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Construct validity of an adapted Radimer/Cornell measure of food insecurity in the Philippines

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ABSTRACT

Introduction: Measuring hunger and food insecurity has always been a challenge given the various tools available to provide estimates both at the macro (sufficiency in staple stock) and micro (household food security) levels. In the Philippines, estimates of food insecurity have been provided by the Food and Nutrition Research Institute (FNRI) starting 2001 using an adaptation of the Radimer/Cornell (1992) measures of hunger and food insecurity. The tool has been found to be reliable using the 2003 data extracted from the sixth National Nutrition Survey (NNS), Food Security module but was recommended for further exploratory factor analysis to test for efficiency of items. **Methods:** This study assessed the construct validity of the adapted Radimer/Cornell instrument for measuring household food insecurity using principal component analysis with varimax rotation based on the 2003 NNS data. **Results:** The results revealed the prevalence of food insecurity was higher at the mother's level (33.7%) compared to the child (21.0%), indicative of "managed process" or coping with food insecurity at the households. "Altered eating" emerged (factor 1) at the individual level of food insecurity, while "anxiety over quantity and quality of food" was (factor 2) at the household level, that explained 44.0% and 23.2% of the total variance, respectively. Thus, a high cumulative variance (67.2%) was generated for these two factors, implying sufficient variance was obtained to justify the derivation of these two factors from the dataset. **Conclusion:** The food security items in the adapted Radimer/Cornell instrument contained valid indicators for assessing food insecurity in Filipino households.

Keywords: Radimer/Cornell, food insecurity, Philippines, Filipino households

INTRODUCTION

Global hunger and food insecurity remain high. In 2017, chronic food deprivation or undernourishment was estimated to affect 821 million people comprising 10.9% of the world population of which 770 million experienced this at higher severity of food insecurity (FAO, IFAD, UNICEF, WFP & WHO, 2018).

The Food and Agriculture Organization (FAO) measures hunger as undernourishment referred to as the "proportion of the population whose dietary energy consumption is less than a pre-determined caloric threshold, the minimum that most people require to live a healthy and productive life" (FAO, 2008). The mean per capita calorie intake of 69% of Filipino households were below 100% of its dietary energy requirements in 2015 (FNRI-DOST, 2016).

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Studies on food security and related issues in the Philippines are limited. Some studies examined households' response to economic and social shocks, as these affect daily food access and consumption at home and the changes in household food and non-food expenditure and consumption pattern (Castañeda *et al.,* 2006; Villavieja *et al.*, 1985; Valdecañas *et al.*, 1984). In 2001, a survey on food security was undertaken by the Department of Science and Technology's Food and Nutrition Research Institute (DOST-FNRI) to determine food security status of Filipino households (Molano *et al.,* 2003) using an adaptation of the Radimer/Cornell measures of hunger and food insecurity (Radimer *et al.*, 1992).

Radimer/Cornell measures of hunger and food insecurity

The origins and use of the Radimer/Cornell measures of hunger and food insecurity stemmed from the need to evaluate the impact of the United States' targeted food programmes amidst arguments that "hunger is a construct that is hard to measure." The tool was developed in two phases: Phase 1 that extracted perceptions of hunger as these are experienced among 32 rural women using grounded theory and Phase 2 that focused on the development of hunger items and subjecting these to face and construct validation.

According to Radimer *et al.* (1992), hunger is manifested in eight concepts that were experienced at the individual and household levels. The concepts at the individual level are: (a) insufficient intake, (b) nutritional inadequacy, (c) lack of choice and feeling of deprivation and (d) disrupted eating pattern. At the household level, these are: (e) food depletion, (f) unsuitable food, (g) food anxiety and (h) food acquisition in socially acceptable way. These concepts are further described as quantitative (a and e), qualitative (b and f), psychological (c and g) and social (d and h).

Five out of these eight concepts were validated as Phase 2 by Radimer *et al.* (1992) among a convenience sample of 189 women. These concepts were: "insufficient intake", "nutritional adequacy" and "disrupted eating pattern" for the individual level assessment; and "food depletion" and "food anxiety" for household level assessment. Further construct validation of the tool using principal component factor analysis yielded 12 hunger measures (out of the 30 items extracted) that were included in the final Radimer/Cornell instrument. Detailed descriptions of the procedures in developing these items and scale measurements as well as the list of the 30 items are described in by Radimer *et al.* (1992).

