



**USAGE, INTERNAL VALIDITY AND RELIABILITY
OF EXPERIENCE-BASED HOUSEHOLD FOOD
INSECURITY SCALES IN INDIAN SETTINGS**

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Suggested citation: Sethi, V. et al, 'Usage, internal validity and reliability of experience-based household food insecurity scales in Indian settings', *Nutrition Reports*, issue 5, United Nations Children's Fund, New Delhi, India, 2016.

USAGE, INTERNAL VALIDITY AND RELIABILITY OF EXPERIENCE-BASED HOUSEHOLD FOOD INSECURITY SCALES IN INDIAN SETTINGS

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Nutrition Reports, Issue 5, 2016

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EXECUTIVE SUMMARY

INTRODUCTION

Household food insecurity is a key underlying cause of child stunting. However, information on the extent and severity of food insecurity experiences in Indian households is limited as none of the large scale Indian surveys include composite and validated experience-based measures of household food insecurity (HFI). It is also unclear which HFI scale or questions within that scale are most relevant for the Indian context. UNICEF and the Food and Agriculture Organization (FAO), India, therefore, commissioned a review paper in 2015, bringing together seven researchers from five organizations with experience on the use of experience-based HFI scales in Indian settings.

METHODS

Between 1 June and 31 August 2015, the authors reviewed 19 published and unpublished studies that used experience-based HFI scales that were conducted in India between January 2000 and June 2015. As part of this exercise, the internal validity and reliability of scales used in these studies were examined, the field experiences of 31 researchers on the difficulties of using HFI scales in India were gathered, and psychometric tests were conducted where raw data were available.

RESULTS

Out of the 19 studies reviewed, three studies used the 18-item United States Department of Agriculture (USDA) scale, three studies used only eight child items of the USDA scale, six studies used the 9-item Household Food Insecurity Access Scale (HFIAS), five studies used the 6-item short-form scale and two studies used

the 8-item Food Insecurity Experience Scale (FIES). HFI prevalence varied depending on the type of scale used. Internal reliability across scales ranged between 0.75-0.94; however, certain items ('balanced meal', 'preferred food', 'worried food would run out') had poor in-fit and out-fit statistics.

CONCLUSION

The authors found that HFI experiential scales used in the Indian context are internally reliable. To improve validation, the following actions are suggested: (i) cognitive testing of quality of diet items; (ii) avoid child-referenced items; (iii) rigorous training of enumerators; (iv) add a follow-up question of 'how often' to avoid rare events and, hence, overestimating food insecure conditions; (v) split the 'cut and skip meal' item; and (vi) use a standardized set of questions for aiding comparison of construct validity across scales.

India is signatory to reporting progress on the agreed indicators of the Sustainable Development Goals (SDG). SDG Indicator 2.1.2, i.e., prevalence of moderate or severe food insecurity in the population, is based on FIES. Hence, it is timely for India to start an evidence-based policy dialogue to include FIES in its national surveys. It needs to invest in contextualizing and harmonizing the HFI scale and/or questions within the scale across multiple surveys (National Sample Survey Organization survey, National Family Health Survey) to aid comparability over time, and support decision making as well as SDG reporting. The inclusion of FIES in the ongoing Comprehensive National Nutrition Survey (CNNS) of the Ministry of Health and Family Welfare will provide an opportunity to test its validity across Indian states before inclusion in national demographic surveys.





REPORT

INTRODUCTION

Nearly 40 per cent of Indian children under five years of age (~47 million) are chronically undernourished, while over half (51 per cent) of children in the poorest wealth quintiles are so affected (MWCD, 2014). Household food insecurity (HFI) is one of the key determinants of stunting in Indian children, particularly for those living in income insecure environments.

HFI is defined as the inability of a household to acquire or consume adequate quantity or quality of food as a result of inadequate food supplies or lack of resources. As severity of HFI increases, steps taken by the household to cope with it also becomes more intense, starting from adjusting the food budget to adults reducing their food intake and experiencing hunger, and finally the children also experiencing reduced food intake and hunger (Radimer et al., 1990).

Measurement of HFI experiences is not routinely included in large scale demographic Indian surveys. The National Sample Survey Organization (NSSO) survey includes only one question on household daily access to food, which is inadequate to capture the intensity of HFI (NSSO, 2013). The National Family Health Survey (NFHS) measures diet diversity but not HFI experiences.

Globally, there are four validated questionnaires available for measuring HFI experiences of households as reported by respondents. The first is the 18-item scale developed by Hamilton et al, 1997, that served as a model for subsequent HFI scales. It captured four HFI domains: (1) uncertainty and worry about food; (2) inadequate food quality; (3) insufficient food quantity for adults; and (4) insufficient food quantity for children. It supported differentiation of four categories of HFI across diverse settings: high food security (raw score 0), marginal food insecurity (raw score 1-2), low food insecurity (raw score 3-7) and very low food insecurity (raw score 8-18).

The 18-item scale was followed by a 6-item sub-set developed by Blumberg et al., 1999, that differentiated three categories of HFI faced

by adults – high or marginal food security (raw score 0-1), low food security (raw score 2-4) and very low food security (raw score 5-6) – but did not measure the most severe range of adult food insecurity, in which children’s food intake is likely to be reduced as well.

In 2000, the Food and Nutrition Technical Association (FANTA) adapted the 18-item scale to the developing country context and came up with the 9-item Household Food Insecurity Access Scale (HFIAS) (hereafter called the 9-item scale). The 9-item scale captured four categories of HFI with the raw score range of 0-27: food secure (raw score 1), mildly food insecure (raw score 2), moderately food insecure (raw score 3) and severely food insecure (raw score 4) (Coates et al, 2007).

The fourth and latest addition is the 8-item Food Insecurity Experience Scale (FIES) (henceforth called the 8-item scale) to measure individual food insecurity developed by the Food and Agricultural Organization of the United Nations (FAO) and tested for use globally through Gallup surveys. The 8-item FIES can identify four categories of individual food insecurity (FI), but can be modified to measure HFI.

While FIES recommends each country to arrive at FI categorization meaningful to its context, it does provide categorizations for researchers who wish to use discrete raw-score-based categorization. These are high food security (raw score 0), marginal food insecurity (raw score 1-3), moderate food insecurity (raw score 4-6) and severe food insecurity (raw score 7-8) (Ballard et al., 2013).

Items (i.e., questions) included in the above-mentioned HFI scales are detailed in Table 1. It is, however, not clear which HFI scale and/or questions in these scales are valid and reliable for India.

Statistically, the Rasch model helps detect the internal validity and internal reliability of the experience-based measures of HFI (Bond and Fox, 2001). The Rasch model has its roots in

psychometry and Item Response Theory, wherein the construct of interest is 'HFI' and the items representing the underlying phenomenon are arranged along a continuum of 'severity' (Fisher, 1993). The Rasch model assumes the items in the questionnaire collectively assess a single latent trait along a continuum. The internal validity of the scale is established through face validity, conceptual validity, fit statistics, item residual correlation and differential item functioning.

Face validity compares a concept as understood by the target audience with the operational definition of the concept (Derrickson et al., 2000). Face validity of a single item (i.e., question) within a scale might be weak, but a combined set of questions in a scale can be fairly strong.

Item fit statistics help verify ordering of questions, whether each item comprising the scale is associated equally strongly with successive stages of HFI (Fisher, 1993; Bond and Fox, 2001). The HFI scale should have items whose in-fits range between 0.8-1.2. However, in-fits between 0.7-1.3 are also acceptable (Nord et al., 2002).

Conditional item independence indicates the items comprising the scale are correlated, but only because of their mutual association with the latent trait, which is HFI. Conditional independence may be violated, for example, if there exists confusion between questions that are perceived by the respondent to be equivalent (Nord, 2012). Differential Item Functioning (DIF) helps examine whether items are behaving differently for particular subgroups of determined respondents, i.e., by race, gender or ethnicity. The underlying cause of DIF could be either that those respondents in two subpopulations understand the question

differently, or they experience or manage food insecurity differently (Nord, 2012).

Internal reliability is ascertained through tests of sensitivity and specificity compared to the gold standard. Sensitivity is the proportion of those truly food insecure that are measured as food insecure, and specificity implies the proportion of those truly food secure that are measured as food secure. It is also helpful to calculate positive predictive value (calculated as the ratio of true positives over true positives plus false positives), which indicates the probability that a household identified as food insecure (screened positive) by the scale is actually food insecure. Cronbach's alpha and point bi-serial correlations are also helpful to ascertain internal reliability, however, they have several limitations (Cronbach, 1951).

