Global Food Security 15 (2017) 53–64

Contents lists available at ScienceDirect

Global Food Security

journal homepage: www.elsevier.com/locate/gfs

Review article

Adapting an experiential scale to measure food insecurity in urban slum households of India

Chandana Maitra

The University of Queensland, School of Economics, St Lucia Campus, Brisbane, QLD 4072, Australia

ARTICLE INFO

Keywords:
SDG 2.1
Food access
Experiential scale
Urban
India
Targeting

ABSTRACT

In the background of the Sustainable Development Goal 2.1 which proposes promoting universal access to food to all populations across the globe by 2030, this paper measures experiential food insecurity in low income urban households of India. A nine-item experience-based food security scale is constructed by adapting the United States Household Food Security Survey Module in the context of slum households of Kolkata, according to which 15.4% of the households are food insecure. Findings also indicate that multi-sectoral interventions are required to tackle the problem of urban food insecurity – nutritional interventions combined with appropriate education and income support programs and employment generation schemes. Additionally, the experiential indicator has excellent potential to be an alternative metric to measure household food security in urban India.

1. Introduction

India is a country which is facing the paradox of strong economic growth and grim food security conditions. Access to food remains an issue of grave concern as reflected in the fact that the country still hosts the second largest number of undernourished in the world (FAO, 2014). The country's hunger status is classified as 'serious' by the Global Hunger Index (Grebmer et al., 2014). Issues like 'hidden hunger' which were dormant so long have now come to the surface with a growing body of academic literature voicing concern that it might push the country into the potential risk of being trapped in the cycle of hunger, poverty and stalled development (Grebmer et al., 2014; Black et al., 2013). It seems, the benefits of economic growth have not trickled down to those who are the most disadvantaged. Unless India is able to combat food insecurity the country will not be able to progress towards the agreed indicators of the Sustainable Development Goal (SDG) 2.1 which states: "by 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round" (UN, 2016).

Given this dichotomy of rapid economic growth and lagged progress in battling food insecurity, it is important that the households with difficulty in food access are accurately identified so that they are able to reap the benefits of targeting. In identifying the vulnerable households in need of social protection, it is important to highlight the urban food insecure due to the fact that food insecurity of urban households remains relatively invisible to policy makers (Maxwell, 1999), and hence might easily jeopardise such concerted efforts by the government to ameliorate food security as the National Food Security Act (NFSA).[1] India is urbanizing rapidly, however the rate of decline of urban poverty has lagged behind that of rural poverty in recent decades (GOI, 2011), resulting in 'urbanization of poverty'— from about one-in-eight of the poor living in urban areas in the early 1950s to one-in-three in 2012 (Datt et al., 2016). Such developments have implications for food security as well since urban poor, being 'net buyers' of food, are likely to be the hardest hit if there is a sudden hike in food prices as the most recent one in 2008 (FAO, 2010). Urban poor also spend a relatively larger portion of income on food which broadly means that the poverty problem gets translated to a food-insecurity problem.

Against the above backdrop, the key objective of this paper is to capture the extent of food insecurity in low income urban households using an experience-based food security scale. The scale is adapted from the United States Household Food Security Survey Module (US HFSSM); and is based on data collected from 500 randomly selected slum households of Kolkata surveyed in 2010–11. The use of an experiential scale as a metric to measure food insecurity is relevant given the fact that the SDG indicator 2.1.2 is an experience-based indicator — *prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale (FIES)* (UN, 2016).

Experience-based food security scales (EBFSS) which measure the 'access' component of food security are one of the most recent

E-mail addresses: chandana.maitra@uqconnect.edu.au, chandana.maitra@sydney.edu.au.

[1] The National Food Security Act, passed by the Parliament on 10th September 2013 has the objective to provide for food and nutritional security in human life cycle approach, by ensuring access to adequate quantity of quality food at affordable prices to people. The Act provides for coverage of upto 75% of the rural population and upto 50% of the urban population for receiving subsidized food grains under the Targeted Public Distribution System (TPDS) of India, thus covering about two-thirds of the population (GOI, 2016).

http://dx.doi.org/10.1016/j.gfs.2017.04.005
Received 12 July 2016; Received in revised form 11 April 2017; Accepted 22 April 2017

developments in the literature on food security measurement. These indicators are direct measures of access to food, as opposed to indirect or proxy measures like income, food expenditure, household poverty status, dietary intake or nutritional status (Ballard et al., 2013). These scale measures rely on people's direct responses to a series of questions regarding their access to adequate food based on data collected at the household or individual level. Following Pérez-Escamilla (2012), of the SMART criteria used to evaluate the efficacy of indicators the EBFSS have been shown to be specific (and valid), measurable (frequent data collection), achievable (technically possible), and timely (rapid application and sensitive to changes including seasonality and pre/post program).

Given the above, the use of EBFSS in measuring food insecurity has become increasingly popular among researchers worldwide and India is no exception. The present study adds to the existing body of literature. The study is one of the first applications of experiential indicators in India whereby the food security scale is constructed based on locally meaningful standards. The scale is tested for reliability and validity prior to being applied for measuring food insecurity in urban households. Subsequently, the determinants of urban food security are also identified.

The rest of the paper is organized as follows. Section 2 presents a review of the US HFSSM focusing on its theoretical background; Section 3 presents the method of adapting the US HFSSM in Kolkata; Section 4 reports results; Section 5 discusses the results and Section 6 concludes with policy recommendations and directions for future research.

2. Literature review

2.1. The United States Household Food Security Survey Module (US HFSSM): The background

The initial development of experiential scales took place in the U.S. where, in response to a report by President's Task Force on Food Assistance (1984), researchers at the Cornell University (Radimer et al., 1990; Wehler et al., 1992) embarked on concerted efforts to develop methodologically sophisticated measurement scales for food security. Subsequent events led to the development of the 18-item questionnaire referred to as the United States Household Food Security Survey Module (US HFSSM) which was first administered nationally in April 1995. Two measures of household food security are computed from the core module data: Household Food Security Scale which is a continuous measure and Household Food Security Status which is a categorical measure.

Previous research suggested that food insecurity manifests at the household level as a managed process of efforts to cope with inadequate supplies of food and resources to obtain food, which moves through an observable set of stages as food insecurity increases (Radimer et al., 1990; Wehler et al., 1992). In the first stage, household members experience anxiety about their food situation, and adjust their budget and food management patterns. In the second stage, adults reduce their food intake, but in households with children they try to protect the children's food intake. In the third stage, the children also experience a reduction in food intake, and adults' food intake is more sharply reduced.

The 18-item US HFSSM which includes ten adult-referenced items and eight child-referenced items, attempts to capture the above experiences of food insecurity. A six-item short form of the survey module (Blumberg et al., 1999) is also available. The development of the US HFSSM subsequently led to several other attempts to develop a generic tool to measure food insecurity across diverse cultures and contexts around the globe such as the nine-item Household Food Insecurity Access Scale (HFIAS) (Coates et al., 2007) or the eight-item Food insecurity Experience Scale (FIES) (Ballard et al., 2013). FIES is the global version of an experience-based food insecurity scale that originated from a regional initiative in Latin America and the Caribbean-Latin American and Caribbean Food Security Scale (ELCSA) (Pérez-Escamilla et al., 2007).

2.2. Theoretical framework of the US HFSSM

The statistical model that provides the theoretical basis for the experiential scales is a type of nonlinear factor-analytic approach called the single parameter Rasch model (Bond and Fox, 2001). Though this model was used to develop the US HFSSM, its roots are in psychometry and Item Response Theory (IRT), where it is commonly employed to construct educational tests intended to measure 'ability' based on an individual's responses to progressively more difficult questions. In the food security literature, the latent construct of interest is household 'food insecurity' rather than 'ability', and the items representing the underlying phenomenon are arranged along a continuum of 'severity' rather than 'difficulty'. Under the assumptions of Rasch model, food insecurity is viewed as a continuous, unidimensional and unobservable quantity that varies from household to household. Psychometric assessment involves estimating fit statistics and severity parameters for final selection of items necessary to construct the scale.

The item severity parameters represent the position of the items along the constructed food security measurement scale. An item with a high positive severity indicates a greater degree of food insecurity (Hamilton et al., 1997b). The household severity parameter (household scale score) is a continuous interval-level measure of the extent of food insecurity in the household. A higher number of affirmative responses indicate greater household food insecurity. The mathematical form of the relationships assumed by the model are logistic, which allows both the item and the household severity parameters to be placed on an equal interval scale (logit-based) of the construct being measured (see Appendix B for more details).