Hunger was defined by Radimer *et al.* (1992) as "the inability to acquire or consume an adequate quality or sufficient quantity of food in socially acceptable ways, or the uncertainty that one will be able to do so". This concept was reported to be a valid measure of hunger and food insecurity among homogenous (Radimer *et al.*, 1992) and diverse populations (Kendall, Olson & Frongillo, 1995) within rural (Leyna *et al.*, 2007; Frongillo *et al.*, 1997) and urban settings (Shoae *et al.*, 2007; Zalilah & Ang, 2001) in developed and developing countries, and even in situations described to be suffering from the impact of the global economic crisis such as in Java, Indonesia (Studdert, Frongillo & Valois, 2001). The results of our survey of countries that have measured hunger and food insecurity by adapting the Radimer/Cornell tool is shown in Table 1.

The Radimer/Cornell measure of food insecurity adapted for use by the DOST-FNRI as a component of the national and regional surveys of the Institute was found to be reliable (Cronbach's α=0.81 to 0.89) and valid using criterion-related validity (Molano, Gulles & Tarrayo, 2007). However, there are arguments to the use of criterion-related validation. Criterion-

Table 1. Summary of studies that assessed the reliability and validity of the Radimer/Cornell instrument

Country	*Author*	*Items/Subjects*	*Statistical analysis*	*Findings*
Tanzania	Leyna *et al.* (2007)	9-items Radimer/ Cornell questionnaire excluding 1 item	Construct validity using factor analysis	Results revealed two factors: 1) altered eating pattern at household level with loadings ranging from 0.67-0.86; and 2) altered eating pattern at child level with loadings 0.74-0.89.
		530 women aged 15-44 years with children under 5 years old	Internal consistency using Cronbach's α	Cronbach's α = 0.85 (household subscale) and 0.78 (child subscale)
			Criterion-related validity using χ^2 *test*	Food insecurity was significantly associated with age and marital status, while, food insecurity worsened among women without formal education and who are involved in farming.
Tehran, Iran	Shoae *et al.* (2007)	12-item Radimer/ Cornell questionnaire was modified and 6 questions were added	Construct validity using factor analysis	Analysis resulted in the extraction of the following factors: 1) contained items on food anxiety and food depletion; 2) contained items about food intake inadequacy of adults and children and food intake insufficiency of adults; and 3) composed of items about food intake insufficiency of children.
		250 poor urban households with at least one child aged 1-18 years old and non-pregnant and non-lactating woman of childbearing age	Internal consistency using Cronbach's α	Cronbach's α = 0.89, 0.82 and 0.80 for household security, individual insecure and child hunger scales, respectively.
			Criterion-related validity using χ^2 *test*	Adult food insecurity and child hunger were inversely associated with income, parent's education and father's occupation, but directly associated with household size
				Household insecurity inversely associated with household size but directly associated with parent's education, father's occupation and income
Philippines	Molano *et al.* (2007)	Radimer/Cornell hunger and food inseurity items adapted into 10	Internal consistency using Cronbach's α	Cronbach's α = 0.81 (mother); 0.84 (child); 0.89 (household)
			Criterion-related validity	Food secure households, mother and children have higher mean energy and nutrient adequacy level than food insecure households.
		3,568 households with 0-10 years old children		Prevalence of undernutrition is lower for the food secure group compared to the food insecure group