External validation can be established with construct validation. However, the latter is relevant only if internal validity and reliability is robust. This is not generally feasible for experience-based HFI, since food insecurity is not always directly observable. However, association of experience-based HFI measures with factors considered to be determinants or outcomes, such as income, nutrition status and food expenditure, can be done and this is termed as 'construct validation' (Hamilton et al., 1997).

This report maps the use of experience-based HFI scales in India, reviews their internal validity and reliability and captures experiences of researchers who have used such experience-based measures in India. It aims to provide empirical evidence on inclusion of suitable experience-based HFI questions in large scale nutrition/national Demographic Health Surveys (DHSs) in India.

METHODS

The study's geographic scope is India (rural, tribal, urban). It uses a mix of analytic methods, including desk review of published/unpublished studies on experience-based HFI in India; mapping and interviewing researchers contributing to these studies to record their experiences; and future recommendations.

For the desk review, a literature search of HFI in India written in English and conducted between 2000 and 2015 was undertaken. Search engines, including PubMed, Web of science, Medline and Scopus, were used. Search terms applied were 'experience-based', 'experiential', 'food insecurity', 'hunger', 'Rasch model', 'food security scales', 'food security measurement' and 'India'. The search period was 1 June – 31 August 2015.

To gain access to grey literature (papers/reports), a contact list was generated of 31 researchers who have conducted relevant work in India (14 from non-governmental organizations and 17 from academia). Subsequently, an email questionnaire was sent to the identified researchers (N: 31). Of these, 22 responded affirmatively and expressed willingness to fill in an online survey (email questionnaire) and share their reports/papers.

Nine of the 22 researchers who participated provided complete information on all the following four questions of the email questionnaire: (1) which questions have been the most applicable in your context?; (2) which questions have been the most difficult to understand for the respondents in your context?; (3) concern(s)

with translating the questions in local language; and (4) any feedback regarding future application of the scale?

From the 31 researchers contacted and from search across various Boolean operators during the search period, 19 studies were identified (8 from online survey and 11 from journal databases) that had their survey instrument tested for face validity (through focus groups, literature review, expert opinion, key informant interview or cognitive debriefing), and at least one of the measures of internal validity and internal reliability.

For each of the 19 studies, an Excel spreadsheet was prepared, listing study objective, study setting, sample size, period of survey, study population, survey respondents, recall period, type of scale used and information on the scale's reliability statistics (Cronbach's alpha, point bi-serial correlation, Rasch reliability, classification reliability), and validity statistics (face validity, conceptual validity, fit statistics, residual correlations and DIF) (see Table 2).

Cross-cultural validity (Dietchler et al., 2010) was inspected across nine studies, where reliability statistics were available, by examining how the relative severities of equally worded items from various scales compare across diverse settings. To evaluate the external validity of the food security scales across 19 studies, we inspected construct validation and criterion validation by collating available information on bivariate or multivariate association of HFI status with respect to its determinants and consequences.

RESULTS

In total, 19 experience-based HFI studies in Indian settings were identified. All studies were household-based and cross-sectional (see Table 2).

Mapping scales used across 19 districts

Scales

The **18-item scale** and its adaptations were used across six studies. In urban Vellore, Gopichandran et al., 2010, used the original 18-item scale that combines the adult-child item. In the Kolkata slum study, Maitra, 2014, used nine adult items and five child items. In rural Odisha, Nord et al., 2002, adapted the 18-item scale to construct a 9-item adult-child combined scale. Three Delhi-based slum studies used only eight child items as they intended to assess child food insecurity (UHRC, 2011; Gupta et al., 2013; Gupta et al., 2014).

Five studies used the **6-item scale**. Bankura district studies (Mukhopadhyay et al., 2010 and 2011) and a north-east Delhi slum study (Wright and Gupta, 2015) used the original version of the 6-item scale. Delhi (Agarwal et al., 2009) and Meerut (Agarwal et al., 2009a) slum studies shortened it to a 4-item scale.

The **9-item FANTA scale** was used in six studies: rural Mizoram (MSF, 2008), Karnataka (Pasricha et al., 2009), Mumbai slums (Chatterjee et al., 2012), Delhi urban resettlement colony (Chinnakali et al., 2014), rural Odisha (IFPRI, 2015) and statewide Maharashtra nutrition survey (IIPS-UNICEF, 2013).

The **8-item FIES scale** was used in the nationwide Gallup World Poll (GWP) 2014 survey and its 2012 feasibility study (Nord and Cafiero, 2015).

Geographic scope

Only GWP 2014 covered a nationally representative sample (Nord and Cafiero, 2015). The Maharashtra survey ensured state-specific representation (IIPS-UNICEF, 2013). The remaining studies were of smaller sample size and sub-group representations. Six studies were

in rural settings (Nord et al., 2002; Pasricha et al., 2009; Mukhopadhyay et al., 2010 and 2011; IFPRI, 2015; Nord and Cafiero, 2015) and 10 were urban slums/resettlement colonies. The sample size varied from 130 (Gopichandran et al., 2010) to 40,000 (Agarwal et al., 2009b). In the GWP 2014 survey and Maharashtra survey, the sample size was 2,000-3,000 households (Nord and Cafiero, 2015; IIPS-UNICEF, 2013).

Language

GWP 2014 administered the 8-item scale in 11 languages spoken across Indian states. Other studies also administered the scale in the local language: Bengali, Hindi, Kannada, Marathi, Oriya and Tamil (see Table 2).

Study population

Children aged under five years were the study population in five studies (Gupta et al., 2014; Pasricha et al., 2009; Gupta et al., 2013; IIPS-UNICEF, 2013; MSF, 2008). Both children and adults were the study population for three studies (Gopichandran et al., 2010; Maitra, 2014; Nord et al., 2002). In the remaining studies, the study population was adult men and women in the household (see Table 2).

Respondents

The respondents were mostly women of reproductive age, except in five studies (Maitra, 2014; Gopichandran et al., 2010; Mukhopadhyay, 2010 and 2011; Nord and Cafiero, 2015) where respondents were head of household or any responsible adult family member, preferably a woman. For two studies (Nord et al., 2002; IFPRI, 2015), information on respondents was not available.

Recall period

Studies using the 9-item scale had a 30-day recall period and those using FIES and the 6-item scale or its adaptations had a 12-month recall period. The Kolkata slums and rural Odisha studies reported a 30-day recall period while using the 18-item scale for recall accuracy (Maitra, 2014; Nord et al., 2002), although a 12-month recall period is recommended. Only one of the three studies that used the child-referenced items

of the 18-item scale (UHRC, 2011) reported experiencing difficulty with a 12-month recall period and, hence, used a 30-day recall period.

Use of 'How often' options

All studies that used the 9-item scale had standard frequency of occurrence options – 'often' (more than 10 times in the past four weeks), 'sometimes' (three to 10 times in the past four weeks) and 'rarely' (one or two times in the past four weeks) – advised by FANTA in their guidelines (Coates et al., 2007).

The 18-item version of the scale has frequency of occurrence questions for selected items with options, such as 'often', 'sometimes', 'never or almost every month', 'some months but not every month', 'only one or two months'. These options were followed in the Vellore study (Gopichandran et al., 2010) and child food security studies in Delhi slums (Gupta et al., 2014; Gupta et al., 2013; UHRC, 2011). However, the Kolkata slum study incorporated a frequency of occurrence question after every 'occurrence' question except the questions on 'eating rich food' and 'losing weight' and tweaked the frequency of response options to: 'often' (a few times most weeks), 'sometimes' (one or two weeks but not every week) and 'rarely' (only a few days in a month/ one or two days) (Maitra, 2014).

Studies with the 6-item scale used the standard frequency of occurrence options with minor variations – for example, while the Delhi survey (Agarwal et al., 2009) defined 'often' as '10-12 months' or 'almost every month' and 'sometimes' as '3-9 months', the Meerut survey (Agarwal et al., 2009b) worded 'often' as 'few times in most months' or 'almost every month' and 'sometimes' as '6-12 times past year'.

The rural Odisha survey (Nord et al., 2002) did not use any frequency of occurrence response. India was among the few countries of the GWP 2014 survey in which affirmative responses to the two most severe questions 'hungry' and 'whole day' were followed up with frequency of occurrence options (Nord and Cafiero, 2015), such as 'only once or twice', 'in some months but not every month' and 'almost every month'.

