

Review Article

Gender differences in the prevalence of household food insecurity: a systematic review and meta-analysis

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Abstract

Objective: The present review aimed to identify and synthesize literature on household food insecurity with respect to whether the respondent was male or female.

Design: A systematic review of prevalence studies followed by a meta-analysis was conducted between 28 August 2014 and 19 October 2014 in seven electronic databases. The search was updated in April 2016. The included studies used experience-based measures to assess household food insecurity. Dichotomous measures of food insecurity were used. Pooled odds ratios of household food insecurity prevalence in women *v.* men were obtained through random-effect modelling. Quality assessment, publication bias diagnostics and subgroup analysis were also performed.

Setting: Population-based studies (i.e. non-clinical populations).

Subjects: Participants aged 18 years or over.

Results: Out of the 5145 articles initially identified, forty-two studies with a total population of 233 153 were included. In general, results showed that the odds for household food insecurity was 40% higher in studies where women were the respondent (95% CI 1.27, 1.54; $P < 0.001$). Besides, subgroup analysis revealed that female-headed households were 75% (95% CI 49–96%) more likely to be food insecure than male-headed households.

Conclusions: Our results confirm the existence of gender differences in reporting household food insecurity. Furthermore, they indicate that households headed by women constitute a segment of the population that is particularly vulnerable to food insecurity.

Keywords
Food insecurity
Prevalence
Gender
Female

Food security is a multidimensional concept^(1–4). No single measure can encompass all of its aspects⁽¹⁾. Among the various definitions currently in use, the most commonly accepted is that food security exists 'when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life'⁽⁵⁾. In contrast, food insecurity reflects the uncertainty of having or the inability to acquire adequate food intake for all household members, and it stems in large part from the lack of sufficient resources to obtain food in socially acceptable ways^(6,7).

The FAO definition of food security covers the four dimensions of food security: food availability, economic and

physical access to food, food utilization and stability over time^(7–10). These metrics may focus on each or some combination of these domains⁽²⁾. In terms of access indicators, the US government pioneered the approach of assessing household food security through questionnaire-based items that ask an adult respondent for the household to report behaviours and experience directly^(8,11,12). These experience-based measures differ from other approaches in that they attempt to directly measure food security⁽²⁾. Subsequently, a number of other countries, including developing countries, have implemented similar methodologies^(8,12).

One of the major predictors of food insecurity is lower income or poverty, which limits financial resources for

acquiring food^(13,14). In this sense, women and girls are typically the primary group to experience the effects of food insecurity^(15,16). Gender thus deserves marked attention because the restriction on access to education and employment opportunities weakens the economic autonomy of women^(15,16). It has also been suggested that gender affects access to health care and nutrition outcomes, especially in cultures that discriminate against females⁽¹⁷⁾.

From a social perspective traditional discourses about 'family' life and 'women's work' include expectations that women are responsible for caring for their family members and managing household tasks⁽¹⁸⁾. A key feminine responsibility is 'feeding the family', which requires a series of tasks: meal planning, monitoring the supply of household provisions, shopping, cooking and cleaning⁽¹⁹⁾. Women are typically household food managers, a role that directly affects the way the family feeds⁽²⁰⁾.

Increased professional and public discussion of the relationship between food insecurity and gender has motivated a search for a better understanding of the magnitude of the gender difference in the prevalence of household food insecurity. Thus, in the present study, we aimed to contribute to the understanding of this association by systematically reviewing and critically appraising the literature on household food insecurity with respect to whether the respondent was male or female.

Methods

The present systematic review of prevalence studies followed by a meta-analysis was conducted using a predefined protocol and reported in accordance with the MOOSE (Meta-analysis of Observational Studies in Epidemiology) guidelines⁽²¹⁾.

Search strategy

We conducted searches between 28 August 2014 and 19 October 2014 in seven electronic databases: PubMed, Scopus, Web of Knowledge, Embase, LILACS, Scielo and CAPES's Theses Database. The search was updated in April 2016. The full electronic search strategy for all databases is available in Table 1. The descriptors used in the review process were selected after consulting the Health Sciences Descriptors (DeCs) and Medical Subject Headings (MeSH) terms. The search was conducted with words in Portuguese and/or English (depending on the database) using blocks of two concepts: terms derived from 'Food Security', and terms derived from 'Prevalence'. The Boolean operator 'OR' was used to match the descriptors in each block, and the Boolean operator 'AND' was used to combine the blocks together. References of the identified papers were also searched to locate studies that were not identified by the search. No restrictions on time period or language were imposed.