Malaysia	Zalilah & Ang (2001)	Low income, urban poor households *n*=137 preschool children, 4-6 years old	Descriptive statistics	34.3% food insecure; 65.7% with some degree of food insecurity, where 27.7% as household food insecurity, 10.9% as individual food insecurity and 27.0% with child hunger
			Odds ratio	Significant risk factors to food insecurity: larger household size (*OR*=1.418); lower education of fathers (*OR*=0.802); lower education of mothers (*OR*=0.749)
			One-way ANOVA	
			Multinomial logistic regression	No significant differences in nutritional status across categories of food insecurity
Indonesia	Studdert *et al.* (2001)	1,423 mothers with children < 5 years old	Correlation of tool with the Radimer/Cornell and Hamelin measure	Categories created: food security; uncertainty about food; insecurity for family; insecurity for adults; severe insecurity for children or adults
			Graphical representation of consistency of affirmative responses	Concept of household food insecurity: decreased food intake; compromised diets; and changes in food stores
			Criterion validity	High correlation of percent of affirmative responses: food insecure households had both lower food and total expenditures; households with more severe food insecurity were more likely to have had a decline in income, food stores and rice stores
Russia	Welch & Mock (1998)	12 Radimer/ Cornell hunger items to measure hunger of households, women and children	Criterion-related validity	Household socio-economic and demographic characteristics were highly related to hunger where children were least likely classified as hungry, while, mothers and their households were very likely to be considered hungry.
United States of America	Kendall *et al.* (1995)	10-items Radimer/ Cornell question	Construct validity using factor analysis with varimax and oblique rotation	Progression in the severity of hunger and food insecurity, from household level food insecurity to adult level food insecurity to child hunger.
		Random sample survey of 193 households with women and children using 1993 survey data	Internal consistency using Cronbach's α	Cronbach's α = 0.84 (household insecure measure), 0.86 (individual insecure measure); 0.85 (child hunger measure)
			Criterion-related validity by comparing demographic and dietary characteristics	

related validation studies assume the availability of a criterion measure or a close approximation or "gold standard" of the construct of interest (here, food security). However, the criterion measures often used in studies of this nature are "proxy, indirect and derived" which may yield inconclusive results or whether an approximate measure of the construct is indeed provided (Webb *et al.*, 2006; Wolfe & Frongillo, 2001). Criterion measures used in these studies were socio-economic and food and nutrition-related variables.

This study is aimed at assessing the construct validity of an adaptation of the Radimer/Cornell measure of food insecurity by providing a factor model of the food security construct to better characterise the experience among Filipino households. This study is envisioned to contribute to the growing body of evidence on valid measures of assessing food security at different levels of estimates and in different country settings.

MATERIALS AND METHODS

Data set

The study used the Food Security component of the FNRI sixth National Nutrition Survey (NNS) as secondary data. This is a cross-sectional survey undertaken from July through December 2003 that covered 17 regions and 79 provinces and 5,533 households of the Philippines (Molano *et al.*, 2007). The data files on food security were merged with data files on household energy adequacy and nutritional status. Household energy adequacy levels were derived from household food consumption data gathered using food weighing from 25.0% of one replicate of the sample households. Households with children 0-10 years old (n=3,568) and with available data for nutritional status (n=3,535) were included for this analysis. Height, weight and recumbent length of children were measured using standardised techniques. Height/length-for-age and weight-for-age z-scores <-2SD are considered as stunted and underweight, respectively. Accounting for missing data, final sample size included for the analysis of food insecurity measures are household and individuals/mothers (n=3568); children (n=3,525); households with children for questions 9 and 10 (n=3,535).

The FNRI adapted Radimer/Cornell questionnaire

The DOST-FNRI questionnaire asked the respondents whether or not they have experienced specific situations pertaining to food insecurity during the past six months as reference period. Respondents who replied affirmatively to these situations were also asked the frequency of occurrence of the particular experience or food security item (Table 2).

The questionnaire employs ten food insecurity items adapted from the Radimer/Cornell measurement of hunger and food insecurity translated into Filipino. Specifically, four of these items were adapted from the final 12-item Radimer/Cornell measure and six from the full 30-item Radimer/Cornell measure.

Six items addressed to mothers and children were framed as questions and the four items on "knowledge of situation" (denoting household level) were framed as statements. Period of recall was past six months. The FNRI questionnaire used a "yes" or "no" response choice for each frequency of experience for items framed as questions, and "not true", "true, often" and "true, sometimes" for items framed as statements.