Individual items are assessed using 'fit' statistics of which 'infit' is an "information-weighted" statistic for each item that is sensitive to responses by households with severity scores in the range near the severity level of the particular item. 'Outfit' is not weighted and is sensitive to highly improbable responses (outliers). Infits in the range of 0.8–1.2 are considered to be good and 0.7–1.3 are acceptable (Nord et al., 2002). High value of infit indicates a weaker association than expected between that item and the underlying condition of food insecurity and implies, the item may not be suitable for inclusion in the scale.

Once the scale is estimated and tested for reliability and internal and external validity (method discussed in Appendix B), food security categories are created by placing thresholds on the estimated scale using expert judgment.[2] Researchers have often adapted the U.S. scale by selecting cut-offs on the test scale using the U.S. scale as reference (see Nord et al., 2002 for details) (see Appendix B for brief discussion). However, for within-country use it is advisable that each country specifies thresholds and gives the resulting ranges of severity labels that are meaningful in the context, language, and culture predominant in that country typically based on expert opinion.

2.3. Application of the US HFSSM in India

A recent study in India commissioned by the United Nations Children's Fund (UNICEF) (Sethi et al., 2016) with a view to examine the potential of an experiential indicator to be a uniform tool to measure food insecurity in India, identified 10 studies (in addition to the Kolkata study) from the published as well as grey literature which report the use of the US HFSSM in some form: the 18-item US HFSSM (Nord et al., 2002; Gopichandran et al., 2010), the 8-item child scale (Gupta et al., 2013, 2014; UHRC, 2011) and the 6-item short-form adult scale (Agarwal et al., 2009a, 2009b; Mukhopadhyay et al., 2010; Mukhopadhyay and Biswas, 2011; Wright and Gupta, 2015) (see

[2] The estimated statistical model produces a ruler. The decision about appropriate thresholds on the ruler to identify ranges of severity of interest, and the appropriate labels to attach to the ranges, is subjective and should be based on expert opinion.

Table 1
Published/Unpublished Studies using the US HFSSM, India, 2000–15[a].

Authors	Setting	Period of study	Sample size	Study population	Language	Type of scale and recall period	Recall period	Internal Reliability/ validity	External validation
Nord et al. (2002)[b]	Rural Orissa	2000–01	282	all adults and children in the household	Oriya	9-item scale adapted from 18-item US HFSSM[b]	30 days	infit: 0.75–1.11 high outfit: balanced meal, ate less and cut-skip meal	–
Agarwal et al. (2009a)	Slums in North East Delhi	June-July 2008	410	all adults in household	Hindi	four-item scale adapted from six-item shorter version of US HFSSM[c]	12 months	Cronbach's alpha: 0.8. infit: 0.77–1.07 High outfit: cut meal/skip meal	Strongly correlated with unemployment: employment ratio and SLI
Agarwal et al. (2009b)	75 slums of Meerut city	October 2007-March 2008	40,016	women of reproductive age (WRA)	Hindi	four-item scale adapted from six-item shorter version of US HFSSM[d]	12 months	Point biserial correlation: 0.43–0.59 Cronbach's alpha: 0.725 Infit: 0.52–1.11 High outfit: nutritious food	Food insecurity and hunger higher in low wealth quintiles
Gopichnadran et al. (2010)	Tamilnadu, Vellore (urban)	May/June 2009	130	all adults and children in household	Tamil	18-item USHFSSM	12 months	–	–
Mukhopadhyay et al. (2010)	Bankura−1 CD block district, West Bengal	July-August 2009	267 tribal households	all adults in household	Bengali	a validated Bengali version of the US six-item short form food security scale	12 months	kappa (> 0.84) Cronbach's alpha = 0.82	MPCE ≥ Rs. 356, total to earning member ratio ≤ 4:1, regular utilization of PDS, and non-holding of the BPL card significantly related with household food security status
Mukhopadhyay and Biswas (2011)	Bankura−1 CD block district, West Bengal	July-August 2009	188 tribal households	tribal children aged 24–59 months	Bengali	a validated Bengali version of the six-item shorter version of US HFSSM	12 months	Same as above	multiple anthropometric failures more likely in children living in low and very low food secure households
UHRC (2011)	Slum North East Delhi	June-July 2011	232	children below 5 years	adult female ≥18 years of age involved in cooking and purchasing food	Hindi	8-item child food security scale based on US HFSSM	30 days	–
Gupta et al. (2013)	4 Delhi slums	August 2011-October 2012	446	WRA (15–45) years with children (6–35) months	Hindi	8-item child scale based on 18-item USHFSSM	12 months	NA	–
Gupta et al. (2014)	4 Delhi slums	2012	446	WRA (15–45) years with children (6–36) months	Hindi	8-item child scale based on 18-item USHFSSM	12 months	NA	Child food insecurity significantly correlated with anthropometric indicators (bivariate analysis)
Wright and Gupta (2015)	A slum from North-East Delhi	2010	105	convenience sample of members in families receiving care at health centers and clinics	Hindi	6-item shorter version of US HFSSM	12 months	NA	–

Note: Adapted from Sethi et al. (2016). All studies are based on household level cross sectional data.

[a] The present study is not included in the list.

[b] The survey and the initial adaptation of the 18-item US HFSSM in rural Odisha were undertaken by Nikhil Raj and Anup Satpathy. Dr. Mark 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 Labor: 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.

Table 1 for the list of studies). However, much of the literature suffers from the concern that full psychometric assessment of the scales has not been undertaken and the few studies which have conducted thorough psychometric evaluation have not externally validated the measure. These limitations do not allow us to test the experiential scale for wider practical application in India.

3. Adapting the US HFSSM in Kolkata: Kolkata Household Food Security Survey Module (KHFSSM)

3.1. Data

The experiential food security scale is constructed on the basis of a survey conducted in the slums of Kolkata in 2010–11. Responses are collected from 500 randomly selected households located across 15 slums in the Kolkata Metropolitan City (KMC) area. Details of the survey design and sampling techniques are available in Maitra (2013); Maitra and Rao (2015). Fifty-one percent of survey respondents are female and the data were collected during the period April 2010 to January 2011, with a break in the month of October which is the festive season in Kolkata.[3]

The primary survey instrument is the questionnaire (see Appendix A). Part A of the questionnaire collects information on: (a) socio-economic/demographic profile of households; and b) household consumption, following the consumer expenditure schedule used by the National Sample Survey Organisation (NSSO, 2006). Part B of the questionnaire includes the food security scale items adapted from the US HFSSM, and is used to construct the food security scale which we call the Kolkata Household Food Security Scale (KHFSS) henceforth.

The Kolkata Household Food Security Survey Module (KHFSSM) includes 11 adult-referenced items in the questionnaire — Q1 to Q13, excluding Q2 and Q9, which are not scale items.[4] All questions are asked in the local language (Bengali) with 'yes or 'no' response options (1 = yes) (reverse for the question on 'rich food').[5] All questions are asked with a 30-day recall, following Nord et al. (2002) who propose that a shorter reference period may improve recall.[6] For convenience, we report the 11 adult scale items along with their abbreviations and hypothesised domain in Table 2.

We use part A of the questionnaire to construct some of the key variables necessary for external validation of the KHFSS: monthly per capita expenditure (MPCE), poverty status of households and average household consumption of macronutrients which include calorie, protein, and fat. Daily per capita availability of calorie (*pckcl*), protein (*pcprotein*) and fat (*pcfat*) are computed by collecting data on the quantity of food items consumed by the households during the last 30 days preceding the date of inquiry, following NSSO (2007). Household poverty status is constructed as a binary variable *'poor'* with values 1 if MPCE < Rs. 856.28, and 0 otherwise; where Rs. 856.28 represents the poverty line expenditure of urban West Bengal in 2010–11. Further details on construction of the above variables are available in Maitra and Rao (2015).

Table 2
Adult scale items in the Kolkata Household Food Security Scale, Kolkata, 2010–11.

Item No.	Item description	Item abbreviation	Domain	Source (adapted from)
Q1.	worried that food would run out before you could buy more?	worried	anxiety	USHFSSM
Q3.	food stored in home ran out and there was no money to buy more	ran out	anxiety	USHFSSM
Q4.	borrowed food from relatives or neighbours to make a meal	borrowed	acceptability	Bangladesh module (Webb et al., 2001)
Q5.	cooked 'bhalo mondo" ("rich food" such as shemai, paish, or polao)	rich food	quality	Bangladesh module (Webb et al., 2001)
Q6.	had to eat the same kind of food every day	same food	quality	author's adaptation, based on pilot survey
Q7.	adults could not eat at least two square meals a day	two square meals	quantity	NSSO (1983, 1993–94)
Q8.	personally ate less food so that there would be more for the rest of the family	ate less	quantity	Bangladesh module (Webb et al., 2001)
Q10.	adult skipped entire meal so that there would be more food for the family	skip meal	quantity	author's adaptation of UFHSSM item cut/ skip meal, based on pilot survey
Q11.	adults were hungry but did not eat because you couldn't afford enough food	hungry	consequence of reduced intake	USHFSSM
Q12.	adult lost weight because you didn't have enough money for food	lost weight	consequence of reduced intake	USHFSSM
Q13.	adult not eat for a whole day because there wasn't enough money for food	whole day	quantity	USHFSSM

Note: 11 adult scale items are reported. Q2 and Q9 from part B of the questionnaire (in Appendix A) are not scale items and hence not included in this table. See also Maitra and Rao (2015).