Selection of studies and data extraction

The articles were included if they met the following inclusion criteria: (i) surveys that used population-based sampling methods and that reported the prevalence of household food insecurity or that presented data to calculate it; (ii) studies that stratified the analysis of prevalence by the sex of the head of household or the sex of the respondent; and (iii) interviewed individuals were over 18 years of age. Studies with sick populations, with institutionalized people, duplicates and qualitative studies were excluded.

The selection of articles was carried out using a two-stage process. First, two qualified reviewers (N.M.J. and S.P.) independently screened the titles and abstracts of all identified articles. Second, the full text of the pre-selected articles was also independently assessed using the predefined inclusion criteria. A third reviewer (F.S.B.) solved disagreements when necessary.

Data were extracted and tabulated by two reviewers (N.M.J. and S.P.) using a table containing the following variables: author, title, date of publication, city(s)/state(s)/country(s), study design, study population, sample size, percentage male and percentage female, response rate, instruments, food insecurity categories, prevalence and 95% confidence interval. Described below and summarized in Table 2, we reviewed the experience-based indicators used by the articles included in the meta-analysis and present information on the scale, classification, score range and recall period of each one.

Assessment of methodologic quality

The quality of the studies was assessed by adapting a guideline for cross-sectional studies⁽²²⁾. Methodological assessment criteria included the target population, sample size, adequate sample size achieved, response rate, validated questionnaire, interviewer training and confidence intervals.

Statistical analysis

A forest plot was built for the odds ratio of food insecurity prevalence for women *v.* men. To obtain summary measures, we used random-effects models when the heterogeneity test was statistically significant ($P < 0.05$) and fixed-effect models when the test was statistically non-significant ($P \geq 0.05$). Begg's and Egger's tests assessed the existence of publication bias. In order to minimize heterogeneity, subgroup analyses were conducted by response rate, measurement tool, probabilistic sample, unit of analysis, gender (sex of the respondent without considering if those individuals were the head of household or sex of the head of household), Human Development Index and geographic location. The geographical division adopted were the continents: Asia, Europe, Africa, Oceania, North, Central and South America. The impact of exclusion of each study on the combined effect was also assessed. We

Table 1 Search strategy syntax used for each database

Database	PubMed	Scopus	Web of Knowledge	Embase	LILACS	Scielo	Banco de Tese da CAPES
Search date	28/08/2014 and 24/09/2014 and 29/09/2014 and 19/10/2014 and 02/04/2016	05/09/2014 and 29/09/2014 and 20/04/2016	29/09/2014 and 20/04/2016	17/10/2014 and 20/04/2016	03/09/2014 and 29/09/2014 and 05/04/2016	03/09/2014 and 29/09/2014 and 11/04/2016	05/09/2014 and 11/04/2016
Search strategy components							
1st component: terms derived from 'Food Security' (all linked by Boolean OR)	(((((('Food Supply' (MeSH) OR 'Food Storage' (MeSH) OR 'Hunger' (MeSH) OR food security OR food insecurity OR household food security OR global food security) OR household food insecurity)))	(((((('Food Supply') OR 'Food Storage') OR 'Hunger' OR food security OR food insecurity OR household food security OR global food security) OR household food insecurity)))	(((((('Food Supply') OR 'Food Storage') OR 'Hunger' OR food security OR food insecurity OR household food security OR global food security) OR household food insecurity)))	'food security'/exp OR 'food insecurity'/exp OR 'household food security' OR 'household food insecurity' OR 'food supply' OR 'food storage' OR 'hunger' OR 'global food security'	'FOOD SECURITY' (Palavras) or 'SEGURANCA ALIMENTAR E NUTRICIONAL' (Palavras) or 'SEGURANCA ALIMENTAR E NUTRICIONAL (SAN)' (Palavras)	(food security) OR (food insecurity)	Segurança Alimentar e Nutricional Insegurança Alimentar e Nutricional
Boolean term linking 1st and 2nd components	AND	AND	AND	AND	AND	AND	AND
2nd component: terms derived from 'Prevalence' (all linked by Boolean OR)	((('Prevalence' (MeSH) OR 'Cross-Sectional Studies' (MeSH) OR cross-sectional study OR Prevalence Studies OR prevalence study OR Cross-Sectional Analyses OR Cross-Sectional Analysis OR Cross Sectional Analysis OR Cross Sectional Analyses)	((('Prevalence') OR 'Cross-Sectional Studies' OR cross-sectional study OR Prevalence Studies OR prevalence study OR Cross-Sectional Analyses OR Cross-Sectional Analysis OR Cross Sectional Analysis OR Cross Sectional Analyses)	((('Prevalence') OR 'Cross-Sectional Studies' OR cross-sectional study OR Prevalence Studies OR prevalence study OR Cross-Sectional Analyses OR Cross-Sectional Analysis OR Cross Sectional Analysis OR Cross Sectional Analyses)	'prevalence'/exp OR 'cross-sectional study'/exp	X	X	X