Thresholds used across scales for HFI prevalence estimates

Fifteen of the 19 studies used standard recommended raw score thresholds for classifying household food insecurity. The rural Odisha study (Nord et al., 2002), Delhi slum studies (Agarwal et al., 2009; Agarwal et al., 2009a) and Kolkata slum study (Maitra, 2014) attempted to use locally meaningful cut-off for raw scores to capture local context. HFI prevalence varied depending on the type of scale used and geographic context (see Table 2).

Internal reliability and validity

For the nine studies with information on psychometric analysis, the item and household severity parameters are shown in Table 2. For studies using the 18-item scale (Nord et al., 2002; Maitra, 2014), in-fits were in acceptable range for adult items (0.7-1.13) and out-fits were high for 'balanced meal' (4.96), 'ate less' (3.07), 'child cut size-skip meal' (1.95) in the Odisha study (Nord et al., 2022) and for 'rich meal' (5.00) in the Kolkata study (Maitra, 2014).

The adapted 6-item scale into 4-items was administered in Delhi and Meerut slums (Agarwal et al., 2009; Agarwal et al., 2009a), with in-fits ranging from 0.52-1.11 and variant out-fits (0.63-11.22), particularly for 'cut size-skip meal' and 'nutritious meal'.

Using the 9-item scale, the Odisha study (IFPRI, 2015) reports item in-fits of 0.84-1.36, with high in-fit (1.36) and out-fit (1.47) for the item 'preferred food'. In the dichotomous Maharashtra study (IIPS-UNICEF, 2013), in-fits were variant (0.62-1.29), largely owing to erratic responses for the items 'worried', 'preferred food', 'hungry' and 'whole day'. The residual correlation between 'smaller' and 'fewer' is excessive (0.63) (see Table 2).

GWP 2014 survey results (Nord and Cafiero, 2015) on internal validity are available for the dichotomous 8-item scale and the extended trichotomous 8-item scale with 'hungry' and 'whole day' (i.e., followed up by 'how often' questions with three response options). For the basic dichotomous scale, in-fit statistics were 0.7 to 1.3 for all eight items. The Rasch reliability

was 0.72. None of the residual correlations were excessive but consistent with the Rasch model assumption of uni-dimensionality. Item fit statistics were within reasonable range (0.70-1.30) for all subpopulations, although the 'whole day' item had in-fit statistics larger than 1.3 for some subgroups. For the extended FIES, all Rasch-Thurstone in-fit statistics were acceptable (0.7 to 1.3) and Rasch reliability improved to 0.82.

All nine studies reported consistency in ordering of items corresponding to anxiety and quality of food (e.g., 'worried', 'preferred food', 'limited variety') being at the lower end of the scale and the items relating to drastic reduction in adult intake (e.g., 'hungry' and 'whole day') being at the higher end of the scale. In between lie the questions on graduated reduction in quality or intake ('food not want' or 'smaller meal').

Occasional overlaps in ordering of responses to some of the questions were noted, the most striking result being the item 'lost weight' (adult-referenced), while 'personally eating less' and 'rich food' having very low severity in the Kolkata slum study (Maitra,

2014) and the item 'preferred food' having relatively lower severity than expected in the rural Odisha study (Nord et al., 2002).

Cross-cultural validity

Cross-cultural validity for equally worded items across studies was compared by four domain areas: (1) Worry/anxiety related to food budget/food supply; (2) Perceptions of inadequate food quality or quantity; (3) Reported instances of reduced food intake or its consequences for adults; (4) Reported instances of reduced food intake or its consequences for children. For most items, severity of equally worded items was comparable for domain 3 and 4 but not 1 and 2 (see Table 3).

External validation

Construct validity was established with respect to nutritional (child anthropometry) status (Mukhopadhyay et al., 2011; Agarwal et al., 2009; IIPS-UNICEF, 2013). Each of these studies established a positive linear relation showing children from food insecure households have poor nutritional status and a strong association with child stunting.

DISCUSSION

Need for more robust pre-testing and contextualization

In-fit statistics for one or more items in seven of the nine studies where fit statistics were reported were not in the expected range of 0.7-1.3, owing to either low in-fits or extremely high out-fits on selected items (Agarwal et al., 2009; Maitra, 2014; Nord et al., 2002; Agarwal et al., 2009a; Nord and Cafiero, 2015; IFPRI, 2015; IIPS-UNICEF, 2013). Variant out-fits/in-fits were particularly noted for items such as 'worried', 'balanced meal', 'preferred food', 'rich meal', 'adult/child cut-skip meal', 'nutritious meal'. These results show either poor interviewee or interviewer understanding of the questions and, hence, a need for more robust pre-testing and contextualization.

Programmatically, this points to the need for more care in translation and in wording of questions (Ballard et al., 2013). Evidence on the 'uncertainty and anxiety' items is mixed, demonstrating weak association of the item with the underlying latent trait of HFI in India. This also could be an indication that worrying about food is not a common concept in all cultures (Dietchler et al., 2010) and redundancy of some 'worry/anxiety' items for deprived environments.

Quality related items are problematic

Major concerns emerge on items/questions related to the 'inadequate food quality' domain, adult or child specific. First, the 'balanced meal' item may not be applicable in the Indian low income zones unless accompanied by relevant and suitable examples due to lack of equivalent expression for the phrase in the Indian context. Attempts to replace the expression 'balanced meal' by expressions such as 'healthy and varied diet' (child-referenced) or 'nutritious meal' (adult-referenced) have also met with problems in some studies indicating the need for care during translation in a well understood language.

Second, the item 'preferred food' is also problematic based on both psychometric evidence and the researchers' feedback, since the concept of 'preferred' food is likely to vary

according to culture and geographic origin of people and also between adults and children.

Third, an attempt to capture the quality through items such as 'rich food', did not prove meaningful. Items such as 'lost weight', 'personally eating less food' in scales seem to contradict the essence and it would be useful to avoid them.

Severe forms of food insecurity are uniformly cross cultural

The items in the domain of 'inadequate food quantity' perform more or less consistently across all settings and all scales, and were in unacceptable fit-statistics ranges (0.70-1.30) in most cases, providing evidence that the most severe forms of food insecurity are uniform across all cultures and also easier to relate to by respondents.

A challenging item across scales was 'adult cut-skip meal' and researchers (Nord et al., 2002; Agarwal et al., 2009a) have advised to split the item for future applications, since the two behaviours are supposedly different in practice. Similar results have been reported by Derrickson for Hawaii (Derrickson et al., 2000) where the item 'cut size-skip meal' had been tested for inclusion on the national scale and reported poor in-fit statistics.

Problematic items on child food insecurity

There is limited psychometric evidence in the domain of child food inadequacy and its consequences. However, the consensus that emerges from literature and personal feedback of researchers who participated in the online survey is that child food insecurity may not always represent severe food insecurity since reduction in children's meals is possible for reasons other than food insecurity (Coates et al., 2004).

Nord and Cafiero (2015) also caution against using both child and adult items in the same scale unless child items refer only to much younger children under the age of five due to the potential threat of the presence of a strong

second dimension differentiated by adult versus child items. This explains why the child-referenced questions were removed in the 8-item FIES.

Inclusion of follow-up questions should be based on pre-testing

In the 4-item Delhi and Meerut slum studies (Agarwal et al., 2009; Agarwal et al., 2009a), including the follow-up question 'how often' after the combined item 'cut size-skip meal' served to improve the validity of the scale. The Delhi study (Agarwal et al., 2009) also recommended adding 'how often' follow-up questions to the item 'hungry'. Similar suggestions were proposed by the Kolkata study (Maitra, 2014).

Other researchers interviewed suggested that including 'how often' responses may increase respondent burden and greatly complicate analysis as the polytomous model is much more complex than the simple dichotomous Rasch model.

In general, it can be suggested that it may be useful to include such follow-up questions in a research survey to explore the temporal patterns of food insecurity or it may be useful to include such follow-ups to the most severe questions in order to extend the range of measured severity upward. However, the final decision to include follow-up items should be based on pre-testing.

Mixed evidence on cross-cultural validity

Items in the domains of quantity/quality reduction, such as cutting or skipping meals, having a smaller meal/or eating fewer meals, being hungry, not eating a whole day, seem to reflect similar severity of food insecurity across various locations. However, HFI prevalence estimates are not comparable since different scales use various criteria for deciding thresholds.