[3] We dealt with seasonality to the extent that we avoided the festive month, inclusion of which might have generated abnormal expenditure pattern in the data. However, we could not address seasonality issues related to availability of food items and resulting fluctuations of food prices since we have used '30 day' recall period with the purpose of obtaining greater accuracy. A recall period of 12 months would have addressed the issue by averaging out seasonality; however, the trade-off would be with accuracy.

[4] Q2 and Q9 do not represent experiential-scale items – they were added to get additional insight on response to some of the scale items.

[5] With the exception of two questions – Q5 and Q12 – for all other questions 'yes' responses were followed up with 'How often?' asking about the frequency of occurrence of the event. However, we do not report the results incorporating responses on frequency of occurrence in this paper. Details are available in Maitra (2013).

[6] The choice of recall period for experiential scales has implications for the conclusions that can be drawn from the data. US HFSSM has been administered with respect to both 30 days and 12 months recall periods. In general, a twelve month recall period may be more relevant in those settings where averaging out seasonal differences is necessary (Nord, 2015).

3.2. Statistical analysis

3.2.1. The Kolkata Household Food Security Scale (KHFSS)

Rasch model based item fit statistics and severity parameters are estimated by the method of conditional maximum likelihood using Stata's *Raschtest*.[7] Examination of the item fit statistics reveal that the two poorly performing items are 'same food' and 'borrowed'. With these two items removed, the remaining nine items comprise an adequately fitting scale of adult food security with infits in the acceptable range of 0.7–1.3 (Table 3). These nine items comprise the KHFSS.

Table 4 presents household severity parameters and the distribution of households by raw score on the KHFSS, following which the measured range of the KHFSS is 7.52 logistic units, ranging from 3.57 to 11.09.

Internal reliability of KHFSS is examined by estimating Cronbach's alpha, Rasch Reliability and Classification Reliability statistics and Positive Predictive Value (see Appendix tables B.5 and B.6). Internal validity is established by examining the fit statistics.

3.2.2. Household food security categories

Four categories of food security status are identified on the KHFSS – highly food secure, marginally food secure, moderately food insecure and severely food insecure. In order to classify households into various food security categories on the KHFSS, first we plot the severity parameters of items and household raw scores in the nine-item adult scale on the same severity scale, thus generating an item-raw score map (Fig. 1) (see Bond and Fox, 2001). Next, we decide on suitable cut-offs on the scale (and the relevant raw score) by selecting items which would most appropriately describe the experience of food insecurity in typically low income Bengali households.[8]

3.2.2.1. The category "Food Secure". In Bengali, 'getting two square meals a day' has always been the typical expression of food insecurity. In that sense, the item 'two square meals' seems, subjectively, to be the most appropriate candidate for demarcating the food secure and food insecure households on the KHFSS. In fact, 'two square meals' is actually a standard of food adequacy across all states of India not just in the Bengali speaking state of West Bengal. That is why NSSO (1983, 1993–94) published the report on food adequacy in India on the basis of the question of whether all members of the household get two square meals a day. With the item 'two square meals' (' < 2 meal' in the graph in Fig. 1) as the marker of food insecurity, the corresponding raw score for placing threshold is determined to be 5+ from the item-raw score map in Fig. 1.[9] The scale value of the food-insecure threshold, thus, corresponds approximately to the midpoint between the scale values of raw score 4 and raw score 5, which is 6.93.

3.2.2.2. The category "Marginally Food Secure". The threshold for identifying the marginally food secure households is placed near the severity level of the item 'worried' because one would expect some difference in food security status for those households which express anxiety on the possibility of running out of food stores and those who do not. The item 'worried' corresponds to a raw score of three in the item-raw score map.

3.2.2.3. The category "Severely Food Insecure". The item 'skip meal' seems to be the appropriate threshold to identify the severely food insecure households, as the first sign of falling into severe food insecurity would be for adults to skip one meal. There is enough evidence in the literature, of such typical expression of severe food insecurity which would imply 'skipping a meal' or 'skipping a meal of rice', to be more precise (see Devi, 1979). Households that reach this level on the KHFSS have at least one, and potentially more, adult members who have experienced resource-constrained hunger. The raw score corresponding to 'skip meal' in the item-raw score map is seven.

3.2.3. External validation of KHFSS: correlates and outcome of experiential food insecurity in Kolkata slum households

First, we examine the difference in socioeconomic characteristics of households by food security status categories. Next, using an Ordered Logit (OL) model, we examine the association of household food security with these socio-economic variables, with three categories of food security status (highly food secure, marginally food secure and food insecure) as the dependent variable. Households with moderate and severe food insecurity are analysed as a single category because only a small number of households (only 13) are present in the latter category. Following Frankenberger (1992), the key explanatory variables included in the model are: household poverty status, asset ownership status, household size, household composition (share of kids, working age adults and seniors in the family) and; age, gender, education level, employment status, homeownership status and religion of household head. We also examine bivariate association of each of the nine scale items with selected household characteristics.

Next, we test the association of food security status (all four categories) with respect to nutrient intake—calorie, protein and fat; and selected food items such as cereals, vegetables, milk, fish, meat and oil. Additionally, we examine whether consumption adequacy with respect to the norms prescribed by the Indian Council of Medical Research (ICMR) (GOI, 1979) decreases with increasing food insecurity. Finally, for robustness, we also investigate whether food insecure households would consume fewer nutrients (calories, protein and fat) within the framework of an Ordinary Least Square (OLS) model. The dependent variables in the model are *pckcl, pcprotein and pcfat*. For the purpose of this exercise, we define household food security status as a binary explanatory variable *fs* (=1 if food insecure, 0 otherwise). The control variables included in the OLS models are the same as those in OL model mentioned above except we now replace household poverty status by MPCE and drop the variable asset ownership status.[10]

4. Findings

4.1. Sample characteristics

Following Table 5, 13% of the surveyed households are poor with average MPCE (Rs.1630) for the households being well above the poverty line expenditure of Rs. 856.28. About 19% of households in the sample are female headed and a large proportion (33%) of households is headed by illiterate persons.

[7] In the present study fit statistics were calculated using a different formulation, guided by the Economic Research Service (ERS), the United States Department of Agriculture (USDA). The item infit and outfit statistics reported by Stata are in a different formulation than which is actually needed for assessing fit statistics in food security measurement.

[8] To ensure comparability of prevalence statistics using cut-offs set on the KHFSS with that of the U.S. scale [U.S. Current Population Survey Food Security Supplement (CPS-FSS) 2008–09], we follow the techniques described by Nord et al. (2002) briefly discussed in Appendix B. The details of the computation of the adjusted U.S. item and household severity parameters are reported in Appendix B (Tables B.3 and B.4, respectively).

[9] This cut-off of raw score five in the Kolkata scale is comparable to the U.S. cut-off for food insecurity which is at raw score three. Thus, the threshold of 5+ on the Kolkata scale not only identifies food insecurity at a severity level consistent with cultural norms, but is also approximately equivalent to the threshold for food insecurity in the U.S. Similar correspondence with the U.S. scale is noted with respect to the other two thresholds as well - marginal food security raw score of (3 in the Kolkata scale vs. raw score of one in the US scale) and severe food insecurity (raw score of 7 in the Kolkata scale vs. raw score of 6 in the US scale).

[10] We used MPCE as an explanatory variable in the OLS model for calorie demand ensuring there is no threat from collinearity following Garrett and Ruel (1999).

Table 3
Item Severity Parameters and Fit Statistics, Nine-Item Kolkata Household Food Security Scale (N = 406), 2010–11.