MeSH, Medical Subject Heading.

Table 2 Experience-based indicators used by articles included in this meta-analysis

Indicator (reference)	Description	Recall period	Scoring and range	Classification
HFSSM Household Food Security Survey Module ^(8,68)	Eighteen items (eight of which are specific to households with minors) A shortened six-item version of the module has been developed and validated	12 months (30 d has also been used)	Sum of affirmative responses Range: 0–10 for households without minors; 0–18 with minors	Households with one or more children: 0 points (high food security); 1–2 points (marginal food security); 3–7 points (low food security); and 8–18 points (very low food security) Households with no child present: 0 points (high food security); 1–2 points (marginal food security); 3–5 points (low food security); and 6–10 points (very low food security) Short-version: raw score 0–1 (high or marginal food security); raw score 2–4 (low food security); and raw score 5–6 (very low food security) Households with high or marginal food security (old label = food security) are classified as food secure. Those with low (old label = food insecurity without hunger) or very low food security (old label = food insecurity with hunger) are classified as food insecure
EBIA Brazilian Food Insecurity Scale ^(8,69,70)	Adapted from the HFSSM and validated through focus group research The first version resulting from the study conducted in 2003 had fifteen items. Currently EBIA is a fourteen-item scale (eight of which are specific to households with individuals under 18 years old)	3 months	Each affirmative answer receives 1 point Score range: 0–14	Households with (fourteen items) individuals under 18 years of age: food secure (0 points); mildly food insecure (1–5 points); moderately food insecure (6–9 points); and severe food insecurity (10–14 points) Households without (eight items) individuals under 18 years of age: food secure (0 points); mildly food insecure (1–3 points); moderately food insecure (4–5 points); and severe food insecurity (6–8 points)
HFIAS Household Food Insecurity Access Scale ^(2,8,61)	Uses a set of questions that represents universal domains and subdomains of experiencing household food insecurity and more specifically lack of access to food	30 d	Sums responses to nine questions related to the occurrence of increasingly severe experiences of food shortage Four-level frequency response questions: 'no occurrence' is assigned a value of 0, 'rarely' a value of 1, 'sometimes' a value of 2 and 'often' a value of 3 Score from 0 to 27 is obtained	Food secure: experiences none of food insecurity conditions, or just experiences worry, but rarely Mildly food insecure: worries about not having enough food sometimes or often, and/or is unable to eat preferred food, and/or eats a more monotonous diet than desired and/or some food considered undesirable, but only rarely. They do not cut back on quantity nor experience any of the three most severe conditions (running out of food, going to bed hungry or going a whole day and night without eating) Moderately food insecure: sacrifices quality more frequently, by eating a monotonous diet or undesirable foods sometimes or often, and/or has started to cut back on quantity by reducing the size of meals, rarely or sometimes. But they do not experience any of the three most severe conditions Severely food insecure: has graduated to cutting back on meal size or number of meals often, and/or experiences any of the three most severe conditions (running out of food, going to bed hungry or going a whole day and night without eating), even as infrequently as rarely
CHFSS Colombia Household Food Security Survey ^(46,71)	Twelve-item survey concerning the experiences of food insecurity as a result of financial constraint	6 months	Each item was followed by a frequency of occurrence question, which assessed how often a given condition occurred. A negative response to the initial item was scored as 0, and the follow-up questions were scored as 'rarely' = 1, 'sometimes' = 2 and 'always' = 3 Score range: 0–36	Classification: food secure (0 points); mildly food insecure (1–17 points); moderately food insecure (18–26 points); and severe food insecurity (27–36 points)

