FACTORS ASSOCIATED WITH HOUSEHOLD FOOD INSECURITY IN THE SANTA ROSA SUB-WATERSHED AREA OF LAGUNA LAKE WATERSHED, PHILIPPINES

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Abstract. Given the relatively high prevalence of household food insecurity (72.7%) in the Philippines in 2007, it is worthwhile to determine factors associated with household food insecurity to identify vulnerable households, and streamline interventions. This study aims to determine the association between each of the following factors with household food insecurity: occupation of the household head, household size, and adoption of food-related and non-food related coping strategies in instances of food shortage. A cross-sectional analytic study was conducted on 383 randomly-selected households in the Santa Rosa sub-watershed area of Laguna Lake watershed in the Philippines using a self-administered questionnaire. The association of each exposure variable with household food insecurity was estimated by fitting a multiple logistic regression model using backward elimination. Significant confounding was assessed using the change-in-estimate criterion. Multivariate analyses show adoption of food-related (OR = 9.45; 95% CI: 5.63-15.85; $p < 0.001$) and non-food related (OR = 11.48; 95% CI: 6.16-21.40; $p < 0.001$) coping strategies during instances of food shortage were strongly associated with household food insecurity. In addition, the occupation of the household head and household size were found to be associated with household food insecurity; however, the observed associations were statistically insignificant. The direct relationship between coping strategies and food insecurity warrants a shift from merely coping to adapting in instances of food shortage. Such shift can be in the form ensuring that members of households are gainfully employed, or have disposable assets that can protect them sustainably during food shocks.

Keywords: household food insecurity, lake sub-watershed, Philippines

INTRODUCTION

Food security is access by all people at all times to enough food for an active,

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healthy life. It includes, at a minimum, the ready availability of nutritionally-adequate and safe food and an assured ability to acquire acceptable food in a socially-acceptable manner (Bickel *et al*, 2000). In contrast, food insecurity exists when individuals do not, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and preferences for an active and healthy life. In the

Philippines, results from the 7th National Nutrition Survey in 2008 indicate that the prevalence of household food insecurity is at 72.7% (Food and Nutrition Research Institute-Philippines, 2009). While several international studies have determined factors associated with household food insecurity (Nolan *et al*, 2006; Beaumier and Ford, 2010; Coleman-Jensen *et al*, 2011), there seems to be a paucity of researches that examine these factors in the local setting. In addition, determining factors associated with household food insecurity can help identify vulnerable households, and streamline interventions that mitigate food insecurity.

The objective of the study is to determine factors associated with household food insecurity in the Santa Rosa sub-watershed area of the Laguna Lake watershed in the Philippines. Specifically, this study aims to determine the association between the following factors with household food insecurity: occupation of the household head, household size, and adoption of food-related and non-food related coping strategies in instances of food shortage.

MATERIALS AND METHODS

The study utilized a cross-sectional, analytic design. Study and sampling populations consisted of all households in the Santa Rosa sub-watershed area, which included some barangays of Santa Rosa City, Binan City, Cabuyao City in the Province of Laguna, and the Municipality of Silang in the Province of Cavite. In January 2014, a total of 383 randomly-selected households in the sub-watershed area were asked to participate in a survey. Households were identified by systematic sampling with satellite images (obtained from Google Earth™) of

the sub-watershed as sampling frame. The geographic positioning system (GPS) co-ordinates of selected households obtained from satellite images were then used in identifying households on-site through the use of a hand-held GPS camera. The household head or the primary caregiver in the absence of the household head of selected households were asked to answer a self-administered questionnaire (SAQ). The SAQ contained items that assessed for household food insecurity in the previous three months to the survey as well as the independent (*ie*, exposure and confounder) variables of interest. Items on household food insecurity and on the adoption of food-related and non-food-related coping strategies in instances of food shortage were directly lifted from the tool used by the Philippine Food and Nutrition Research Institute (FNRI) in the 7th National Nutrition Survey in 2008 (Food and Nutrition Research Institute-Philippines, 2009).