Item (abbreviation)	% affirmed	Severity Parameters[a]	Infit[b]	Outfit[c]	U.S. item severities adjusted to KHFSS items[d]
Never cooked rich meals (rich meal)	81.60	0.48 (0.41)	1.02	5.00	7.21 (balanced meal)
Worried food would run out (worried)	23.20	5.53(0.21)	1.05	0.75	5.52 (worried)
Had to eat same kind of food every day (same food)	23.20	–	–	–	–
Adult lost weight (lost weight)	20.60	6.03(0.22)	0.78	0.42	11.04 (lost weight)
Ate less so there would be more for others (ate less)	20.00	6.15(0.22)	0.88	0.95	9.35 (eat less)
Food ran out (ranout)	18.80	6.44(0.22)	1.30	0.46	6.53 (food not last)
Adult could not eat two square meals (two square meals)	16.40	6.90(0.22)	0.80	0.62	8.53 (cut size & skip meals)
Borrowed money for food (borrowed)	11.80	–	–	–	–
Adult skipped meals (skip meal)	3.81	9.74(0.30)	0.89	1.11	–
Adult hungry but didn't eat (hungry)	2.40	10.87(0.44)	1.05	0.26	10.21 (hungry)
Adult did not eat for whole day (whole day)	2.20	10.87(0.44)	0.70	0.16	11.44 (whole day)

Note: See also Maitra and Rao (2015). Estimation method: Conditional Maximum Likelihood. No. of groups: 10 (8 of them are used to compute the statistics of test). Number of individuals: 499 (1 household removed for missing values). Number of households with null or perfect score is 93 and these households are omitted from the psychometric analysis. Conditional log-likelihood: - 275.405. Reported item severities have been obtained by adding seven to severity parameters reported by Stata.

[a] Standard errors in parenthesis. The item severity parameters in food security measurement vary as to the severity of food insecurity to which they are sensitive.

[b] The item infit statistic is an information-weighted chi-square-like measure of the extent to which an item discriminates more or less sharply than the average item in the module. Items with average discrimination have an infit of one. Infits in the range of 0.7–1.3 are acceptable (Nord et al., 2002).

[c] Item outfit statistics are not information-weighted, and are, therefore, particularly sensitive to erratic or improbable responses.

[d] For comparison, we report the adjusted severities of the U.S. items (in parenthesis) (U.S. Current Population Survey-Food Security Survey 2008 and 2009) which are approximately equivalent in meaning to the KHFSS items (see Appendix Table B.3 for computational details).

4.2. The KHFSS and prevalence of food insecurity in the Kolkata slum households

Based on Table 4, 84.6% of households are food secure including 76.2% highly food secure and 8.4% marginally food secure; and 15.4% are food insecure, including 12.8% with moderate food insecurity and 2.6% with severe food insecurity.

The KHFSS is internally reliable as is evident from the estimated values of the reliability statistics — Cronbach's alpha (0.85), Rasch Reliability (0.75), Sensitivity (0.83), Specificity (0.97) and Positive Predictive Value (0.85) (see Tables B.5 and B.6 for detailed calculations). Regarding internal validity, we have already examined that infits of all items are in the acceptable range of 0.7–1.3. Outfit is high only for 'rich food' which is also the least severe item (0.48). In general the items exhibit the expected order of severity (following Radimer et al., 1990, Wehler et al., 1992 mentioned in Section 2.1), the most severe items at the upper end of the scale being 'hungry' (10.87), 'whole day' (10.87) and 'skip meal' (9.74) indicating serious food access problems (Table 3). A somewhat unexpected result is relatively low severity of the items 'lost weight' and 'ate less' compared to estimates reported in other countries (see adjusted US item severities in Table 3, for example).

4.3. Socio-economic correlates of experiential food insecurity/association of food insecurity with dietary and nutrient adequacy

Notable differences in household socio-economic characteristics are observed across various food security categories (Table 6). Proportion of income poor, asset poor, female headed and casual labor households and households headed by illiterate persons increase sharply across highly food secure to severely food insecure households. Based on the results of the OL model, the following are reported as significant predictors of household food insecurity in the Kolkata slum households: household poverty status and asset ownership status; gender, education level and employment status of household head. For income-poor households odds of being food insecure are 8.5, as opposed to 5 for asset poor households. The odds of being food insecure are high for female headed households (1.82) and casual labor households (1.99) as well, while households headed by persons with primary-secondary level education have lower odds of food insecurity (0.52). Households with highly educated persons (graduate and above) have the lowest odds of being food insecure, however, the association is weakly significant.

Following Table 7, about 62% of poor households reported not getting two square meals a day, while 10% reported going hungry or going without a meal for a whole day. As expected, of the food insecure households 14% reported going 'hungry' as opposed to only zero percent in the highly food secure households. Asset poor households are significantly affected by all forms of hunger. More than 30% of female headed households worry about not getting enough food, while casual labor households report experiencing more severe forms of food insecurity with 38% reporting adults had to skip a meal.

Table 8 reports intakes of protein, fat, calorie and selected food items for the four categories of food security status. We note the following: (i) average consumption of all nutrients and food items are much higher in food secure households compared to food insecure households; (ii) household food security score is significantly associated with dietary/nutrient intake indicating decreasing intake with increasing raw score; (iii) not only do the highly food secure households consume higher quantities of nutrients and selected food items but their consumption of most of the items is also adequate with respect to the ICMR prescribed norms. Cereals and milk are the only two items which the highly food secure households consume inadequately while the only item that food insecure households consume adequately is vegetables.

The OLS models (Table 9) report negative coefficients for food security status (*fs*) which implies food insecure households are consuming fewer calories, protein and fat compared to food secure households when other predictors of nutrient intake are controlled for. The association is

Table 4
Household Severity Parameters, Food Security Status Categories and Prevalence Rates in the Kolkata slum households according to the KHFSS, 2010–11.

Raw Score	Household Severity[a]	Cumulative Percent	U.S. HH severities adjusted to KHFSS[b]	Category
0	Not defined	17.4	Not defined	Food Secure
1	3.57 (2.34)	69.4	5.70	(76.2%)
2	5.03 (0.62)	76.2	6.77	
	5.43	(midpoint between the scale values of raw score 2 and raw score 3)		Marginally Food Secure (8.4%)
3	5.84 (0.39)	80.6	7.65	
4	6.54 (0.37)	84.6	8.42	
	6.93	(midpoint between the scale values of raw score 4 and raw score 5)		Moderately Food Secure (12.8%)
5	7.32 (0.49)	88.2	9.14	
6	8.54 (0.76)	97.4	9.84	
	9.26	(midpoint between the scale values of raw score 6 and raw score 7)		Severely food insecure (2.6%)
7	9.98 (0.73)	98.4	10.57	
8	11.09 (0.88)	98.8	11.32	
9	12.59 (3.01)	100	12.23	

[a] Standard errors in parenthesis. Household severity parameters are continuous interval-level measures of the extent of food insecurity or hunger in the household. Household Severity Parameters are Maximum Likelihood Estimates based on the item parameters in Table 3. The zero point on the Rasch Scale is arbitrary. Reported household severities have been obtained by adding seven to severity parameters reported by Stata, so as to ensure that the values are positive. The severity of food insecurity in households with raw score zero and nine is unknown. The tabled value of raw score 9 was calculated as if for raw score 8.5. Food security scale has a measured range of 7.52 logistic units – 3.57–11.09 (12.59 not considered, being a pseudo-value based on raw score 8.5). Prevalence rates have been computed for 500 households.

[b] Adjusted U.S. household severity parameters (U.S. Current Population Survey-Food Security Survey 2008 and 2009) are reported for comparison (see Appendix Table B.4 for computational details)

also significant in all cases except for fat availability. Full results are reported in Tables B.7–B.9.

5. Discussion

Several important findings emerge from the present study. First, with reference to the KHFSS, 15.4% of slum households are food insecure. Given that the study sample mostly covers low-income households, it might seem counter-intuitive at first that such a small fraction of households is reported to be food insecure. However, the results would seem reasonable if we go back to the self-reported hunger figures reported by NSSO (2013) according to which the proportion of urban households reporting not getting two square meals every day in any month of the year has dropped from 0.5% to 0.0% in urban India between 1993-94 and 2009-10. The Gallup World Poll Survey 2010 estimated 27% of Indian households to be food insecure in terms of self-assessed food security (Headey, 2013). A UNDP survey (2008) of 16 districts in the seven poorest states of India showed that only for 7.5% of respondents access to food was 'highly' inadequate; and for another 29% of the households it was 'somewhat' inadequate.

Reporting bias in self-assessed measures is a much discussed issue (Ravallion, 2012) and specifically with subjective food insecurity there is a possibility that self-assessed food insecurity is biased downward in settings where food intake is low and diet is monotonous (Hamilton et al., 1997b, cited in Headey, 2013). However, subjectivity might be less of a concern with the US HFSSM since it actually synthesises qualitative information to generate quantitative indicators through rigorous testing using mathematical models (Webb et al., 2006). Gender of respondent and recall period are also potential sources of bias. In fact, one of the major criticisms of NSSO's self-assessed hunger figures is that the survey respondent is the male head of the household who tends to under-report the number of meals taken. There's evidence in the literature that the male head of household might feel shame in reporting that he is not capable of providing 'two square meals' to his family (Kundu, 2006). In our case, about 50% of respondents are male and results could have been different if all respondents were female (Coates et al., 2010). Another potential source of bias is the survey recall period. If household food insecurity is transient or occasional for a substantial proportion of those who are food insecure, then the difference between the 12-months and 30 days may be substantial (Nord, 2015).