Table 2 *Continued*

Indicator (reference)	Description	Recall period	Scoring and range	Classification
CCHS Canadian Community Health Survey ⁽³¹⁾	Assesses the food security of adults and children separately Contains ten adult-referenced items (Adult Food Security Scale) and eight child-referenced questions (Child Food Security Scale)	12 months	Sum of affirmative responses In contrast to the HFSSM, which uses three or more affirmative responses as a basis for the classification of a household as food insecure, the Canadian version uses a less strict classification of two or more affirmative responses	Ten-item adult food security scale: food secure (0–1 affirmative responses); food insecure–moderate (2–5 affirmative affirmed responses); and food insecure–severe (≥ 6 affirmative responses) Eight-item child food security scale: food secure (0–1 affirmative responses); food insecure–moderate (2–4 affirmative responses); and food insecure–severe (≥ 5 affirmative responses)
ELCSA Latin American and Caribbean Household Food Security Scale ⁽⁶⁾	Based on scales used and trialled in Venezuela, Brazil and Colombia, and stemming from the HFSSM. Intended for use in Latin America and the Caribbean Fifteen-item survey	3 months	Sum of the number of affirmative responses	Classification: 0 = food secure; 1–3 (no minors)/1–5 (minors) = mildly food insecure; 4–6/6–10 = moderately food insecure; 7–8/11–15 = severely food insecure

do not report these results because the exclusion of any one of the included studies did not attenuate or increase the effect measure significantly. We also conducted sensitivity analysis by study quality, excluding studies that presented four or more items classified as unclear or/and high risk of bias. Data analyses were performed using the statistical software package Stata version 12.1.

Results

Study selection

The literature search resulted in 5145 articles (2298 from PubMed, 401 from Scopus, sixty-nine from Web of Knowledge, 180 from Scielo, 493 from LILACS, 1550 from Embase, 154 from CAPES's theses database), which yielded a total of 4381 initial records after duplicate items were removed. The first screening excluded 4158 results and the second screening another 184 results, leaving thirty-nine final records for analysis. References of these articles were checked, resulting in three additional articles. A total of forty-two articles were eligible for review. Figure 1 depicts a flowchart of studies retrieved, screened and included in the systematic review.

Study characteristics

Table 3 describes the characteristics of the included studies. Most were conducted in North (n 17; 40.48%)^(18,23–38) and South America (n 15; 35.71%)^(39–53). The country with the highest number of included studies was Brazil (n 13; 30.95%)^(39–45,48–52,54), followed by the USA (n 11; 26.19%)^(18,23,24,26,27,29,30,32–34). Of the remaining articles, four were carried out in Asia^(1,55–57), three in Europe^(58–60) and three in Africa^(61–63). We did not find any eligible studies from other Latin American countries. The majority of the studies (n 35; 83.33%) had collected their data from 2000 onwards. Five articles did not present information about the year of data collection^(26,36,47,57,61).

More than half of the articles (n 22; 52.38%)^(23–30,32–35,37,38,40,45,50,52,53,57,59,63) stratified the prevalence of food insecurity by the sex of the respondent without considering if those individuals were the head of household or not. The remaining studies stratified the outcome by the head of the head of household (n 20; 47.62%)^(1,18,31,36,39,41–44,46–49,51,55,56,58,60–62). Sample sizes ranged from fifty to 65 190 households or individuals. Half of them (n 21) had sample sizes of more than 1000^(1,18,24,26,27,29,30,35,37,39,41,42,44–46,48,52,55,58,60,63). Food insecurity was assessed by a range of different instruments.