STATA version 12 (College Station, TX) was used in crude and multivariate analyses, which collectively aimed to develop four models that relate each exposure of interest (*ie*, occupation of the household head, household size, adoption of food-related coping strategies in instances of food shortage, and adoption of non-food-related coping strategies in instances of food shortage) with household food insecurity. Crude analyses were used to screen confounders (*ie*, identified from the literature review) for each model. A variable was a potential confounder if the *p*-value for the test of association is ≤ 0.25. Confounders found to be significantly associated with household food insecurity were then fitted in a multiple logistic regression model that related a specific exposure of interest with household food insecurity (*ie*, full model).

Model building was then performed by sequentially deleting the confounder with the highest *p*-value based on the Wald statistic in the full model. Comparison of the full and the reduced model (*ie*, model that remains with each sequential deletion of the confounder) was performed using the change in estimate criterion [*ie*, change in estimate = $(OR_{full model} - OR_{reduced model}) / OR_{full model}$] to assess for significant confounding. A change-in-estimate ≥ 10% was considered a sufficient distortion of the odds ratio, implying that the variable must be retained in the model. This process was continued until none of the variables could be eliminated based on the set criteria.

Each of the four final models contained the exposure variable of interest and significant confounders, and was used in estimating the relationship between the exposure variable of interest and household food insecurity. The logistic regression models can be transformed into the logit of P as follows:

$$logit (P) = \beta_0 + \beta_1 E_1 + \beta_2 X_1 + \beta_3 X_2 \ldots + \beta_i X_i$$

where: logit (P) = logit of the model, E_1 = exposure variables of interest, X_1, X_2… X_i = significant confounders, β = logistic regression coefficient.

The study was approved by the Ethics Review Board of the National Institutes of Health, University of the Philippines Manila.

RESULTS

The prevalence of household food insecurity in the Santa Rosa sub-watershed area in the preceding three months to the survey (October to December 2013) is estimated at 35% (95% CI: 30.35-39.93). As shown in Table 1, only 23.9% of household heads were engaged in either fishing or farming or both. Majority of household heads were males (81.0%) and were on the average 45.91 ± 12.59 years old. Close to 73% of household heads were at most high school graduates. On the other hand, spouses of household heads were on the average 42.11 ± 12.66 years old, and majority were at most high school graduates (56.7%).

The average size of selected households was at 5 ± 2 persons, while majority (75.7%) were at or above the poverty threshold. Close to 40% of households adopt food-related coping strategies (*ie*, relying on less preferred and less expensive foods; borrowing food from neighbors /relatives/friends; purchasing food on credit; eating wild foods or harvesting immature crops; reducing the portion sizes of the meal; reducing the number of meals consumed in a day; restricting consumption for adults so that children have enough; skipping an entire day without eating; sending family members to eat elsewhere) in instances of food shortage. On the other hand, 55.9% of the households adopt non-food-related coping strategies (*ie*, obtaining loan; selling assets; migrating to look for a job; asking a child to be absent in school) in instances of food shortage. In addition, majority (67.4%) of the households have at least one member who participates or engages in governments-sponsored food and nutrition programs (*ie*, supplemental feeding).

Crude logistic regression analyses (Table 2) show significant statistical associations of the educational attainment of the household head, age and educational attainment of the spouse, socio-economic status, adoption of food-related and non-food-related coping strategies in instances of food shortage, and participation in government-sponsored food and nutrition programs with household food insecurity.

Multiple logistic regression analyses

Table 1
Frequency distribution and summary statistics of the independent variables.