Items in domains of uncertainty and quality reduction, such as 'worried', 'balanced meal', 'preferred food', 'no food to eat', have different severities across different scales and settings. Nonetheless, the 8-item FIES tested across various settings and subpopulations in India did find cross-cultural comparability, indicating that its prevalence rates will have little bias. However, the question of equivalence of different scales remains unanswered due to inadequate data.

Relevance of construct validity

Construct validation is relevant only if internal validity and reliability is robust and a standardized set of characteristics are defined for use across studies. Reporting poor association of HFI scales (with poor internal validity) will misrepresent the information. Although the respondent in the majority of studies reviewed was an adult female member in the household, possible sources of bias in the surveys may affect the validity of the scales, such as gender of respondent, period of survey and choice of recall period, thereby reducing comparability (Coates et al., 2010).

Recall period: 12 months or 30 days?

The survey period is also an important consideration in eliminating risk of response bias due to seasonality and subsequent change in food habits, especially during festivities (Maitra, 2014). The shorter reference period may improve recall. Difference in recall periods should also be kept in mind when comparing HFI prevalence. A 12-month recall period may be more relevant in those settings where averaging out seasonal differences is necessary. If HFI is transient or occasional for a substantial proportion of those who are food insecure, then the difference between the 12-month and 30-day recall period may be substantial.

CONCLUSION

This paper reviewed the internal reliability and validity of 19 studies using experience-based HFI in the India. The following conclusions are based on this analysis:

1. HFI experiential scales used in the Indian context are internally reliable. To improve validation, the following actions are suggested: (i) cognitive testing of quality of diet items; (ii) avoid child-referenced items; (iii) rigorous training of enumerators; (iv) add the follow-up question 'how often' to avoid rare events and, hence, overestimation of food insecure conditions; (v) split the 'cut and skip' meal item; (vi) use a standardized set of questions for aiding comparison of construct validity across scales; and (vii) apart from evaluating the Rasch assumption of equal item discrimination, examine the assumption of conditional item independence to eliminate the threat of redundant items and of a second dimension in the data, such as households with and without children.
2. The survey recall period may be decided according to the survey purpose and based on pre-testing and duration of food insecurity periods.
3. It is critical to establish external validity of HFI scales with nutritional (anthropometric) indicators and this should be incorporated in surveys, based on available resources.
4. Equivalence of the scales across diverse settings should be established to ensure comparability of prevalence estimates across subpopulations, with similar questions, scale and recall periods. The 8-item FIES, tested psychometrically, for

cross-cultural validity may be included in large scale Indian nutrition surveys to further establish and test this equivalence.

However, for the exploratory/pre-testing phase in India, we recommend including 'How often' follow-up questions to all items; using standard thresholds for categorization of raw scores; removing the two-child referenced questions; and testing whether last 30 days/12 months recall period works best for Indian settings. This will help to finally arrive at an Indian FIES – with the most relevant questions, recall period and items requiring follow-up questions, which can be included in DHSs after expert opinion from a good representation of nutritionists and related policy and advocacy groups under the aegis of a nationally recognized body.

5. India is signatory to reporting progress against the agreed indicators of the Sustainable Development Goals (SDG). SDG Indicator 2.1.2, i.e., prevalence of moderate or severe food insecurity in the population, is based on the 8-item FIES. It is, therefore, timely for India to start an evidence-based policy dialogue to include FIES in India's national surveys. It needs to invest in contextualizing and harmonizing the HFI scale and/or questions within the scale across multiple surveys (NSSO, NFHS) to aid comparability over time and support decision making as well as SDG reporting. The inclusion of FIES in the ongoing Comprehensive National Nutrition Survey (CNNS) of the Ministry of Health and Family Welfare will provide an opportunity to test its validity across Indian states before inclusion in national demographic surveys.

LITERATURE CITED

Agarwal, S., V. Sethi and M. Nord, *Levels and Predictors of Experiential Household Food Insecurity among Urban Poor of North India*, Urban Health Resource Centre India, Economic Research Service, USDA, Washington DC, 2009.

Agarwal, S., V. Sethi, P. Gupta and M. Jha, 'Experiential household food insecurity in an urban underserved slum of North India', *Food Security*, vol.1, no.3, 2009a, pp. 239-250.

Ballard, T.J., A.W. Kepple and C. Cafiero, *The food insecurity experience scale: development of a global standard for monitoring hunger worldwide*, Food and Agriculture Organization, Rome, Italy 2013. Retrieved from <www.fao.org/fileadmin/templates/ess/voh/FIES_Technical_Paper_v1.1.pdf>.

Bickel, G., M. Nord, C. Price, W. Hamilton and J. Cook, *Guide to measuring household food security* (revised), US Department of Agriculture, Food and Nutrition Service, Alexandria, Virginia, USA, 2000.

Blumberg, S.J., K. Bialostosky, W.L. Hamilton and R.R. Briefel, 'The Effectiveness of a Short Form of the Household Food Security Scale', *American Journal of Public Health*, vol. 89, no.8, 1999, pp. 1231-1234.

Bond, T.G., and C.M. Fox, *Applying the Rasch Model: Fundamental Measurement in the Human Sciences*, Lawrence Erlbaum Associates, Publishers, Mahway, New Jersey, USA, 2001.

Carlson, S. J., M. S. Andrews and G. W. Bickel, 'Measuring food insecurity and hunger in the United States: Development of a national benchmark measure and prevalence estimates', *Journal of Nutrition*, vol. 129 (2S Suppl.), 510S, 1999.

Chatterjee, N., G. Fernandes and M. Hernandez, 'Food insecurity in urban poor households in Mumbai, India', *Food Security*, vol. 4, no. 4, 2012, pp. 619-632.

Chinnakali, P., et al., 'Prevalence of Household-level Food Insecurity and Its Determinants in an Urban Resettlement Colony in North India', *Journal of Health, Population and Nutrition*, vol. 32, no. 2, 2014, pp. 227-236.

Coates, J. C., et al., ' "He said, she said": Who Should Speak for Households about Experiences of Food Insecurity in Bangladesh?', *Food Security*, vol. 2, no. 1, March 2010, pp. 81-95.

Coates, J., A. Swindale and P. Bilinsky, *Household Food Insecurity Access Scale (HFIAS) for measurement of household food access: indicator guide (v. 3)*, Food and Nutrition Technical Assistance Project, Academy for Educational Development, Washington DC, USA, 2007.

Coates, J., *Experience and Expression of Food Insecurity across Cultures: Practical Implications for Valid Measurement*, Food and Nutrition Technical Assistance Project, Academy for Educational Development, Washington DC, USA, 2004.

Cronbach, L. J., 'Coefficient Alpha and the Internal Structure of Tests', *Psychometrika*, vol. 16, no. 3, 1951, pp. 297-334.

Dastgiri, S., H. Tutunchi, A. Ostadrahimi and S. Mahboob, 'Sensitivity and Specificity of a Short Questionnaire for Food Insecurity Surveillance in Iran', *Food and Nutrition Bulletin*, vol. 28, no. 1, 2007, pp. 55-58.

Deitchler, M., T.J. Ballard, A. Swindale and J. Coates, *Validation of a measure of household hunger for cross-cultural use*, FANTA-2, Technical Report, Academy for Educational Development, Washington DC, USA, 2010.

Derrickson, J.P., A.G. Fisher and J.E. Anderson, 'The core food security module scale measure is valid and reliable when used with Asians and Pacific Islanders', *Journal of Nutrition*, vol. 130, no. 11, 2000, p. 2666.

Fisher, A.G., 'The assessment of IADL motor skills: an application of many-faceted Rasch analysis', *American Journal of Occupational Therapy*, Official Publication of the American Occupational Therapy Association, vol. 47, no. 4, 1993, p. 319.

Frongillo, E. A. and S. Nanama, 'Development and Validation of an Experience based Tool to Directly Measure Household Food Insecurity within and Across Seasons in Northern Burkina Faso', Division of Nutritional Sciences, Cornell University, Ithaca, USA, 2003.

Gopichandran, V., et al., 'Household food security in urban Tamil Nadu: a survey in Vellore', *The National Medical Journal of India*, vol. 23, no. 5, 2010, p. 278.

Gupta, P., K. Singh and V. Sethi, 'Food insecurity among the young children (6-35 months) in urban slums of Delhi, India', *Indian Journal of Maternal and Child Health*, vol.15, no. 4, 2013, pp. 1-6.