Prevalence of food insecurity

Of the forty-two studies, thirty-five reported data that enabled the calculation of prevalence of food insecurity. We contacted seven authors for additional information,

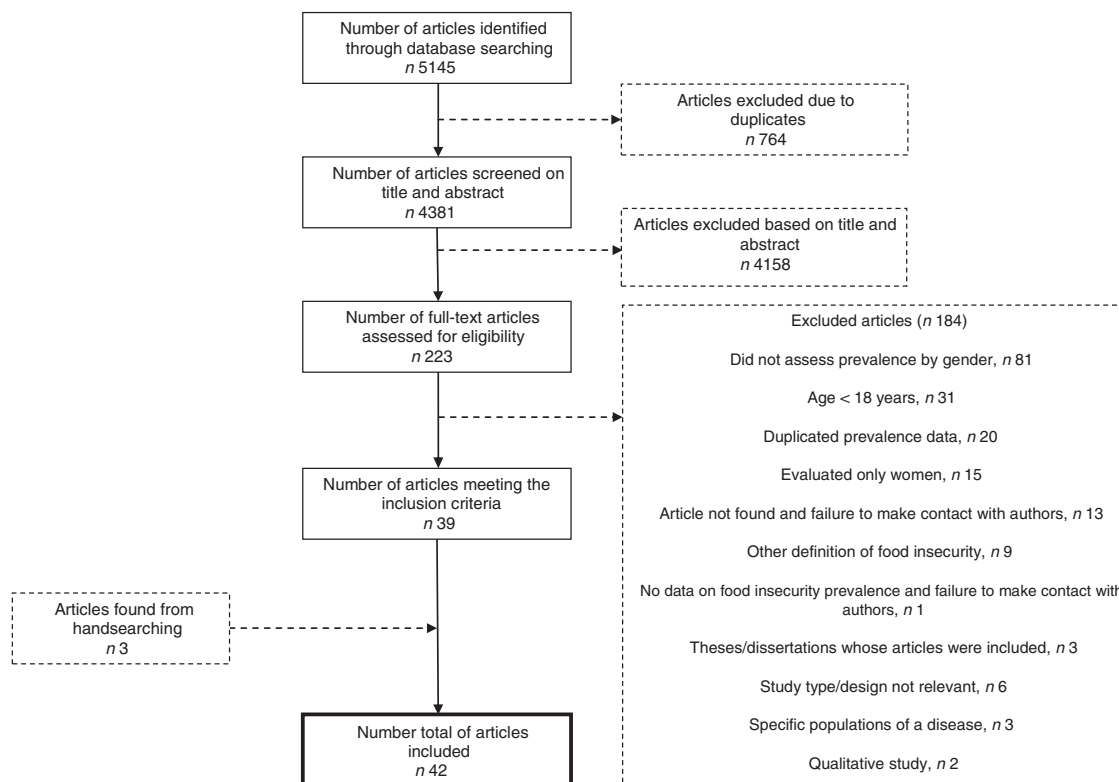


Fig. 1 Flowchart of studies retrieved, screened and included in systematic review

but only two responded. Of the remaining five articles, four studies reported an OR as the measure of effect. In these studies a logarithm transformation was made in order to get logarithm OR and its SE. One study reported the relative risk and this measure was converted into an OR⁽⁶⁴⁾.

The overall prevalence of food insecurity as well as the prevalence stratified by gender is shown in Table 4. The results of the included studies showed a wide range in the prevalence of food insecurity, from 4.83%⁽¹⁸⁾ to 91.18%⁽⁴⁰⁾. Household food insecurity reported by males ranged from 3.87%⁽⁵⁵⁾ to 83.33%⁽⁴⁰⁾, whereas in females it ranged from 5.60%⁽¹⁸⁾ to 96.00%⁽⁵⁶⁾. In general, prevalence was higher in females than males, except in four studies^(23,26,32,52).