The present study adds to the knowledge gained from the previous application of the US HFSSM in India. Comparing our results with those from the previous studies, we find, Agarwal et al. (2009a) and Wright and Gupta (2015) estimated food insecurity to be 51% and 57%, respectively, in the Delhi slum area and Gopichandran et al. (2010) reported 61.5% food insecurity for urban Vellore. [11] In another unpublished study conducted in 75 slums of Meerut city Agarwal et al. (2009b) reported 74% food insecurity. These figures are higher but prevalence rates are not comparable due to stark differences in study design and methodology as noted in Table 1. For prevalence rates to be comparable across different studies, various scales have to be equated using the technique described by Nord et al. (2002) (see Appendix B).

However, apart from the methodological differences it is also plausible that Kolkata slum households share somewhat different socio-economic characteristics. For example, only 13% of the slum households are poor in Kolkata. One possibility is that the Kolkata survey was designed in such a way that it covered slums across the length and breadth of the KMC area, hence encompassing slums of diverse economic conditions which on average produce less alarming figures. In contrast, some of the other studies have been conducted in one or two selected regions of the city – for example, the study by Agarwal et al. (2009a) was concentrated in slums of north-east Delhi which might be experiencing greater deprivation compared to slums in other parts of the city. However, even with broader coverage Meerut reports very high food insecurity, one explanation of which may follow from the findings of a National Family Health Survey report on living and health conditions in selected Indian cites (Gupta et al., 2009) which states that conditions may be worse in the recently established or rapidly growing slums in medium and large cities (such as Meerut or Indore) than in the better established slums in the mega cities (such as Delhi or Kolkata). Finally, it is important to note that contrary to popular perception, not all slum dwellers may be poor — a survey of nine slums in Howrah district of West Bengal revealed that almost two-thirds of the people living in slums were above the poverty line (Sengupta, 1999). On the whole, at this point the results of prevalence estimates of food insecurity indicate that further research is necessary in this direction.

Interesting observations also follow from the findings on socio-economic correlates of food security. We note that household poverty status, asset-ownership status; gender, employment status and education level of household head strongly influence food security status of these low income urban households. These results are substantiated by the observations that relatively higher percentages of asset poor or casual labor households are experiencing severe food insecurity — going hungry or going without food the whole day. Empirical evidences available from other studies corroborate our findings. The literature has adequate evidence that casualization of labor or asset poverty are threats to food insecurity (Barrett, 2002), and income-poverty places a household at greater risk of food insecurity (Rose, 1999; Maitra and Rao, 2015) — facts which become all the more glaring in an urban setting since the majority of workers in urban slums work in the informal sector, earn highly variable income and have limited assets as an

[11] Nord et al. (2002), Mukhopadhya et al. (2010) and Mukhopadhyay and Biswas (2011) had rural samples and hence results are not reported. Results from Gupta et al. (2013, 2014) are also not reported because they estimated child food insecurity and hence their results are not comparable with ours.

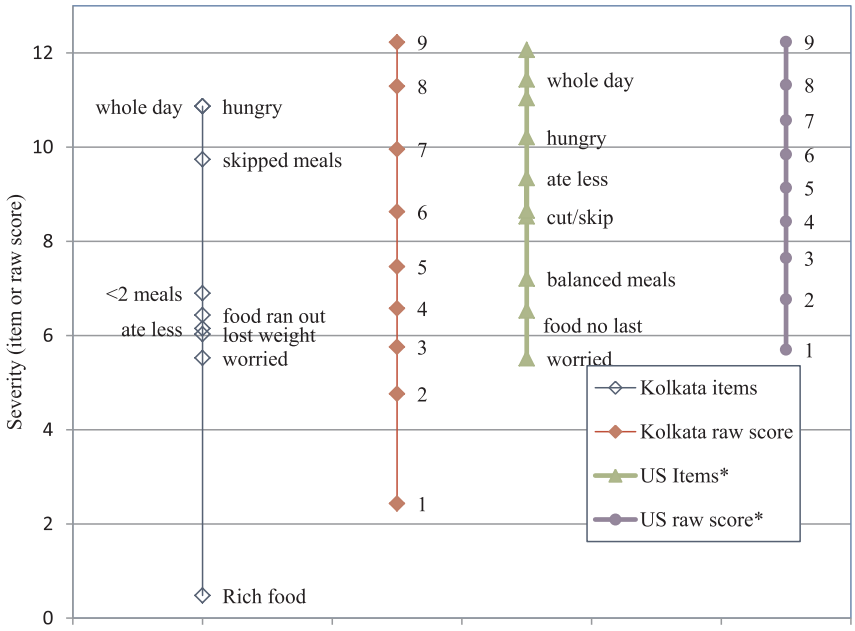

Fig. 1. Item-Raw Score Map: Severities of Items and Raw Scores for the Kolkata 9-item Adult Scale.

*US item parameters and raw scores are reported for comparison only. US item parameters and household measures were adjusted to the metric of the Kolkata scale based on four items that appear to be equivalent in the two scales, worried, food didn't last/ran out, hungry, and whole day.

Table 5
Summary Statistics of Variables, Kolkata, 2010–11.

Variables	Definition	Mean (s.e)
pckcl	adjusted calorie intake (per capita per day)	1876.37 (600.24)
pcprotein	adjusted protein intake (per capita per day)	52.24 (20.17)
pcfat	adjusted fat intake (per capita per day)	43.12 (48.53)
MPCE	household monthly per capita expenditure	1629.9 (865.16)
poor[a]	=1 if household is poor	0.13
asset[b]	=1 if household does not own assets other than fan	0.13
lnhhsize	logarithm of household size	1.37 (0.54)
hage	age of household head,	47.86 (13.77)
gender	=1 if female headed, else 0	0.19
hhtype[c]	=1 if casual labor household, else 0	0.22
dwell	=1 if owns home, else 0 (hired or encroached)	0.33
relig0	omitted base group, household belongs to Hinduism	0.52
relig1	= 1 if household belongs to Islam, else 0	0.44
relig2	=1 if household belongs to 'Christianity or Others, else 0	0.04
headlit0	omitted base group, household head illiterate or below primary level education	0.33
headlit1	=1 if household head has primary to middle level education, else 0	0.58
headlit2	=1 if household head is graduate and above, else 0	0.09
kidshare	share of kids (below 15 years) in the household	0.18(0.20)
wadshare	share of working age adults (15 years and above and below 65 years) in the household	0.75(0.23)
senior	omitted base group, share of seniors (65 years and above) in the household	0.07(0.16)

Note: Total number of households is 499, because in constructing the food security scale, 1 observation was deleted for missing value. Standard errors in parenthesis are reported for continuous variables only.

[a] Poverty line expenditure for Kolkata, for 2010-11, was determined by updating the poverty line expenditure for urban West Bengal for 2004-05, using the Consumer Price Index for Urban Industrial Workers (base 2001).

[b] Household durable assets other than fan include refrigerator, TV black and white, TV colour, bicycle, mobile phone and car.

[c] Reference group is 'Others' which include regular salary earners, self-employed and other households

insurance against risk (Floro and Swain, 2013). It is also not surprising that female headed households are more susceptible to food insecurity. Weak bargaining power and an inadequate safety net in urban areas makes urban female-headed households particularly vulnerable to shocks and compels them to compromise food access (World Bank, 2011; Mitra, 2005). In conformity with our results on education, Gupta et al. (2009) report that more than half of poor household heads in Hyderabad (61%), Meerut (56%), and Kolkata (51%) have no education.

It is also noteworthy that food insecure households consume fewer nutrients compared to food secure households – a result which is confirmed by other studies in the literature (Rose and Oliveira, 1997; Kirkpatrick and Tarasuk, 2008). Inadequate dietary intake caused by food insecurity is concerning when it is accompanied by nutrient inadequacies. Hence, nutritional vulnerability associated with food insecurity should be a cause of concern for policy makers.

Regarding the KHFSS, the experiential indicator is found to be a valid and reliable tool to measure food insecurity of adults in the studied households. However, internal validity needs to be improved because for certain items such as 'rich food' the outfit statistic is high indicating an erratic response pattern. It is also noteworthy that the items 'ate less' and 'lost weight' have relatively lower severities in the KHFSS relative to their severity ranking in other countries. The item 'ate less' is adapted directly from the Bangladesh Module (Webb et al., 2001) and is found to have low severity in Bangladesh too, which could be due to a different social condition in South Asian households where some family members (typically women) would eat less just to keep more for their husband, kids or major earning member in the family merely as part of a cultural practice (Harris, 1990). Regarding the item 'lost weight', it seems highly probable that this question is understood to refer to a different objective condition in the studied population.