The Radimer/Cornell tool did not use a reference period of recall of the hunger experience, and a score were assigned to each response choice to denote scale of responses. The team of Radimer saw fit that response choices covers "periodic and episodic types of

Table 2. Ten-item FNRI Food Security Survey Questionnaire

Food security items		*Frequency of occurrence*
Knowledge of self (in the last 6 months)		
1	Did you skip eating or miss meals/food, because there was no food or no money to buy food?	0 – never 1 – yes, once during the past 6 months 2 – yes, > once during the past 6 months
2	Did you ever not eat for a whole day because there was no food or money to buy food?	
3	Were you ever hungry but did not eat because there was no food or money to buy food?	
Knowledge of child/children		
4	Did your child/children skip eating or miss meals/food, because there was no food or no money to buy food?	0 – never 1 – yes, once during the past 6 months 2 – yes, > once during the past 6 months
5	Did your child/children ever not eat for a whole day because there was no food or money to buy food?	
6	Was/were your child/children ever hungry but did not eat because there was no food or money to buy food?	
Knowledge of situation (statement form)		
7	"I worried that our food would run out before we got money to buy more"	0 – not true 1 – true, often 2 – true, sometimes
8	"The food we bought did not last and we did not have enough money to get more"	
9	"The children were not eating enough because we did not have enough food and we could not afford to buy more"	
10	"We could not feed the children nutritionally adequate meals because we do not have enough food and enough money to buy food more"	

hunger, thus avoiding specific time-referenced response choices and including more generic ones" such as "never", "sometimes" and "often" for items framed as questions and "not true", "true, sometimes" and "true, often" for items framed as statements.

Four items used in the questionnaire were adapted from the Radimer/Cornell tool, one each from the mother and child level. These items were related to "insufficiency of intake":

- Were you ever hungry but did not eat because there was no food or money to buy food? (mother; quantitative, intake insufficiency)
- Was/were your child/children ever hungry but did not eat because there was no food or money to buy food? (child; quantitative, intake insufficiency)

The two statements that pertained to "knowledge of the situation" or household level was related to "food depletion" and "food anxiety" in the household:

- "The food we bought did not last and

we do not have enough money to get more" (quantitative, food depletion)
- "I worried that our food would run out before we got money to buy more" (psychological, food anxiety)

Two statements, namely "children were not eating enough" and "we could not feed the children a nutritionally-adequate meal" that were used to assess "knowledge of the situation" are items intended to measure child hunger in the initial 30-item list of the Radimer/Cornell instrument.

At the individual level, the Radimer/Cornell tool focused on food insecurity experiences in terms of "inadequacy and insufficiency of diets" (qualitative and quantitative domains) compared to the adapted questionnaire used by the DOST-FNRI which focused on "disrupted eating patterns" as measures of the food insecurity experience. "Disrupted eating pattern" was initially included in Radimer's analysis, but was eventually excluded in the final tool as this did not figure significantly in the statistical analysis. Based on this, Radimer's group refrained from recommending the "use of 'disrupted eating pattern' as hunger indicators (alone) since these are very specific indicators of intake quantity and that more general items are more widely applicable and preferable" according to Radimer, Olson & Campbell (1990). A major adaptation by the DOST-FNRI was the use of "disrupted eating pattern" as a concept of food insecurity in assessing the situation of mothers and children, specifically "skipped eating or missed meals" and "hungry but did not eat".

Financial constraint is the conditional phrase used in administering the Radimer tool: "there was no food or no money to buy food". The social support network embedded in the Filipino culture as well as the practice of engaging in home food production activities were considerations in adapting the questionnaire for use in the Philippine setting. These were viewed as "coping mechanisms" to access "food on the table" (for the household), thereby giving some form of assurance or security. Nevertheless, the conditional phrase "there was no food or no money to buy food" was still used.

Pretesting of the questionnaire had been previously undertaken prior to the start of the 2001 regional nutrition survey. The tool was used for the first time in DOST-FNRI's 2001 updating of the Nutritional Status of the Filipino Children at the Regional Level, after which it became part of the NNS as its food security component from 2003 to 2011.

Construct validation

Construct validation of the data entailed exploratory factor analysis that "focuses on finding structures (patterns) of correlation in the data" (Vogt, 2007). Construct validity of the FNRI food security questionnaire was assessed using principal component analysis with varimax rotation (SPSS 16 for Windows). The FNRI tool containing ten items were subjected to factor analysis at three levels (mother, child, household). The analysis extracted two factors after the first run had complied with data requirements.

The components collectively explained more than 60 percent of the variance in the set of included variables (total Eigenvalue is 67.2%).

a. The derived components explained 50 percent or more of the variance in each of the variables, i.e., have a communality greater than 0.500 (0.550 - 0.757).
b. None of the variables had loadings (or correlations) of 0.400 or higher for more than one component, i.e., did not have a complex structure.
c. None of the components consisted of only one variable.