Gupta, P., K. Singh, V. Sethi, S. Agarwal and P. Mathur, *Association of Food Insecurity and Malnutrition among Young Children (6-36 Months)*, unpublished report, 2014.

Hamilton, W. L., et al., *Household food security in the United States in 1995: Technical report*, US Department of Agriculture Food and Consumer Service, Office of Analysis and Evaluation, and Abt Associates Washington DC, USA, 1997.

International Food Policy Research Institute (IFPRI), *Report*, IFPRI, New Delhi, India, 2015.

International Institute for Population Sciences-United Nation Children's Fund (IIPS-UNICEF), *Comprehensive Nutrition Survey of Maharashtra Report*, available from www.iipsindia.org/IIPS-UNICEF_report.htm, IIPS-UNICEF, Mumbai, India, 2013.

Linacre, J., *A User's Guide to WINSTEPS, MINISTEP Rasch-Model Computer Programs*, John M. Linacre, Chicago, USA, 2006.

Maitra, C., *Going beyond calories - Looking at experiential food insecurity in urban slum households in Kolkata*, Discussion paper no. 523, School of Economics, University of Queensland, Brisbane, Australia, 2014, available at <www.uq.edu.au/economics/abstract/523.pdf>.

Médecins Sans Frontières (MSF), *Food Security Assessment Report*, Chittagong Hill Tracts Sajek Union, MSF, Bangladesh, 2008.

Mukhopadhyay, D., S. Mukhopadhyay and A. Biswas, 'Enduring starvation in silent Population: A study on prevalence and factors contributing to household food security in the tribal population in Bankura, West Bengal', *Indian Journal of Public Health*, vol. 54, no. 2, 2010, p. 92.

Mukhopadhyay, D.K. and A.B. Biswas, 'Food security and anthropometric failure among tribal children in Bankura, West Bengal', *Indian Pediatrics*, vol. 48, no. 4, 2011, p. 311.

Ministry of Women and Child Development (MWCD), *Rapid survey of children (RSOC)*, MWCD, Government of India, 2014.

Nord, M. and C. Cafiero, *Experiential Food Security Measures in Nationally Representative Surveys in India: Psychometric Analysis*, Voices of the Hungry, Food and Agricultural Organization of the United Nations, Rome, Italy, 2015.

Nord, M., et al., *Comparing Household Survey-Based Measures of Food Insecurity Across Countries: Case Studies in India, Uganda and Bangladesh*, Discussion Paper No 7, Friedman School of Nutrition Science and Policy, Tufts University, 2002.

Nord, Mark, *Assessing Potential Technical Enhancements to the U.S. Household Food Security Measures*, TB-1936, US Department of Agriculture, Economic Research Service, December 2012.

National Sample Survey Organisation (NSSO), *Reported Adequacy of Food Intake in India, 1993-94*, Report No. 415, 50th Round, July 1993 - June 1994, NSSO, Department of Statistics, Government of India, New Delhi, India.

National Sample Survey Organisation (NSSO), *Perceived adequacy of food consumption in Indian households, 2009-10 (July 2009 - June 2010)*, Report No. 547, 66th Round, NSSO, Government of India, New Delhi, India, February 2013, <http://mospi.nic.in/Mospi_New/upload/nss_report_547.pdf>.

Pasricha, S.-R., et al., 'A community based field research project investigating anaemia amongst young children living in rural Karnataka, India: a cross sectional study.' *BMC Public Health*, vol. 9, no. 1, 2009, pp. 59-59.

Radimer, K.L., C.M. Olson and C.C. Campbell, 'Development of indicators to assess hunger', *Journal of Nutrition*, vol.120, 1990, pp.1544-1548.

Urban Health Resource Center (UHRC), *Coping strategies and levels of child food insecurity among urban-poor food insecure households living in urban slums of Seelampur*, Delhi, UHRC, New Delhi, India, 2011.

Webb, P., J. Coates and R.F. Houser, *Food Insecurity Measurement and Validation Study: A Report on the Formulation of the Core Food Security Module, and Experiences in its Implementation in Bangladesh*, Report to Academy for Educational Development, Food and Nutrition Technical Assistance Project, United States Agency for International Development, Washington DC, USA, 2001.

Wehler, C.A., R.I. Scott and J.J. Anderson, 'The community childhood hunger identification project: a model of domestic hunger - demonstration project in Seattle', *Journal of Nutrition Education*, Washington, USA, 24 Suppl., 1992, pp. 29-35.

Wright, L. and P. Gupta, 'Coping Strategies Adopted by Urban Poor to Ameliorate Food Insecurity: Case of United States, Belize and India', *Journal of Food Security*, vol. 3, no. 2, 2015, pp. 40-46.



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TABLES

Table 1 Food security scale questionnaire: various scales

Items	18-item US HFSSM	6-item short form US HFSSM	9-item HFAS	8-item FIES
	12 months	12 months	30 days	12 months
Recall period				
Food bought just didn't last/household ran out of food	✓	✗	✓	✓
Couldn't afford to eat balanced meals/healthy/nutritious food	✓	✓	✗	✓
Cut the size or skip meals	✓	✓	✗	✗
Did you ever eat less than you felt you should	✓	✓	✗	✗
Hungry but didn't eat	✓	✗	✗	✗
Lose weight because there wasn't enough money for food	✓	✗	✗	✗
Not eat for a whole day because there wasn't enough money for food?	✓	✗	✗	✗
Relied on only a few kinds of low-cost food to feed child/the children	✓	✗	✗	✗
Couldn't feed child/the children a balanced meal	✓	✗	✗	✗
Child/children not eating enough	✓	✗	✗	✗
Cut size of child's meals	✓	✗	✗	✗
Child/children ever skip meals	✓	✗	✗	✗
Child/children ever hungry	✓	✗	✗	✗
Child/any children not eat for a whole day	✓	✗	✗	✗
Not able to eat preferred foods	✗	✗	✓	✗
Eat limited variety of foods/few kinds of foods	✗	✗	✓	✓
Eat some foods you really did not want to eat	✗	✗	✓	✗
Eat a smaller [meal] than you felt you needed	✗	✗	✓	✗

Table 1 (contd.)

Items	18-item US HFSSM 12 months	6-item short form US HFSSM 12 months	9-item HFIAS 30 days	8-item FIES 12 months
Recall period				
Eat [fewer meals in a day]/Ate less	✗	✗	✓	✓
No food to eat of any kind in your household because of lack of resources to get food?	✗	✗	✓	✗
Sleep at night hungry	✗	✗	✓	✗
Whole day and night without eating anything/Went without eating for a whole day	✗	✗	✓	✓
Skip a meal	✗	✗	✗	✓
Hungry but did not eat	✗	✗	✗	✓
Any of the children younger than 5 years old: Did not eat healthy and nutritious foods	✗	✗	✗	✓
Any children younger than 5 years old was not given enough food	✗	✗	✗	✓

Table 2 Summary of published/unpublished work on experiential household food security scales, India, 2000-2015

ID	Authors	Setting	Period of study	Sample size	Study population	Respondent	Language
1.	Nord et al. (2002) ¹	Rural Orissa	2000-2001	282	All adults and children in the household	-	Oriya
2.	MSF (2008)	Chittagong Hill Tracts Sajek Union, bordering Bangladesh and Mizoram, India	March-April 2008	151 households from 34 villages	Children aged 1-5 years	Adult females/ males in the household	Bengali
3.	Agarwal et al. (2009)	Slum in north-east Delhi	June-July 2008	410	All adults in household	Adult female involved in cooking/ purchasing food	Hindi
4.	Agarwal et al. (2009a)	75 slums in Meerut city	October 2007-March 2008	40,016	Women of reproductive age	Adult female	Hindi
5.	Pasricha, et al. (2009)	Rural Karnataka	-	415	Children aged 12-23 months	Mothers of the children	Kannada
6.	Gopichandran et al. (2010)	Vellore (urban), Tamil Nadu	May-June 2009	130	All adults and children in household	Head of household/ housewife	Tamil
7.	Mukhopadhyay et al. (2010)	Bankura –1 CD block district, West Bengal	July-August 2009	267 tribal households	All adults in household	Head of household/ responsible adult family member, preferably a woman	Bengali
8.	Mukhopadhyay and Biswas (2011)	Bankura –1 CD block district, West Bengal	July-August 2009	188 tribal households	Tribal children aged 24-59 months	Mothers of the children	Bengali
9.	Chatterjee et al. (2012)	Three slums in north-west Mumbai	January -March 2010	283	All adult members	Adult female	Marathi
10.	Chinnakali et al. (2014)	Resettlement colony in south Delhi		250	All adult members	Females aged 18-50 years	Hindi
11.	Maitra (2014)	15 slums in Kolkata Metropolitan Corporation area	April 2010 -January 2011	500	All adults and children	Head of household/ adult female in charge of kitchen	Bengali