Independent variables	n (%)
Occupation of the household head	
Neither farmer nor fisherman	283 (76.1)
Farmer or fisherman	89 (23.9)
Gender of the household head	
Male	299 (81.0)
Female	70 (19.0)
Age of the household head (years)	
Mean ± SD	45.91 ± 12.59
Education of the household head	
At most a high school graduate	278 (72.6)
More than a high school graduate	105 (27.4)
Age of the spouse (years)	
Mean ± SD	42.11 ± 12.66
Education of the spouse	
At most a high school graduate	217 (56.7)
More than a high school graduate	166 (43.3)
Household size	
Mean ± SD	5.00 ± 1.87
Socio-economic status	
At or above the poverty threshold	290 (75.7)
Below the poverty threshold	93 (24.3)
Adoption of food coping strategies	
No	229 (59.8)
Yes	154 (40.2)
Adoption of non-food coping strategies	
No	169 (44.1)
Yes	214 (55.9)
Participation in nutrition programs	
No	121 (32.6)
Yes	250 (67.4)

(Table 3) show that households whose heads were engaged in either farming or fishing were 11% less likely to be food insecure than do households whose heads were engaged in neither farming nor fishing (OR = 0.89; 95% CI: 0.52-1.53) while controlling for the age, sex, and educational attainment of the household head. However, the observed association is not statistically significant. In the sec-ond model, multiple logistic regression analysis reveal that an increase in the household size by one member increases the likelihood of the household being food insecure by 3% (OR = 1.03; 95% CI: 0.91-1.19), while controlling for the age of the household head and of the spouse. However, the observed association is not statistically significant.

In terms of coping strategies, house-

Table 2

Univariate analysis relating independent variables with household food insecurity.

Independent variables	OR	*p*-value
Occupation of the household head		
Neither farmer nor fisherman	1.00	
Farmer or fisherman	0.85	0.512
Gender of the household head		
Male	1.00	-
Female	1.30	0.327
Age of the household head (years)	1.00	0.752
Education of the household head		
At most a high school graduate	1.00	-
More than a high school graduate	0.42	0.001
Age of the spouse (years)	1.02	0.044
Education of the spouse		
At most a high school graduate	1.00	-
More than a high school graduate	0.51	0.002
Household size	1.05	0.403
Socio-economic status		
At or above the poverty threshold	1.00	-
Below the poverty threshold	1.67	0.035
Adoption of food coping strategies		
No	1.00	-
Yes	10.62	<0.001
Adoption of non-food coping strategies		
No	1.00	-
Yes	14.13	<0.001
Participation in nutrition programs		
No	1.00	-
Yes	2.94	<0.001

holds who adopt food-related coping strategies in instances of food shortage are 9.45 times more likely to be food insecure (OR = 9.45; 95% CI: 5.63-15.85) than households who do not adopt food-related coping strategies. Similarly, households who adopt non-food-related coping strategies in instances of food shortage are 11.48 times more likely to be food insecure (OR = 11.48; 95% CI: 6.16-21.40) than households who do not adopt non-food-related coping strategies. For both models, the estimated odds ratios were adjusted for the education of the household head and spouse, and the participation of at least one household member in government-sponsored food and nutrition programs.

DISCUSSION

This research examined the association between socio-demographic factors (occupation of the household head, household size) and coping strategies to food shortages (food-related and non-food-related), and household food insecurity

Table 3
Multivariate analysis on the exposure variables of interest and household food insecurity.

Independent variable	Odds ratio (95% CI)	p-value
Model 1		
Occupation of the household head		
Neither farming nor fishing	Referent	-
Either farming or fishing	0.89 (0.52-1.53)	0.684
Age of the household head	1.00 (0.98-1.01)	0.959
Gender of the household head	1.40 (0.80-2.47)	0.243
Education of the household head	0.35 (0.19-0.63)	<0.001
Model 2		
Household size	1.03 (0.91-1.19)	0.581
Age of the household head	0.98 (0.95-1.01)	0.287
Age of the spouse	1.03 (1.00-1.06)	0.045
Model 3		
Adoption of food-related coping strategies	9.45 (5.63-15.85)	<0.001
Education of the spouse	0.74 (0.42-1.30)	0.297
Education of the household head	0.60 (0.31-1.17)	0.134
Participation in government nutrition programs	2.15 (1.19-3.88)	0.011
Model 4		
Adoption of non-food-related coping strategies	11.48 (6.16-21.40)	<0.001
Education of the household head	0.55 (0.29-1.05)	0.070
Education of the spouse	0.76 (0.44-1.33)	0.342
Participation in government nutrition programs	2.11 (1.17-3.80)	0.012