RESULTS

Characteristics of the study households and children are presented in Table 3.

Table 3. Percent distribution of selected characteristics of Filipino households and children: food security component of the National Nutrition Survey, 2003

Variable	*n*	*%*
Household	3568	
Household size (*M*=6.04, *SD*=2.30)		
1 – 3	364	10.2
4 – 6	1945	54.5
7 – 9	947	26.5
10 – 12	259	7.3
≥ 13	53	1.5
Children	3535	
Sex		
Male	1858	52.8
Female	1677	47.2
Age		
0 – < 1 year	656	18.1
1 – 3 years	1914	54.4
4 - 6 years	843	24.8
7 - 9 years	115	3.5
10 years	7	0.2
Weight-for-age†		
Normal	2605	74.2
Underweight	879	24.2
Overweight	51	1.6
Height-for-age‡		
Normal	2549	72.7
Stunted/short	966	26.7
Above average/tall	20	0.6

†Underweight: <-2SD, Normal: -2SD to +2SD, Overweight: >+2SD
‡Stunted/short: <-2SD, Normal: -2SD to +2SD, Above average/tall: >+2SD

Mean household size was five, while 31% had 4-6 members.

Half of the children were male (52.8%), and were mostly young, within the ages of infancy (18.1%), toddlers (54.4%) and preschool age (24.8%). Less than 5% were school-aged children (7 – 10 years old). Prevalence of underweight and stunting were high at 24.2% and 26.7%, respectively.

Food security situation among women, children and households

In terms of specific food security items, 71.0% mothers claimed that they themselves did not experience "skipping of meals", "going hungry for a day" (87.8%) or "not eating even when hungry" (75.6%), suggesting food security at her own level (Table 4). Lower proportions of mothers responded "yes, more than once" to these questions (14.3%, 4.6% and 11.5%, respectively), indicating the presence of serious food insecurity faced by the mothers themselves.

High proportions of the mothers answered "never" to questions that indicate child facing food insecurity – "skipping meals" (82.0%), "not eating the whole day" (91.8%), or "not eating even when hungry" (84.9%). This suggests that more mothers considered their children did not experience food insecurity.

Household food insecurity was reported whereby, while 27.2% did not "worry that food would run out", 44.8% affirmed that this experience was "true,

Table 4. Percentage distribution of responses by food security items, Philippines, 2003

Food security items	*n*	*Never (%)*	*Yes, once (%)*	*Yes, more than once (%)*	*Total* † *(%)*
Knowledge of self (in the last 6 months)					
1 Did you skip eating or miss meals/food, because there was no food or no money to buy food?	3568	71.0	14.7	14.3	100
2 Did you ever not eat for a whole day because there was no food or money to buy food?	3568	87.8	7.6	4.6	100
3 Were you ever hungry but did not eat because there was no food or money to buy food?	3568	75.6	13.0	11.5	100
Knowledge of child/children					
4 Did your child/children skip eating or miss meals/food, because there was no food or no money to buy food?	3525	82.0	9.6	8.3	100
5 Did your child/children ever not eat for a whole day because there was no food or money to buy food?	3525	91.8	5.0	3.3	100
6 Was/were your child/children ever hungry but did not eat because there was no food or money to buy food?	3525	84.9	8.2	6.9	100
Knowledge of situation (statement form)		Not true	True – sometimes	True-often	
7 "I worried that our food would run out before we got money to buy more"	3568	27.2	44.8	28.1	100
8 "The food we bought did not last and we did not have enough money to get more"	3568	38.4	38.1	23.5	100
9 "The children were not eating enough because we did not have enough food and we could not afford to buy more"	3535	48.2	31.5	20.3	100
10 "We could not feed the children nutritionally adequate meals because we do not have enough food and enough money to buy food more"	3535	42.9	34.4	22.7	100

†Figures may not add up to 100% due to rounding

sometimes" and 28.1% said that this was "true, often". While 38.4% did not experience that "the food bought did not last", the same proportion affirmed that they did experience this "sometimes", while the remaining 23.5% experienced this "often". More than 40.0% (42.9%) of households did not experience "not feeding the children nutritionally-adequate meals" nor perceived that their "children were not eating enough" (48.2%). However, 31.5% and 20.3% of the households experienced this type of food insecurity "sometimes" and "often", respectively.