On the issue of the items 'same food' and 'borrowed' getting dropped from the scale, it is plausible that the former performed poorly because in the surveyed households dietary variety is quite low to begin with so that eating a diet with low variety is not a good marker for food insecurity, while the latter is a kind of coping strategy only. Further research is needed in this direction involving extensive cognitive testing of items.

Table 6
Socio-economic Determinants of Food Security Status, Kolkata. 2010–11.

	Highly Food Secure (0 ≤ raw score < 3)	Marginally Food Secure (3 ≥ raw score < 5)	Moderately Food Insecure (5 ≤ raw score < 7)	Severely Food Insecure (7 ≤ raw score ≤ 9)	Unadjusted OR (s.e)	Adjusted OR (s.e)
HH is Poor (MPCE < Rs.856.28)	0.05	0.12	0.51	0.62	14.6*** (4.48)	8.50***(2.89)
HH has no asset other than fan	0.06	0.12	0.41	0.54	8.02*** (2.36)	4.90***(1.68)
Age of HH head	48.43 (13.31)	47.68 (15.17)	46.01 (15.48)	40.61 (12.42)	0.99 (0.008)	0.99 (0.009)
Logarithm of Household size	1.36 (0.55)	1.32 (0.55)	1.46 (0.51)	1.27 (0.54)	1.03 (0.05)	0.92(0.227)
Casual labor household	0.17	0.24	0.45	0.62	3.47 ***(0.81)	1.99** (0.57)
HH head is Female headed	15.22	31.71	29.69	38.46	2.46*** (0.58)	(1.82)**(0.55)
HH head is Illiterate*	25.98	48.78	54.69	69.23	–	–
HH head has Primary-Middle Level education	62.73	51.22	42.19	30.77	0.33*** (0.07)	0.52**(0.15)
HH head is Graduate & above	11.29	0	3.13	0.00	0.07*** (0.05)	0.22* (0.17)
HH owns home	34.38	21.95	35.94	15.38	0.80 (0.19)	0.78 (0.23)
HH is Hindu*	50.66	60.98	46.88	15.38	–	–
Islam	44.88	39.02	50.00	76.92	0.91 (0.19)	0.84 (0.22)
Christianity or others	4.46	0	3.13	23.08	0.37 (0.30)	0.28 (0.27)
Share of kids	0.16 (0.19)	0.16 (0.18)	0.26 (0.23)	0.38 (0.25)	7.37*** (3.86)	1.94 (1.93)
Share of working age adults	0.77 (0.22)	0.69 (0.28)	0.68 (0.23)	0.52 (0.17)	0.17*** (0.07)	0.28 (0.22)
Households with dependency ratio[a] > 1	62.99	68.29	73.44	92.31	0.60** (0.14)	–
MPCE	1818.13 (875.6)	1289.04 (523.7)	902.41 (340.24)	770.50 (344.70)	0.97 (0.004)***	–

Note: ***, **, * indicate significance at 1%, 5% and 10% level, respectively. Standard errors in parenthesis. Adjusted Odds Ratio (OR) reported for ordered logit model with three categories of food security status as the dependent variable – highly food secure, marginally food secure and food insecure. The control variables are: poor, asset, hage, lhhsize, genderh, hhtype, headlit, relig, kidshare and wadshare. Log pseudolikelihood for ordered logit model = −264.79632. *OR not reported for reference groups.
Household dependency ratio and MPCE not included in ordered logit model.

[a] Dependency ratio is the ratio of dependents (people younger than 15 years or older than 64 years), to the working-age population (those aged between 15 and 64 years) (World Bank, 2014).

At this point it is important to note that the present study has some caveats. First, the experiential indicator itself has its own limitations - the main concerns being response bias (Pinstrup-Andersen, 2009) and obscurity, induced by subjectivity, in deciding on cut-offs to classify the food insecure population into various categories by severity of food insecurity. Second, we could not completely address the issue of seasonality in food insecurity given the fact that we have used a shorter survey recall period for constructing the food security scale – food insecurity could have been higher in the months not captured in the survey. Third, a larger sample size and longitudinal data would have better revealed the food access problem in urban households especially since we could have taken account of price changes over time. Finally, the results are based on a single city and cannot be generalized to urban India in general. However, taking into account the results of the studies conducted in Delhi, Meerut or Vellore, it may be possible to move towards a conclusion that there are possibilities of a wider application of an experience-based measure similar to the US HFSSM in the context of urban India.

6. Conclusion and policy implications

The motivation behind the present study comes from the fact that despite strong economic growth in recent years, food insecurity continues to be a major concern in India. The need to identify the food insecure households is more urgently felt in urban areas since India is experiencing rapid urbanization of poverty which has made urban food

Table 7
Distribution of the KHFSS items across selected household socio-economic characteristics in the Kolkata slum households, 2010–11.

	(1) worried	(2) ran out	(3) rich food	(4) two square meals	(5) atetless	(6) skip meal	(7) hungry	(8) lost weight	(9) whole day
Poor	66.67 (0.66***)	59.09 (0.67***)	89.39 (0.20*)	62.12 (0.75***)	68.18 (0.74***)	13.64 (0.49***)	9.09 (0.51**)	66.67 (0.71***)	10.61 (0.59***)
Asset poor	61.9 (0.60***)	50.8 (0.56***)	98.4 (0.57***)	47.62 (0.57***)	49.21 (0.50***)	14.29 (0.50***)	14.29*** (0.75***)	53.97 (0.55***)	11.11 (0.60***)
Highly food secure[a]	4.20	1.84	76.38	0.26	1.31	0.52	0.00	1.57	0.00
Marginally food secure[a]	60.98	53.66	97.56	24.39	56.10	2.44	0.00	53.66	0.00
Food insecure[a]	97.40	83.12	98.70	92.21	93.51	20.78	14.29	97.40	14.29
Female headed	37.89 (0.30***)	34.74 (0.37***)	84.21 (0.07)	26.32 (0.25**)	28.42 (0.20**)	6.32 (0.19)	2.11 (−0.01)	32.63 (0.27**)	4.21 (0.23)
Casual labor	37.50 (0.32***)	37.50 (0.45***)	90.18 (0.26*)	31.25 (0.39***)	38.39 (0.43***)	10.71 (0.49***)	5.36 (0.36**)	41.96 (0.48***)	4.46 (0.27*)
HH head is illiterate[b]	36.81	31.90	88.96	26.99	33.13	9.20	5.52	34.36	5.52
HH head is home owner[b]	19.39	16.36	78.79	17.58	19.39	1.82	0.00	17.58	0.61
HH has dependence ratio > 1	25.69 (−0.15*)	21.71 (−0.21**)	82.26 (−0.05)	19.57 (−0.24*)	23.85 (−0.25**)	4.28 –(0.11)	3.06 (−0.36)	23.55 (−0.19**)	3.06 (−0.36)

Note: Adapted from Maitra and Rao (2017). Columns 1–9 describe items in the 9-item Kolkata Food Security Scale (KHFSS). Figures in the parenthesis represent correlation between each item and household characteristic.

[a] All correlations except with 'ran out' are insignificant.

[b] Correlations insignificant.

Table 8
Average Intake of Nutrients and Selected Food Items and Food Adequacy by Food Security Status, Kolkata 2010–11.

Nutrients and Food Items	Mean Consumption					
	Highly Food Secure (N = 381)	Marginally Food Secure (N = 41)	Moderately Food Insecure (N = 64)	Severely Food Insecure (N = 13)	ICMR Norm	Correlation[a] of nutrient/item with food security score
Calorie (kcal per person per day)	1990.2(0.95)	1768.5(0.84)	1385.0(0.66)	1298.4(0.62)	2100	−0.38
Fat (gm. per person per day)	48.8 (0.95)	31.1(0.61)	21.9(0.43)	16.3 (0.32)	51.1	−0.24
Protein (gm. per person per day)	56.5(1.10)	47.3(0.92)	35.0(0.68)	27.4(0.53)	51.3	−0.43
Cereals (gm. per person per day)	285.8(0.68)	291.9(0.69)	249.1(0.59)	192.6(0.46)	420	−0.17
Vegetables (gm per person per day)	279.5(2.24)	243.7(1.95)	213.7(1.71)	142.9(1.14)	125	−0.24
Fish (gm per person per day)	33.1 (1.32)	27.2(1.08)	15.0(0.60)	7.5(0.29)	25	−0.25
Meat (gm per person per day)	28.2 (1.13)	22. 1(0.88)	11. 4(0.46)	5. 3(0.21)	25	−0.20
Milk (gm per person per day)	93.9(0.63)	47.7(0.32)	31.6(0.22)	7.6(0.05)	150	−0.29
Oil (gm per person per day)	24.4(1.11)	20.4(0.93)	15.8 (0.73)	9.9(0.45)	22	−0.28

Note: ICMR norms reported from MSSRF (2002). Figures in parenthesis indicate adequacy ratio (shortfall from ICMR norm).
[a] All correlations (polychoric) are significant at 5% level of significance.

insecurity an emerging concern. Given the above, we attempt to measure the extent of food insecurity in a setting of slum households of Kolkata surveyed in 2010-11 using an experiential food security scale adapted from the US HFSSM. The exercise is highly consistent with SDG 2.1 which stresses on promoting universal access to food by all populations across the globe by 2030, and proposes use of an experiential scale (FIES) as one of the SDG indicators (SDG indicator 2.1.2).