Type of scale	Recall period	Internal reliability/validity	Food security status
9-item scale adapted from 18-item US HFSSM ²	30 days	In-fit: 0.75-1.11 High out-fit: balanced meal, ate less and cut/skip meal	Food secure: 8.0% Food insecure: 92.0% (food insecure with hunger: 57.0%)
9-item FANTA HFIAS version 3	30 days	-	Food secure: 4.0% Mildly food insecure: 4.6% Moderately food insecure: 11.9% Severely food insecure: 79.5%
4-item scale adapted from 6-item shorter version of US HFSSM ³	12 months	Cronbach's alpha: 0.8 In-fit: 0.77-1.07 High out-fit: cut/skip meal	Food secure: 9.0% Food insecure: 51.0% (food insecure without hunger: 27.1%; food insecure with hunger: 23.9%)
4-item scale adapted from 6-item shorter version of US HFSSM ⁴	12 months	Point bi-serial correlation: 0.43-0.59 Cronbach's alpha: 0.725 In-fit: 0.52-1.11 High out-fit: nutritious food	Food insecure: 74.2% (food insecure without hunger: 31.5%; food insecure with hunger: 42.7%)
9-item FANTA HFIAS version 3	30 days		Food secure: 42.0% Food insecure: 58.0%
18-item US HFSSM	12 months	-	Food secure: 25.4% Food insecure with hunger: 61.5% Food insecure without hunger: 13.1%
A validated Bengali version of the US 6-item short form food security scale	12 months	Kappa: >0.84 Cronbach's alpha: 0.82	High/marginal food security: 47.2% Low food security: 29.6% Very low food security: 23.2% Low food security in households with children aged under five: 31.2% Very low food security in households with children aged under five: 24.3% Low food security of households without children aged under five: 24.6% Very low food security of households without children aged under five: 20.0%
A validated Bengali version of the 6-item shorter version of US HFSSM	12 months	Same as above	High/marginal food security: 46.8% Low food security: 28.7% Very low food security: 26.5%
9-item FANTA HFIAS	30 days	-	Food secure: 23.7% Severely food insecure: 59.7% Mildly to moderately food insecure: 16.6%
9-item FANTA HFIAS	30 days	-	Food insecure: 77.2% (mildly food insecure: 49.2%; moderately food insecure: 18.8%; severely food insecure: 9.2%)
9-item adult scale and 5-item child scale adapted from 18-item US HFSSM ⁵	30 days	9-item adult scale Cronbach's alpha: 0.85 Rasch reliability: 0.75 Sensitivity: 0.83 Specificity: 0.97 Positive predictive value: 0.85 In-fit: 0.7-1.3. High out-fit: never cooked rich meal 5-item child scale Rasch reliability: 0.94 Sensitivity: 0.87 Specificity: 0.97 Positive predictive value: 0.89 In-fit: 0.63-1.25 High out-fit: child could not eat three square meals	9-item adult 'ever' scale Food insecure: 15.4% (moderately food insecure: 12.8%; severely food insecure: 2.6%) Food secure: 84.6% (highly food secure: 76.2%; marginally food secure: 8.4%) 5-item child scale Food insecure: 20.4% households Highly food secure: 70.7% households (marginally food secure: 7.9% households with children)

Table 2 (contd.)

ID	Authors	Setting	Period of study	Sample size	Study population	Respondent	Language
12.	UHRC (2011)	Slum in north-east Delhi	June -July 2011	232	Children aged below 5 years	Adult female aged ≥ 18 years involved in cooking and purchasing food	Hindi
13.	Gupta et al. (2013)	Four Delhi slums	August 2011-October 2012	446	Women of reproductive age (15-45 years) with children (6-35 months)	Mothers involved in cooking and purchasing food	Hindi
14.	Gupta et al. (2014)	Four Delhi slums	2012	446	Women of reproductive age (15-45 years) with children (6-36 months)	Mothers involved in cooking and purchasing food	Hindi
15.	Nord and Cafiero (2015)	Rural/urban India	2012 Gallup World Poll Survey	2,540	Adult men and women aged 15+ years, children aged <15 years	Randomized adult (aged 15+) in household	Multiple. Hindi (n=1,480), Marathi (n=280), Bengali (n=230), Telegu (n=210), smaller numbers in Gujarati, Kannada, Malayalam, Tamil, Oriya, Punjabi and Assamese
16	IIPS-UNICEF (2013)	Maharashtra state – aggregate/rural/urban	February-April 2012	2,630	Household with children below 2 years of age	Household member, primarily involved in food preparation and means	Marathi/English
17.	Wright and Gupta (2015)	Slum in north-east Delhi	2010	105	Convenience sample of members in families receiving care at health centres and clinics	Women of reproductive age (18-45 years) who were responsible for food procurement	Hindi

Type of scale	Recall period	Internal reliability/validity	Food security status
8-item child food security scale based on US HFSSM	30 days	-	Households where children are food secure: 0.4% Marginally food secure: 8.6% Food insecure without hunger: 27.6% Food insecure with hunger: 63.4%
8-item child scale based on 18-item US HFSSM	12 months	-	Food secure: 45.0% - 81.0% Low food insecure: 18.0% - 49.0% Very low food insecure: 1.0% - 15.0%
8-item child scale based on 18-item US HFSSM	12 months	-	Food insecure: 38.1% of children
FIES ⁶ 8 adult items 7 child items	12 months	Adult scale In-fits: 0.7-1.3 except item 'ran out' (1.38) Rasch reliability: 0.72 Child scale (6 items) In-fits: acceptable range 0.7-1.3 Combined adult-child scale In-fits: acceptable range 0.7-1.3	Not available
FANTA 9-item HFIAS	30 days	Maharashtra basic dichotomous (yes/no) scale Cronbach's alpha: 0.91 Rasch reliability: 0.818 In-fits: 0.62-1.29 High out-fits: worried (4.50), preferred food (5.99), hungry (7.04) and whole day (11.54) Maharashtra basic dichotomous rural Cronbach's alpha: 0.91 In-fits: 0.62-1.35 (worried high in-fit) High out-fits: worried, preferred food, hungry and whole day Maharashtra basic dichotomous urban Cronbach's alpha: 0.90 In-fits: 0.61-1.21 High out-fits: worried, preferred food, hungry and whole day Maharashtra (sometimes/often = 1, rarely/never = 0) Cronbach's alpha: 0.88 Rasch reliability: 0.729 In-fits: 0.75-1.29 High out-fits: worried and hungry Maharashtra polytomous scale Rasch reliability: 0.807 In-fits: 0.77-1.45 In-fit for worried is high High out-fit: worried, hungry and whole day	Food secure: 57.0% Mildly food secure: 17.0% Moderately food secure: 13.0% Severely food insecure: 14.0%
6-item shorter version of US HFSSM	12 months	-	Food insecure: 57.0%

Table 2 (contd.)

ID	Authors	Setting	Period of study	Sample size	Study population	Respondent	Language
18.	Nord and Cafiero (2015)	Rural/urban India	2014 Gallup World Poll Survey	3,000 (nationally representative sample)	Men and women aged 15+ years	Randomized adult (aged 15+ years) in household	Multiple. Hindi (n=1,480), Marathi (n=280), Bengali (n=230), Telegu (n=210), smaller numbers in Gujarati, Kannada, Malayalam, Tamil, Oriya, Punjabi and Assamese
19.	IFPRI (2015)	Odisha	2015	-	-	-	-

Note: All studies are household-based cross-sectional studies.

¹The survey and initial adaptation of the 18-item US HFSSM in rural Odisha was undertaken by Nikhil Raj and Anup Satpathy. Dr. Mark Nord joined the project at a later stage to undertake the psychometric assessment of the scale. The original paper is cited as: Raj, Nikhil and Anoop Kumar Satpathy. 2002. "Household Food Insecurity and Child Labour: Some Evidences from Rural Orissa," Chapter 14 in *Coming to Grips with Rural Child Work*, Nira Ramchandran and Lionel Massum (eds.). New Delhi: IHD Publishers.

