanized iron/aluminum sheet, asbestos cement sheets, tile (clay or wooden), brick etc.; Temporary materials include: bamboo, thatch/grass, hay/leaves, salvaged materials etc.
[b] From a list that includes: watch, bicycle or cyclo, motorcycle or motor scooter, motorcycle cart, oxcart or horse cart, car or truck or van, CD/DVD player, boat