Results indicate that 15% of the households are food insecure with 2.6% severely food insecure. On the face of it, the prevalence of food insecurity in Kolkata slum households may seem to be somewhat low, however, it should not deter policy makers from taking concerted actions to combat hunger and food insecurity in such settings since urban food insecurity is a complex phenomenon. In the words of Maxwell (1999): "the complexity of cities — the diversity of their class, gender, ethnic, and demographic characteristics and their corresponding needs and access problems – creates new challenges in the attempt to ensure urban food security." Perhaps such complexity explains why we find strong association of food insecurity in these households with factors such as household poverty status, asset ownership status; and gender, education level and employment status of household head. Nutritional inadequacy seems to be another concerning outcome of food insecurity. The findings inform policy makers that addressing the challenges of urban food insecurity needs multi-sectoral interventions whereby appropriate nutritional policy is to be combined with relevant government income and education support programs and employment generating schemes.

Another key policy implication of the findings is that the experiential indicator has excellent potential to be an alternative metric to measure food security in India, which in conjunction with existing indicators such as calorie intake, dietary diversity indicators or nutritional status can identify the food insecure more accurately rendering targeting more cost-effective. Whether such efforts can be undertaken by conducting nationwide surveys under the aegis of a nationally recognized body is a matter of future research and at this point we can only suggest it as a direction. However, if India is to progress towards SDG 2.1, such efforts will eventually be mandatory.

Research in such directions will be consistent with the post-2015 development agenda, which emphasizes the need for a "data revolution" for sustainable development. In order to translate policy to action, the new development agenda recommends that the "data gathered will need to be disaggregated by gender, geography, income, disability, and other categories, to make sure that no group is being left behind" (UN 2013, p. 23).

Table 9
Effect of Household Food Security Status on Household Calorie, Protein and Fat availability: Multivariate Linear Regression Model, Kolkata, 2010–11.

Dependent variables	food security status (*fs*) (=1 if food insecure)
Calorie availability per capita per day	−275.25***(53.61)
Protein availability per capita per day	−7.16***(1.49)
Fat availability per capita per day	−4.50 (3.29)

Note: ***, **, * implies significance at 1%, 5% and 10% level, respectively. Standard errors in parenthesis. Control variables are MPCE, household size, age, gender, religion, education level, homeownership status of household head and household composition. See Appendix B for detailed results.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Acknowledgement

I gratefully acknowledge the support from the School of Economics, the University of Queensland (UQ), Brisbane, Australia, in conducting this research. I sincerely acknowledge the contribution of A/Professor Renuka Mahadevan (UQ, School of Economics) and Professor D.S. Prasada Rao (UQ, School of Economics) at various stages of this work. I'm especially thankful to Dr. Mark Nord from Economic Research Division, United States Department of Agriculture (presently with 'The Voices of the Hungry' project, Food and Agricultural Organization), from whom I've received valuable input in terms of learning the techniques of constructing the experiential food security scale. His contributions to the paper remain deeply valued. I also thank Mr. Swapan Deb and Mr. Dipesh Sen for doing an excellent work in assisting with the survey in the slums of Kolkata, and Mr. Byomjatri Ganguli for helping with data entry. Finally, I thank Dr. Ranjana Ghosh from the West Bengal Bureau of Economics and Statistics and the employees of the National Sample Survey Organization, Kolkata, for providing valuable guidance in conducting the survey in Kolkata. Finally, I thank the anonymous referees for their excellent suggestions in revising the manuscript.

Appendix A. Supplementary information

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.gfs.2017.04.005.

References

Agarwal, S., Sethi, V., Gupta, P., Jha, M., Agnihotri, A., Nord, M., 2009a. Experiential household food insecurity in an urban underserved slum of North India. Food Secur. 1, 239–250.

Agarwal, S., Sethi, V., Nord, M., 2009b. Levels and predictors of experiential household food insecurity among urban poor of North India. Unpublished presentation (personal communication).

Ballard, T.J., Kepple, A.W., Cafiero, C., 2013. The Food Insecurity Experience Scale: Development of a Global Standard for Monitoring Hunger Worldwide 2013 FAO, Rome (Avaialble at). 〈http://www.fao.org/fileadmin/templates/ess/voh/FIES_Technical_Paper_v1.1.pdf〉.

Barrett, C.B., 2002. Food security and food assistance programs. In: Gardner, B.L., Rausser, G., C. (Eds.), 1st ed. Handbook of Agricultural Economics 40. Elsevier, pp. 2103–2190.

Black, R.E., Victora, C.G., Walker, S.P., Bhutta, Z.A., Christian, P., Onis, M.D., Ezzati, M., McGregor, S.G., Katz, J., Martorell, R., Uauy, R., 2013. Maternal and child undernutrition and overweight in low-income and middle-income countries. Lancet 382 (9890), 427–451.

Blumberg, S.J., Bialostosky, K., Hamilton, W.L., Briefel, R.R., 1999. The effectiveness of a short form of the household food security scale. Am. J. Public Health 89 (8), 1231–1234.

Bond, T.G., Christine, M. Fox, 2001. Applying the Rasch Model: Fundamental Measurement in the Human Sciences. Lawrence Erlabaum Associates, Mahway, New Jersey.

Coates, J., Swindale, A., Bilinsky, P., 2007. Household Food Insecurity Access Scale (HFIAS) for Measurement of Household Food Access: Indicator Guide 3 Food and Nutrition Technical Assistance Project Academy.

Coates, J.C., Webb, P., Houser, R.F., Rogers, B.L., Wilde, P., 2010. "He said, she said": who should speak for households about experiences of food insecurity in Bangladesh. Food Secur. 2010 (2), 81–95.

Devi, Mahasweta, 1979. Sreshtho Galpo. Karuna Prakashoni, Kolkata.

Datt, G., Ravallion, M. and Murgai, R. 2016. Growth, Urbanization and Poverty Reduction in India, No 21983, NBER Working Papers, National Bureau of Economic Research, Inc, 〈http://EconPapers.repec.org/RePEc:nbr:nberwo:21983〉.

FAO, 2010. State of Food Insecurity in the World. Food and Agricultural Organistaion of the United Nations, Rome.

FAO, 2014. State of Food Insecurity in the World. Food and Agricultural Organistaion of the United Nations, Rome.

Floro, M.S., Bali Swain, R., 2013. Food security, gender, and occupational choice among urban low-income households. World Dev. 42 (0), 89–99. http://dx.doi.org/10.1016/j.worlddev.2012.08.005.

Frankenberger, T., 1992. Indicators and data collection methods for assessing household food security. In: Maxwell, S., Frankenberger, T. (Eds.), Household Food Security: Concepts, Indicators, Measurements: A Technical Review. UNICEF and IFAD, New York and Rome.

Garrett, J.L., Ruel, M.T., 1999. Are determinants of rural and urban food security and nutritional status different? Some insights from Mozambique. World Dev. 27 (11), 1955–1975.

GOI, 1979. Report of the Task Force on Projections of Minimum Needs and Effective Consumption Demand. Planning Commission, Government of India, New Delhi (Avaialble at). 〈http://planningcommission.nic.in/aboutus/taskforce/tsk_mneff.pdf〉.

GOI, 2011. Report of the Working Group on Urban Poverty, Slums, and Service Delivery System. Steering Committee on Urbanization, Planning Commission, New Delhi (Available at). 〈http://planningcommission.nic.in/aboutus/committee/wrkgrp12/hud/wg_Final_Urb_Pvt.pdf〉.

GOI, 2016. National Food Security Act (NFSA), 2013. Department of Food & Public Distribution. Government of India (Available at). 〈http://dfpd.nic.in/nfsa-act.htm〉.

Gopichandran, V., Claudius, P., Baby, L.S., Felinda, A., Mohan, V.R., 2010. Household food security in urban Tamil Nadu: a survey in Vellore. Natl. Med. J. India 23 (5), 278.