² Household scales were estimated for adult items only, combined adult-child items, and child items only. The items 'adult/child cut size-skip meal' had the follow-up question 'how often'.

^{3&4} Three items had the follow-up question 'how often'. Only 'slept hungry' had no follow-up.

⁵ All items except 'did you get rich food' and 'did adult/child lose weight' were followed by frequency of occurrence.

⁶ No follow-up question 'how often'.

⁷ Extension was to include 'how often' follow-up questions to the two most severe questions (hungry and whole day). Response options: 'only once or twice', 'in some months but not every month', 'almost every month'. Partial credit Rasch model analysis. Child items were for research purposes and not included in the scale.

Type of scale	Recall period	Internal reliability/validity	Food security status
Extended FIES 8 adult items (plus 2 child items if child aged under five lived in the household) ⁷	12 months	In-fit: 0.7-1.3 for 8 items and excellent for 7 (0.8-1.2) Rasch reliability: 0.72 Extended FIES (hungry and whole day trichotomous) All Rasch-Thurstone in-fit statistics were in an excellent range: 0.8-1.2 Overall item in-fit statistics good for all 8 items: 0.7-1.3 Rasch reliability: 0.82	Not yet released
9-item FANTA HFIAS	30 days	In-fits: 0.92-1.36 (high in-fit: preferred food) High out-fit: preferred food	Not available

Table 3 Food insecurity themes and corresponding items, India, 2000-2015

Study	Setting	Language	Item (abbreviation)	% yes	Severity (s.e)	In-fit	Out-fit
Anxiety relating to food budget or food supply							
Nord et al. (2002)	Odisha/rural	Oriya	Food bought didn't last (food no last)	75.9	2.79 (0.16)	0.75	0.16
Agrawal et al. (2009 and 2009a)	Delhi/urban Meerut/urban	Hindi Hindi	Food did not last and no money for more Food did not last and no money for more	51.7 74.5	4.80 (0.4) 5.25 (0.03)	0.77 0.60	0.56 1.11
Chatterjee et al. (2012)	Mumbai/urban	Hindi	Worried household wouldn't have enough food	61.1*	-	-	-
Maitra (2014)	Kolkata/urban	Bengali	Worried food would run out	23.0	5.53 (0.21)	1.05	0.75
Maitra (2014)	Kolkata/urban	Bengali	Food stored ran out	18.8	6.44 (0.22)	1.30	0.46
Chinnakali et al. (2014)	Delhi/urban	Hindi	Worried household would not have enough food	2.0*	-	-	-
IIPS-UNICEF (2013)	Maharashtra State (yes/no)	Marathi, English	Worried household would not have enough food	42.1	3.24 (0.11)	1.29	4.50
	Polytomous scale no=0, rarely=1, sometimes/often=2	Marathi, English	Worried household would not have enough food	-	-	1.56	1.78
IFPRI (2015)	Odisha	Oriya	Worried household would not have enough food	34.1	3.80 (0.19)	0.92	0.89
Perceptions of inadequate food quality or quantity							
Nord et al. (2002)	Odisha/rural	Oriya	Couldn't afford to eat balanced meals (balanced meal)	77.3	2.94 (0.17)	1.00	4.96
	Odisha/rural	Oriya	Eat less than you felt you should (ate less)	48.2	5.50 (0.14)	1.11	3.07
	Odisha/rural	Oriya	Child couldn't have a balanced meal (child balanced)	56.7	3.56 (0.17)	0.94	0.24
Pasricha et al. (2009)	Rural Karnataka	Kannada	Same as above	-	-	-	-
Agrawal et al. (2009)	Delhi/urban	Hindi	Could not afford to eat balanced meal	65.8	2.25 (0.46)	1.00	0.31
Agrawal et al. (2009a)	Meerut/urban	Hindi	Could not afford to eat nutritious meal (nutritious)	84.2*	3.63 (0.03)	1.11	11.22
UHRC (2011)	Delhi/urban	Hindi	Relied on only a few kinds of low-cost food to feed children Could not afford children a balanced meal Children not eating enough	99.5* 89.7* 83.6*	- - -	- - -	- - -

Table 3 (contd.)

Study	Setting	Language	Item (abbreviation)	% yes	Severity (s.e)	In-fit	Out-fit
Chatterjee et al. (2012)	Mumbai/urban	Hindi	Eat the same foods daily	60.1*	-	-	-
			Have to eat any type of food that you did not want (undesirable food)	57.6*			
Gupta et al. (2014)	Delhi/urban	Hindi	Relied on only a few kinds of low-cost food to feed children	39.7			
			Could not feed children a balanced meal Children not eating enough	40.4 30.9			
Maitra (2014)	Kolkata/urban	Bengali	Did you cook <i>bhalo mondo</i> ('rich food' such as <i>shemai</i> , <i>paish</i> or <i>polao</i>) (not as part of a festival day) (rich food)	81.6	0.48 (0.41)	1.02	5.00
			Could not give children their preferred food and had to rely on only a few kinds of low-cost food (child preferred food low-cost food)	16.4	5.36 (0.30)	0.96	2.02
Chinnakali et al. (2014)	Delhi/urban	Hindi	Children could not be given a varied and healthy diet (varied and healthy)	38.5	3.94 (0.35)	1.04	0.86
			Children were not eating enough food	11.3	8.90 (0.33)	0.63	0.29
IIPS-UNICEF (2013)	Maharashtra State (only yes/no)	Marathi, English	Not able to eat the kinds of foods you preferred	1.6	-	-	-
			Have to eat a limited variety of foods Have to eat some foods that you/they really did not want to eat	0.4 0.4*			
IIPS-UNICEF (2013)	Polytomous scale no=0, rarely=1, sometimes/often=2	Marathi, English	Not able to eat the kinds of foods you preferred	-	-	1.05	1.01
IIPS-UNICEF (2013)	Maharashtra State (only yes/no)	Marathi, English	Have to eat a limited variety of foods	31.4	5.19 (0.09)	0.85	0.85
IIPS-UNICEF (2013)	Polytomous scale no=0, rarely=1, sometimes/often=2	Marathi, English	Have to eat a limited variety of foods	-	-	0.91	0.90

Table 3 (contd.)

Study	Setting	Language	Item (abbreviation)	% yes	Severity (s.e)	In-fit	Out-fit
IIPS-UNICEF (2013)	Maharashtra State (only yes/no)	Marathi, English	Have to eat some foods that you really did not want to eat	25.5	6.08 (0.09)	0.94	0.87
IIPS-UNICEF (2013)	Polytomous scale no=0, rarely=1, sometimes/often=2	Marathi, English	Have to eat some foods that you really did not want to eat	-	-	0.91	0.84
IFPRI (2015)	Odisha	Oriya	Not able to eat the kinds of foods you preferred	40.5 (65.5)*	3.16 (0.19)	1.36	1.47
IFPRI (2015)	Odisha	Oriya	Have to eat a limited variety of foods	26.5 (67.8)*	4.59 (0.19)	0.88	0.74
IFPRI (2015)	Odisha	Oriya	Have to eat some foods that you really did not want to eat	25.2 (63.2)*	4.74 (0.19)	0.97	0.89
Reported instances of reduced food intake or its consequences for adults							
Nord et al. (2002)	Odisha/rural	Oriya	Adults in your household ever cut the size of your meals or skip meals (adult cut/skip)	43.3	6.30 (0.12)	0.76	0.32
Nord et al. (2002)	Odisha/rural	Oriya	Hungry but didn't eat (hungry)	31.9	7.00 (0.11)	0.98	1.11
Agrawal et al. (2009)	Delhi/urban	Hindi	Cut meal size or skipped meal	23.9	8.97 (0.52)	1.07	4.63
Agrawal et al. (2009)	Delhi/urban	Hindi	Hungry but couldn't afford food	14.7	11.98 (0.72)	1.00	0.19
Agrawal et al. (2009a)	Meerut/urban	Hindi	Cut meal size or skipped meal	43.5	8.14 (0.03)	0.52	0.63
Agrawal et al. (2009a)	Meerut/urban	Hindi	Slept hungry but did not eat	20.7	11.98 (0.04)	1.03	6.43
Chatterjee et al. (2012)	Mumbai/urban	Hindi	Eat less than you felt you should	46.3*	-	-	-
			Adult in your household cut the size of your meals	48.4*			
			Skip some of your daily meals (skip meal)	30.1*			
			Food didn't last and no money to buy more (no food)	34.0*			
			Hungry and you did not eat a meal	49.8*			
			Not eat for a whole day	19.1*			
Maitra (2014)	Kolkata/urban	Bengali	Adults in your family couldn't eat at least two square meals (full stomach meals) a day (two square meals)	16.4	6.90 (0.22)	0.80	0.62

Table 3 (contd.)