in the Santa Rosa sub-watershed area of Laguna Lake watershed during the period spanning October to December 2013. In the interpretation of findings, it is important to consider that not all barangays in Santa Rosa City, Binan City, Cabuyao City and the Municipality of Silang are situated within the Santa Rosa sub-watershed area; hence, findings may only apply to the sub-watershed area and not to all the barangays in the four local government units. Moreover, since coping strategies vary depending on short-term instances of food shortage or insufficiency, estimates of the proportion of households adopting said coping strategies may only hold true for the specific circumstances present during the survey.

Several of the associations found in the study were consistent with those reported in other researches such as the association between food insecurity and the occupation of the household head (Willows *et al*, 2009; Huet *et al*, 2012; Mc-Intyre *et al*, 2014). However, while other studies considered occupations specific to the study population (*eg*, formal industry sectors such as manufacturing and service in more developed countries), this study provided the advantage of examining the relationship of some occupations specific to heads of households in the sub-watershed area (such as farming and fishing) and household food insecurity.

In addition, the study also found that coping strategies during food shortage

were negatively associated with food se-curity. These findings were consistent with results from studies in other populations in that coping strategies were inversely related with household food insecurity (Maxwell *et al*, 1999; Ellis, 2000; Devereux, 2001; Snel and Staring, 2001; Senefeld and Polsky, 2006; Mjonono *et al*, 2009). The results of the study may be counter-intuitive on initial examination but Davies (1993) makes a distinction between "cop-ing strategies" as fall back mechanisms to deal with a short-term insufficiency of food versus "adaptive strategies", which refers to long-term or permanent changes in the way in which households and indi-viduals acquire sufficient food or income. Hence, it is posited that coping strategies do not simply imply that people somehow "get by"; rather, the adoption of coping strategies in instances of food shortage or insufficiency is an indication of worsening food and livelihood conditions. The nega-tive association between coping strategies and food security can also be explained by the contention that coping strategies are nutritionally unsustainable, and are likely to be economically and environmentally unsustainable as well (Davies, 1993).

Despite interesting findings from the study, it is not possible to completely rule out bias in the observed measures of association. Due to data limitations, information on some confounders was not included in the analysis. For instance, data on the health of the household head and maternal parity, though identified as probable confounders from the literature review, were not considered when ex-amining the relationship between socio-demographic factors and household food insecurity. It is possible that since the health of the household head is negatively associated with food insecurity and since healthier household heads are able to

engage in more economically-productive occupations, the confounding effect of the health of the household head on the association between occupation and food insecurity may be a negative bias towards the null. On the other hand, it is also possible that since maternal parity is positively associated with both household food insecurity and household size, the confounding effect of maternal parity on the association between household size and food insecurity may be a positive bias away from the null.

Moreover, the use of the SAQ as the method of data collection makes the study susceptible to information bias. Differen-tial misclassification of coping strategies according to categories of household food insecurity, which may have resulted from more accurate recall of antecedents to instances of food insecurity, may bias the measure of association between coping strategies and food insecurity positively away from the null. On the other hand, it is possible that, with respect to food insecurity, non-differential misclassifica-tion might have occurred since the post-sampling stratification of the outcome was done after eliciting information on the exposure variables of interest. Hence, the measures of effect may be biased towards the null.

The results of the study can serve as evidence for the streamlining of interven-tions that address food insecurity. The di-rect relationship between the adoption of coping strategies during instances of food shortage and food insecurity warrants a shift from merely coping to adapting. Though the shift is a lot more complex as it seems, current interventions can focus on sustainable livelihood opportunities and employment for household members to protect them from food shocks. In ad-dition, while short-term coping strategies

may be desirable in the early stages of food shortage, concurrent interventions should ensure a shift towards sustainable adoptive measures such as backyard and / or community gardening, or small scale livestock or poultry farming. This, on the other hand, necessitates some form of financial assistance from both government and private sectors.

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