Grebmer, v., K., Ringler, C. Rosegrant, Olofinbiyi, M.W., T., Wiesmann, D., Fritschel, H., Badiane, O., Torero, M., Yohannes, Y., Thompson, J., Constanze, vO., Rahall, J., 2014. 2014 Global Hunger Index Data. International Food Policy Research Institute. 〈http://www.ifpri.org/publication/2014-global-hunger-index〉.

Gupta, K., Arnold, F., Lhungdim, H., 2009. Health and Living Conditions in Eight Indian Cities. National Family Health Survey (NFHS-3). International Institute for population Sciences, Mumbai, India (Calverton, Maryland, USA: ICF Macro).

Gupta, P., Singh, K., Sethi, V., Agarwal, S., Mathur, P., 2014. Association of Food Insecurity and Malnutrition among Young Children (6–36 Months). Indian J Nutr Diet 51 (3), 293–305.

Gupta, P., Singh, K., Sethi, V., 2013. Food insecurity among the young children (6-35 months) in urban slums of Delhi, India. Indian J. Matern. Child Health 15 (4), 1–6.

Hamilton, W.L., Cook, J.T., Thompson, W.W., Buron, L.F., Frongillo Jr, E.A., Olson, C.M., Wehler, C.A., 1997b. Household Food Security in the United States in 1995: Technical Report of the Food Security Measurement Project. US Department of Agriculture Food, Washington, DC.

Harris, B., 1990. The intrafamily distribution of hunger in South Asia. In: Dreze, J., Sen, A., Hussain, A. (Eds.), The Political Economy of Hunger: Selected Essays. Clarendon Press, Oxford.

Headey, Derek D. 2013. The Impact of the Global Food Crisis on Self-Assessed Food Security. Policy Research Working Paper 6329. World Bank.

Kirkpatrick, S., Tarasuk, V., 2008. Food insecurity is associated with nutrient inadequacies among Canadian adults and adolescents. J. Nutr. 138 (3), 604–612.

Kundu, A., 2006. Food security system in India: analysing a few conceptual issues in the contemporary policy debate. In: Safety Nets (Ed.), Protecting the Vulnerable Poor in India: The Role of Social. World Food Programme, New Delhi.

Maitra, C., 2013. Measurement and Analysis of Food Secuirty: A case of Urban India (Unpublished doctoral thesis). The University of Queensland, Brisbane, Australia.

Maitra, C., Rao, D.S.P., 2015. Poverty–food security nexus: evidence from a survey of urban slum dwellers in Kolkata. World Dev. 72, 308–325. http://dx.doi.org/10.1016/j.worlddev.2015.03.006.

Maitra, C., Rao, D.S.P., 2017. An empirical investigation into measurement and determinants of food security. J. Dev. Stud. http://dx.doi.org/10.1080/00220388.2017.1324144.

Maxwell, D., 1999. The political economy of urban food security in Sub-Saharan Africa. World Dev. 27 (11), 1939–1953.

Mitra, A., 2005. Women in the urban informal sector: perpetuation of meagre earnings. Dev. Change 36 (2), 291–316. http://dx.doi.org/10.1111/j.0012-155X.2005.00412.x.

MSSRF, 2002. Food Insecurity Atlas of Urban India. Chennai, M.S.Swaminathan Research Foundation and the World Food Programme.

Mukhopadhyay, D., Mukhopadhyay, S., Biswas, A., 2010. 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 J. Public Health 54 (2), 92.

Mukhopadhyay, D.K., Biswas, A.B., 2011. Food security and anthropometric failure among tribal children in Bankura, West Bengal. Indian Pediatr. 48 (4), 311.

Nord, M., Satpathy, A.K., Raj, N., Webb, P., Houser, R., 2002. Comparing Household Survey-Based Measures of Food Insecurity Across Countries: Case Studies in India, Uganda and Bangladesh. Discussion Paper No. Friedman School of Nutrition Science and Policy, Tufts Universitypp. 7.

Nord, M., 2015. Personal communication with Dr. Mark Nord, Food and Agricultural Organisation, September 2015.

NSSO, 1983. Per capita and Per Consumer Unit Per Diem Intake of Calorie, Protein and Fat and Perception of People on Adequacy of Food (Report No. 348, 38th Round). National Sample Survey Organisation, Department of Statistics, Government of India, New Delhi.

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

NSSO, 2006. Level and Pattern of Consumer Expenditure, 2004–05 (Report No. 508, 61st Round, July 2004 – June 2005). National Sample Survey Organisation, Ministry of Statistics and Programme Implementation, Government of India, New Delhi.

NSSO, 2007. Nutritional Intake in India (Report No. 513, July 2004 – June 2005). National Sample Survey Organisation, Ministry of Statistics & Programme Implementation, Government of India, New Delhi.

NSSO. Perceived Adequacy of Food Consumption in Indian Households (Report No. 547, 66th Round, July 2009–June 2010) Minist. Stat. Program. Implement., Natl. Sample

Surv. Off. 2013.
Pérez-Escamilla, R., Melgar-Quiñonez, H., Nord, M., Alvarez Uribe, M.C., Segall-Correa, A.M., 2007. Escala Latinoamericana y Caribeña de Seguridad Alimentaria (ELCSA) [Latinamerican and Caribbean Food Sec Security Scale]. Perspectivas en Nutrición Humana, Colombia, pp. 117–134.
Pérez-Escamilla, R., 2012. Can experience-based household food security scales help improve food security governance? Glob. Food Secur. 1 (2), 120–125. http://dx.doi.org/10.1016/j.gfs.2012.10.006.
Pinstrup-Andersen, P., 2009. Food security: definition and measurement. Food Secur. 1, 5–7.
President's Task Force on Food Assistance, 1984. Final report. US Government Printing Office, Washington, DC (January).
Radimer, K.L., Olson, C.M., Campbell, C.C., 1990. Development of indicators to assess hunger. J. Nutr. 1990 (120), 1544–1548.
Ravallion, Martin, 2012. Poor, or just feeling poor? On using subjective data in measuring poverty. Policy Research Working Paper Series with number. World Bank, Washington, DC, pp. 5698.
Rose, D., Oliveira, V., 1997. Nutrient intakes of individuals from food-insufficient households in the United States. Am. J. Public Health 87, 12.
Rose, D., 1999. Economic determinants and dietary consequences of food insecurity in the United States. J. Nutr. 129 (2), 517.
Sengupta, C., 1999. Dynamics of community environmental management in Howrah slums. Econ. Political Wkly. 22, 1290–1296.
Sethi, V., Maitra, C., Unisa, S., Avula, R., Goswami, B., Gallagher, K., Mebrahtu, Saba, 2016. Usage, Internal Validity and Reliability of Experience-Based Household Food Insecurity Scales in Indian settings. Nutrition Reports 5 United Nations Children's Fund, New Delhi, India.
Urban Health Resource Center (UHRC), 2011. Coping strategies and levels of child food insecurity among urban-poor food insecure households living in urban slums of Seelampur, Delhi—a report. Urban Health Resource Center, New Delhi, India. Unpublished report.
United nations (UN), 2013. A New Global Partnership: Eradicate Poverty and Transform Economies Through Sustainable Development. The Report of the High-Level Panel of Eminent Persons on the Post-2015 Development Agenda. United Nations Publications, New York.
United Nations (UN), 2016. Goal 2 End hunger, achieve food security and improved nutrition and promote sustainable agriculture. Available at: ⟨http://unstats.un.org/sdgs/files/metadata-compilation/Metadata-Goal-2.pdf⟩.
United Nations Dvelopment Program (UNDP), 2008. Study on Perception of Disadvantaged in Seven States of India. UNDP, New Delhi.
Webb, P., Coates, J., Houser, R., 2001. 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.
Webb, P., Coates, J., Frongillo, E.A., Rogers, B.L., Swindale, A., Bilinsky, P., 2006. Measuring household food insecurity: why it's so important and yet so difficult to do. J. Nutr. 136 (5), 1404S.
Wehler, C.A., Scott, R.I., Anderson, J.J., 1992. The community childhood hunger identification project: a model of domestic hunger – demonstration project in Seattle, Washington. J. Nutr. Educ. 24 (Suppl), 29–35.
World Bank, 2011. World Development Report 2012: Gender Equality and Development. World Bank, Washington DC (Available at). ⟨http://siteresources.worldbank.org/INTWDR2012/Resources/7778105-1299699968583/7786210-1315936222006/Complete-Report.pdf⟩.
World Bank, 2014. Accessed on April 12, 2014.
Wright, L., Gupta, P., 2015. Coping strategies adopted by urban poor to ameliorate food insecurity: case of United States, Belize and India. J. Food Secur. 3 (2), 40–46.