The combined OR of household food insecurity by gender of the respondent (women *v.* men) across the forty-two studies was 1.40 (95% CI 1.27, 1.54) with the random-effect model (Fig. 2). Heterogeneity was statistically significant ($Q=399.56$; $P<0.001$). Similarly, sensitivity analyses excluding fifteen studies with high risk of bias showed an OR of food insecurity by gender of 1.46 (95% CI 1.32, 1.63).

Subgroup analysis

In general, the heterogeneity among studies was not reduced using subgroup analysis (Table 5). Subgroup analysis supported the claim that female gender is associated with household food insecurity when gender analysis is based on the sex of the head of household but

not when gender analysis is based only on the sex of the respondent. In this sense, our research demonstrates that female-headed households were 75% more likely to be food insecure than male-headed households. In addition, important gender differences were observed between the continents.

Risk of bias assessment

The quality assessment of the included studies is shown in Fig. 3. Most of the studies had low risk of bias in terms of the definition of target population as well as in terms of use of a probabilistic sample. More than half of the works used validated questionnaires. About half of the authors did not report training of interviewers. The majority of the studies were classified as being at 'risk' or having 'unclear risk' in the response rate domain.

Publication bias

According to both Begg's and Egger's tests, no publication bias was detected. These results were confirmed by funnel plot symmetry.

Discussion

The present meta-analysis assessed the gender difference in the prevalence of household food insecurity. In general, our results showed that the gender of the respondent is a

Table 3 Summary of study characteristics and methodological approaches (*n* 42)

Study	City(s)/state(s) Country(s)	Study type	Year of data collection	Total sample size	Gender	Measurement tool	Dichotomization
Álvares (2013) ⁽⁶⁰⁾	Portugal	Cross-sectional of secondary data	2005–2006	3630	Head of household	Six-Item Short Form HFSSM	FS: food secure FI: low and very low FS††
Anschau <i>et al.</i> (2012) ⁽⁴³⁾	Toledo/Paraná Brazil	Cross-sectional	2006–2007	421	Head of household	EBIA	FS: food secure FI: mild, moderate and severe FI
van den Berg and Raubenheimer (2015) ^{(63)*}	Free State South Africa	Cross-sectional	2013	1382	Respondent	Adult HFSSM (ten-item scale)	FS: food secure FI: food insecure with and without hunger
de Souza Bittencourt <i>et al.</i> (2013) ⁽³⁹⁾	Salvador/Bahia Brazil	Cross-sectional	2007	100	Head of household	EBIA	FS: food secure FI: mild, moderate and severe FI
Cabral <i>et al.</i> (2013) ⁽⁴⁰⁾	Maceió/Alagoas Brazil	Cross-sectional	2011	204	Respondent	EBIA	FS: food secure FI: mild, moderate and severe FI
Pia Chapparro <i>et al.</i> (2009) ⁽²³⁾	Honolulu/Hawai'i USA	Cross-sectional	2006	408	Respondent	Adult HFSSM (ten-item scale)	FS: high and marginal FS FI: low and very low FS††
Dean and Sharkey (2011) ^{(24)*}	Brazos Valley/Texas USA	Cross-sectional analysis of secondary data	2006	1803	Respondent	Isolated question†	FS: negative answer FI: positive answer††
Dos Santos <i>et al.</i> (2010) ⁽⁴⁴⁾	Pelotas/Rio Grande do Sul Brazil	Cross-sectional population-based	2007–2008	1018	Head of household	Six-Item Short Form HFSSM	FS: food secure FI: food insecure with and without hunger††
Endale <i>et al.</i> (2014) ^{(62)*}	Farta District Ethiopia	Cross-sectional community-based	2012	836	Head of household	HFIAS	FS: food secure FI: mildly, moderately and severely FI††
Facchini <i>et al.</i> (2014) ⁽⁴¹⁾	Northeastern/Southern Brazil	Cross-sectional community-based	2010	10 074	Head of household	EBIA	FS: food secure FI: mild, moderate and severe FI
Falcão <i>et al.</i> (2015) ⁽⁵³⁾	Rio de Janeiro Brazil	Cross-sectional	2011	270	Respondent	EBIA	FS: food secure FI: mild, moderate and severe FI††
Ferreira <i>et al.</i> (2014) ⁽⁴²⁾	North of Alagoas Brazil	Cross-sectional	2010	1444	Head of household	EBIA	FS: food secure and mild FI FI: moderate and severe FI††
Ford and Berrang-Ford (2009) ^{(25)*}	Igloolik/Nunavut Canada	Cross-sectional community-based	2007	50	Respondent	Adapted Adult HFSSM (eight-item scale)	FS: high and marginal FS FI: low and very low FS††
Gao <i>et al.</i> (2009) ^{(26)*}	Boston/Massachusetts USA	Cross-sectional	NI	1358	Respondent	Adult HFSSM (ten-item scale)	FS: high and marginal FS FI: low and very low FS††
Godoy <i>et al.</i> (2014) ⁽⁴⁵⁾	Brazil	Cross-sectional	2010–2011	1637	Respondent	EBIA	FS: food secure FI: mild, moderate and severe FI††
Goldhar <i>et al.</i> (2010) ^{(28)*}	Qeqertarsuaq Greenland	Cross-sectional	2008	60	Respondent	Adapted Adult HFSSM (eight-item scale)	FS: high and marginal FS FI: low and very low FS††
Gowda <i>et al.</i> (2012) ⁽²⁷⁾	USA	Cross-sectional analysis of secondary data	1999–2006	12 191	Respondent	HFSSM	FS: fully FS and marginally FI FI: highly food insecure (low and very low FS)††