Construct validity

Two factors emerged from the rotated principal component analysis of the adapted Radimer/Cornell food insecurity items. These two factors were at two levels, namely individual (mothers and children) and household. These are components of "altered eating" (factor 1)

Table 5. Distribution of affirmative responses and rotated factor loadings of the adapted Radimer/Cornell food security items as assessed in Filipino households, 2003

	Food security item[†]	*%*[‡]	*Factor loadings*
	Altered eating (Individual)		Factor 1[§]
1	Did you skip eating or miss meals/food, because there was no food or no money to buy food?	29.0	0.766
2	Did you ever not eat for a whole day because there was no food or money to buy food?	12.2	0.763
3	Did you ever not eat for a whole day because there was no food or money to buy food?	24.4	0.808
4	Did your child/children skip eating or miss meals/ food, because there was no food or no money to buy food?	18.0	0.827
5	Did your child/children ever not eat for a whole day because there was no food or money to buy food?	8.2	0.784
6	Was/were your child/children ever hungry but did not eat because there was no food or money to buy food?	15.1	0.841
	Anxiety over quantity and quality of food (Household)		Factor 2[¶]
7	"I worried that our food would run out before we got money to buy more"	72.8	0.741
8	"The food we bought did not last and we did not have enough money to get more"	61.6	0.853
9	"The children were not eating enough because we did not have enough food and we could not afford to buy more"	51.8	0.845
10	"We could not feed the children nutritionally adequate meals because we do not have enough food and enough money to buy food more"	57.1	0.859

[†]Source (table format): Leyna *et al.* (2007)

[‡]Responding as "yes, once" or "yes, more than once" and "true, sometimes" or "true, often" to the food insecurity items

[§]Factor 1 explained 44.0% of the total variance

[¶]Factor 2 explained 23.2% of the total variance

and "anxiety over quantity and quality of food" (factor 2), that explained 44.0% and 23.2% of the total variance, respectively (Table 5). The results showed high cumulative variance (67.2%) for these two factors which implies that sufficient variance was obtained to justify the two components or factors derived from the dataset.

Food security items 1 to 6 loads highly for the first component with factor loadings ranging from 0.763-0.841. Food security items 7 to 10 load highly for the second component with factor loadings ranging from 0.741-0.859. A higher proportion of mothers "skipped meals" (29.0%) with a factor loading of 0.766 compared to "not eating" (12.2%) or "going hungry" (24.4%). Less than 20.0% of children "skipped meals" (18.0%), "went hungry" (15.1%) and "did not eat" (8.2%). Majority of households "worried that food would run out" (72.8%) and "food bought will not last" (61.6%). Anxiety over their inability to feed their children "nutritionally-adequate meals" or "they were not eating enough" were experienced by 57.1% and 51.8% of the households, respectively.

High internal consistency across the items in the tool were found with Cronbach's α at 0.84 for all items and 0.88 and 0.86 at the individual and household levels, respectively.

DISCUSSION

The Radimer/Cornell measure of hunger and food insecurity as adapted in different country settings (Leyna *et al.*, 2007; Shoae *et al.*, 2007; Molano *et al.*, 2007) has been reported to be reliable with Cronbach's α coefficient ranging from 0.85-0.89 (household level), 0.78-0.84 (child level) and 0.81-0.82 (individual level). This study revealed a range of severity with prevalence of food insecurity higher at the mother's level (33.7%) compared to the child (21.0%). This is similar to the study conducted by Castañeda *et al.* (2006) where 57.0%, 31.6%, and 27.6% of Filipino mothers, fathers or both, respectively, reportedly "skipped meals", while only 11.4% of their children was reported to have done so.

The study also indicates some forms of "managed process" or coping with food insecurity as described in Radimer *et al.* (1992) being practised among the study households. For example, "altered eating" among mothers and children contributed to 44.0% of the total variance of the construct. "Skipping" and "missing out" on meals characterise individual food insecurity experience among Filipino households. Castañeda *et al, (*2006) reported that among marginalised Filipino communities in Baguio, Dumaguete and Davao City, adjustments of food quantity and quality preceded cutting down on number of meals as a form of coping mechanism. They reported that 86.6% of the households "eliminated or sacrificed food items" and 70.2% "reduced quantity of foods served". "Skipping of meals" and "cutting down on the number of meals" were observed among 57.5% and 32.2% of 210 households with preschool and school children, respectively.