Study	Setting	Language	Item (abbreviation)	% yes	Severity (s.e)	In-fit	Out-fit
Maitra (2014)	Kolkata/urban	Bengali	Personally eat less food so that there would be more for the rest of the family (ate less)	20.0	6.15 (0.22)	0.88	0.95
Maitra (2014)	Kolkata/urban	Bengali	Adults in your family skip entire meals	3.8	9.74 (0.30)	0.89	1.11
Maitra (2014)	Kolkata/urban	Bengali	Hungry but didn't eat	2.4	10.87 (0.44)	1.05	0.26
Maitra (2014)	Kolkata/urban	Bengali	Adult lost weight	20.6	6.03 (0.22)	0.78	0.42
Maitra (2014)	Kolkata/urban	Bengali	Adults in your family not eat for a whole day	2.2	10.87 (0.44)	0.70	0.16
Chinnakali et al. (2014)	Delhi/urban	Hindi	Have to eat a smaller meal than you felt you needed	0.4*	-	-	-
			Have to eat fewer meals in a day	0.8*			
			No food of any kind to eat in your household	2.0*			
			Go to sleep at night hungry	0.4*			
			Go a whole day and night without eating anything	0.0*			
IIPS-UNICEF (2013)	Maharashtra State (yes/no)	Marathi, English	Have to eat a smaller meal than you felt you needed	20.3	6.90 (0.09)	0.62	0.37
IIPS-UNICEF (2013)	Polytomous scale no=0, rarely=1, sometimes/often=2	Marathi, English	Have to eat a smaller meal than you felt you needed	-	-	0.67	0.52
IIPS-UNICEF (2013)	Maharashtra State (yes/no)	Marathi, English	Have to eat fewer meals in a day	18.2	7.35 (0.09)	0.63	0.47
IIPS-UNICEF (2013)	Polytomous scale no=0, rarely=1, sometimes/often=2	Marathi, English	Have to eat fewer meals in a day	-	-	0.68	0.53
IIPS-UNICEF (2013)	Maharashtra State (yes/no)	Marathi, English	No food of any kind to eat in your household	12.2	8.65 (0.10)	0.86	0.92
IIPS-UNICEF (2013)	Polytomous scale no=0, rarely=1, sometimes/often=2	Marathi, English	No food of any kind to eat in your household	-	-	0.92	0.72
IIPS-UNICEF (2013)	Maharashtra State (yes/no)	Marathi, English	Go to sleep at night hungry	7.7	9.97 (0.13)	0.85	7.04

Table 3 (contd.)

Study	Setting	Language	Item (abbreviation)	% yes	Severity (s.e)	In-fit	Out-fit
IIPS-UNICEF (2013)	Maharashtra State (only yes/no)	Marathi, English	Go a whole day and night without eating	4.5	11.37 (0.18)	1.09	11.54
IIPS-UNICEF (2013)	Polytomous scale no=0, rarely=1, sometimes/often=2	Marathi, English	Go a whole day and night without eating	-	-	1.19	2.10
IFPRI (2015)	Odisha	Oriya	Have to eat a smaller meal than you felt you needed	23.3 (59.8)	4.96 (0.19)	0.86	0.78
IFPRI (2015)	Odisha	Oriya	Have to eat fewer meals in a day	19.6 (51.7)	5.45 (0.19)	0.88	0.76
IFPRI (2015)	Odisha	Oriya	No food of any kind to eat in your household	13.9 (47.3)	6.37 (0.20)	0.84	0.66
IFPRI (2015)	Odisha	Oriya	Go to sleep at night hungry	12.1	6.75 (0.20)	1.13	0.90
IFPRI (2015)	Odisha	Oriya	Go a whole day and night without eating	11.1 (31.8)	7.00	1.19	0.93
Reported instances of reduced food intake or its consequences for children							
Nord et al. (2002)	Odisha/rural	Oriya	Cut the size of any of the children's meals/or ever skipped meals of children (child cut/skip)	14.2	8.04 (0.12)	0.86	1.95
Nord et al. (2002)	Odisha/rural	Oriya	Children ever not eat for a whole day (child whole day)	4.96	9.04 (0.16)	1.10	0.73
UHRC (2011)	Delhi/urban	Hindi	Cut the size of children's meals	64.7	-	-	-
			Children ever hungry but you just could not afford more food	63.4			
			Children ever skip meals	34.1			
			Frequency of skipping meals	31.1			
			Child not eat for a whole day	0.0			

Table 3 (contd.)

Study	Setting	Language	Item (abbreviation)	% yes	Severity (s.e)	In-fit	Out-fit
Gupta et al. (2014)	Delhi/urban	Hindi	Cut the size of children's meals	8.5	-	-	-
			Children hungry but could not afford food	5.6			
			Children ever skip meals	2.9			
			Frequency of skipping meals	1.6			
			Child not eat for a whole day	1.3			
Maitra (2014)	Kolkata/urban	Bengali	Children in your family could not eat at least three square meals (full stomach meals) a day (child 3 square meals)	9.1	9.66 (0.39)	1.25	5.37
Maitra (2014)	Kolkata/urban	Bengali	Skip child's/any of the children's meals	1.1	-	-	-
Maitra (2014)	Kolkata/urban	Bengali	Child/children hungry but you just couldn't afford more food	1.5	-	-	-
Maitra (2014)	Kolkata/urban	Bengali	Children in the household lost weight /felt weak (child lost weight)	20.0	7.14 (0.28)	0.71	0.46
Maitra (2014)	Kolkata/urban	Bengali	Child did not eat a whole day	0.75	-	-	-
Nord and Cafiero (2015) GWP 2014 ³	India	Multiple	Child not given enough food because of lack of money or other resources	-	-	-	-

Note: * indicates percentage of affirmative responses to combined 'sometimes+often' follow-ups. All questions were followed by phrases such as 'because of a lack of money or other resources' or 'because you didn't have enough money to buy food/more'. The item 'run out of food/run out/food no last' was included in the domain of 'worry/anxiety' in US HFSSM (18 or 6-item scale) and FIES GWP 2012; however, it represents a more severe food insecurity condition in the HFIAS and FIES GWP 2014.

¹ GWP 2014 had extended FIES (8 adult items) where the extension was to include 'how often' follow-up questions to the two most severe questions ('hungry' and 'whole day').

² GWP 2012 data for FIES included seven questions that asked about food conditions among children aged 0-14 years in the household.

³ GWP 2014 had 2 child items if child aged under five lived in the household. Child items were for research purposes and not included in the scale. No child items are included in the GWP 2015 surveys.

ACKNOWLEDGEMENTS

The following researchers completed the online survey: Professor Craig Gunderson (University of Illinois, USA); Dr. Gopichandran (Department of Community Health, Christian Medical College, Vellore, Tamil Nadu, India); Dr. D.K. Mukhopadhyay (Department of Community Medicine, BS Medical College, Bankura, West Bengal, India); Dr. Nilesh Chatterjee (John Hopkins University Center for Communication Programs, New Delhi, India); Dr. Mauro Migotto (Organisation for Economic Co-operation and Development, Paris, France); and Dr. Patrick Webb (Tufts University, Friedman School of Nutrition Policy and Science, Boston, Massachusetts, USA).

Dr. Pradnya Paithankar (United Nations World Food Programme, India) and Dr. Palak Gupta and Ms. Preeti Kamboj (Lady Irwin College, India) shared their unpublished research studies and related tools in addition to completing the online survey.

Dr. Mark Nord (Food and Agriculture Organization, Rome, Italy) provided the psychometric analysis for the raw data for India from the Gallup World Poll 2014 and 2012 India surveys, supported the conception and provided a series of reviews of the initial drafts.

Thanks go to Ms. Caroline den Dulk, Chief, Advocacy and Communication Section, UNICEF India Country Office, New Delhi, for branding clearance; Mr Omesh Matta, Audio Visual Assistant, Advocacy and Communication Section, UNICEF India Country Office, New Delhi, for photo coordination; Ms. Delice Gan for providing editorial support; New Concept Information Systems Pvt. Ltd. for layout. The research and report were funded by UNICEF.



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