Table 3 Continued

Study	City(s)/state(s) Country(s)	Study type	Year of data collection	Total sample size	Gender	Measurement tool	Dichotomization
Guerrero <i>et al.</i> (2014) ^{(29)*}	Wisconsin USA	Cross-sectional analysis of secondary data	2008–2012	2552	Respondent	Isolated question†	FS: negative answer FI: affirmative answer
Gulliford <i>et al.</i> (2003) ⁽³⁶⁾	Trinidad and Tobago	Cross-sectional	NI	525	Head of household	Six-Item Short Form HFSSM	FS: high and marginal FS FI: low and very low FS††
Guo <i>et al.</i> (2015) ⁽³⁸⁾	Iqaluit/Nunavut Canada	Cross-sectional	2013	254	Respondent	HFSSM	FS: high and marginal FS FI: low and very low FS††
Hackett <i>et al.</i> (2010) ⁽⁴⁶⁾	Antioquia Colombia	Cross-sectional	2006	2783	Head of household	CHFSS	FS: food secure FI: mild, moderate and severe FI
Kim <i>et al.</i> (2011) ⁽⁵⁵⁾	Republic of Korea	Cross-sectional analysis of secondary data	2008	6238	Head of household	Six-Item Short Form HFSSM	FS: high and marginal FS FI: low and very low FS††
Gustavo and Alejandro (2008) ⁽⁴⁷⁾	Capurganá y Sapzurro Acandí Darién Caribe Colombiano	Cross-sectional	NI	126	Head of household	CHFSS	FS: food secure FI: mild, moderate and severe FI
Leung <i>et al.</i> (2012) ^{(30)*}	California USA	Cross-sectional analysis of a large population-based health survey	2003, 2005, 2007 and 2009	35 747	Respondent	Six-Item Short Form HFSSM	FS: high and marginal FS FI: low and very low FS††
Mallick and Rafi (2010) ⁽¹⁾	Bengali and four indigenous ethnic groups living in the Chittagong Hill Tracts Bangladesh	Cross-sectional	1999	2530	Head of household	NI§	FS: breakeven and food surplus FI: chronic and transition FI††
Marin-Leon <i>et al.</i> (2011) ⁽⁴⁸⁾	Brazil	Cross-sectional analysis of secondary data	2004	51 356	Head of household	EBIA	FS: food secure and mild FI FI: moderate and severe FI††
Martin and Lippert (2012) ^{(18)*}	USA	Cross-sectional	2003	7931	Head of household	HFSSM	FS: high and marginal FS FI: low and very low FS††
Martin-Fernandez <i>et al.</i> (2013) ⁽⁵⁸⁾	Paris France	Cross-sectional analysis of cohort	2010	3005	Head of household	Adapted HFSSM (thirteen-item scale)¶	FS: food secure FI: low and very low FS††
Matheson and McIntyre (2014) ^{(35)*}	Canada	Cross-sectional	2005/2008	65 190	Respondent	HFSSM	FS: high and marginal FS FI: low and very low FS††
Mayer <i>et al.</i> (2014) ⁽³⁷⁾	Pennsylvania USA	Cross-sectional analysis of secondary data	2008/2010/2012	11 599	Respondent	Isolated question	FS: negative answer FI: affirmative answer
Mullany <i>et al.</i> (2013) ^{(34)*}	Southwestern reservation communities, Arizona and New Mexico USA	Cross-sectional	2010	425	Respondent	Adapted Adult HFSSM (five-item scale)	FS: food secure FI: food insecure (at least four affirmative answers)††
Neter <i>et al.</i> (2014) ^{(59)*}	Netherlands	Cross-sectional	2010–2011	251	Respondent	Six-Item Short Form HFSSM	FS: food secure FI: low and very low FS††
Omidvar <i>et al.</i> (2013) ^{(56)*}	Tehran and Mashhad Iran	Cross-sectional	2010	310	Head of household	HFIAS	FS: food secure FI: mild, moderate and severe FI
Omuemu <i>et al.</i> (2012) ⁽⁶¹⁾	Egor Edo State Nigeria	Cross-sectional	NI	416	Head of household	HFIAS	FS: food secure FI: mild, moderate and severe FI††
Panigassi <i>et al.</i> (2008) ⁽⁴⁹⁾	Campinas/São Paulo Brazil	Cross-sectional	2003	456	Head of household	EBIA	FS: food secure FI: moderate and severe FI††