Conversely, "having three meals a day" was perceived to contribute to a sense of food security among women-respondents in a study by Balatibat (2004) who examined the linkages between food and nutrition security in lowland and coastal villages in the Philippines. Gender differences in the perception of food security was noted wherein "security of income base" dominated the men-respondents' perception of food security being the usual breadwinner.

In this study, "altered eating" emerged as the first factor at the individual level of food insecurity, similar to the validation study of Leyna *et al.* (2007) among 530 women with children under 5 years in rural Tanzania. However, the "altered eating pattern" at the child level reported by Leyna *et al.* (2007) pertained

to economic constraints in the quantity and quality of available food as well as hunger experience of the children, whereas "altered eating" in the present study pertained more to "skipping" and "missing out" on meals, termed as "disrupted eating pattern" by Radimer *et al.* (1992).

"Anxiety over quantity and quality of food" emerged as the second factor at the household level in this study. A similar finding was cited by Shoae *et al.* (2007), in a study among 250 poor urban households with at least one child aged 1-18 years. Their finding may be expected among low socio-economic status of the subjects.

According to Radimer's hypothesis, mothers tend to sacrifice "their" own food needs for their children as a form of coping mechanism. It should be cautioned that biased reporting of food insecurity experiences may confound findings where a greater proportion of children experienced food insecurity (27.0%) compared with individual/ mother experience (10.9%) as seen in the study by Zalilah and Ang (2001).

Food security continuum as defined by the FAO (2008) encompasses both quantitative and qualitative aspects of food accessibility and availability. In this study, the qualitative aspect of food security pertained to item ten in the adapted FNRI questionnaire used for households with children: "we could not feed the children nutritionally adequate meals because we do not have enough food and enough money to buy food more". Kendall *et al.* (1995) recommended the "inclusion of items assessing diet quality especially in a more socio-economically diverse population in order to accurately estimate the prevalence of individual-level food insecurity".

Based on the high factor loadings derived for each food insecurity item, the use of some questions from the individual and the household level measures are suggested below for further investigations.

1. While any item from the individual level can be used for this purpose, regardless of the derived factor loading, addressed either to the respondent (mother, caregiver) or the child as reference individual, items one and four appear to be more plausible given the high percentage of affirmative answer for these items.
   a. Question 1: Did you skip eating or miss meals/food, because there was no food or money to buy food?
   b. Question 4: Did your child/ children skip eating or miss meals/ food, because there was no food or money to buy food?
2. For the household level, item seven or eight can be used since this does not require a child to be present in the household before they can be assessed for food insecurity.
   a. Question 7: "I worried that our food would run out before we get money to buy more."
   b. Question 8: "The food we bought did not last and we did not have enough money to get more."

Rapid assessment of food insecurity can be used to document transient food insecurity which may now become more apparent with the compounding effects of disaster and climate change-related incidents.

Limitations of study

The strength of this validation study lies in characterising hunger and food insecurity as experienced among Filipino households. The gold standard of providing a real picture of the phenomenon via the use of criterion-related validity remain elusive, hence, proxy indicators have been used (socio-economic variables and food and nutrition-related variables).

As suggested in the interpretation of the Radimer/Cornell measure and as

used by the DOST-FNRI, a response in at least one of these items presupposes the food insecurity experience that is used to record prevalence of food insecurity. This interpretation, however, could mask the more specific experiences of individuals and households.

CONCLUSION

The adapted Radimer/Cornell measure of food insecurity contains valid indicators of food insecurity. "Altered eating" characterises the individual level of food insecurity while "anxiety over quantity and quality of food" characterises the household level of food insecurity. This study indicates the feasibility of the FNRI adaptation of the Radimer/Cornell tool to detect food insecurity at the individual and household levels.

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Authors' contributions

RMARM, conceptualised, conducted analysis and interpretation of results, prepared the draft of the manuscript; VRV, reviewed related literature, conducted factor analysis and drafting of manuscript; AGP, reviewed related literature, conducted factor analysis and interpretation of factor model.

Conflict of interest

The authors declare that they have no competing interests in whatever form.

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