Table 3 Continued

Study	City(s)/state(s) Country(s)	Study type	Year of data collection	Total sample size	Gender	Measurement tool	Dichotomization
Pattón-Lopez <i>et al.</i> (2014) ^{(33)*}	Oregon USA	Cross-sectional web-based	2011	354	Respondent	Six-Item Short Form HFSSM	FS: food secure FI: food insecure with (moderate and severe) and without hunger††
Maria do Rosário Gondim <i>et al.</i> (2014) ⁽⁵⁰⁾	Itumbiara/Goiás Brazil	Cross-sectional	2011–2012	356	Respondent	EBIA	FS: food secure FI: mild, moderate and severe FI††
Robaina and Martin (2013) ⁽³²⁾	Hartford/Connecticut USA	Cross-sectional	2010–2011	212	Respondent	HFSSM	FS: high and marginal FS FI: low and very low FS††
Santos (2012) ⁽⁵¹⁾	Vale do Jiquiriçá/Bahia Brazil	Cross-sectional population- based	2011	774	Head of household	EBIA	FS: food secure FI: mild, moderate and severe FI††
Sobrinho <i>et al.</i> (2014) ⁽⁵²⁾	Belo Horizonte/Minas Gerais Brazil	Cross-sectional	2009–2010	1657	Respondent	EBIA	FS: food secure FI: mild, moderate and severe FI††
Vahabi <i>et al.</i> (2011) ^{(31)*}	Toronto Canada	Cross-sectional	2008	70	Primary household caregiver	CCHS**	FS: food secure FI: moderate and severe FI††
Vuong <i>et al.</i> (2015) ⁽⁵⁷⁾	Ho Chi Minh City Vietnam	Cross-sectional	NI	250	Respondent	Fifteen-item ELCSA	FS: food secure FI: mild, moderate and severe FI††

NI, no information; HFSSM, Household Food Security Survey Module; EBIA, Brazilian Food Insecurity Scale; HFIAS, Household Food Insecurity Access Scale; CHFSS, Colombia Household Food Security Survey; CCHS, Canadian Community Health Survey; ELCSA, Latin American and Caribbean Household Food Security Scale; FS, food secure/security; FI, food insecure/insecurity.

*Studies that presented four or more items classified as unclear or/and high risk of bias.

†'The food that we bought didn't last and we didn't have enough money to buy more?'

‡'In the last 12 months, have you been concerned about having enough food for you or your family?'

§Used the perception of participants on food production, availability, purchasing power and access to common resources, but did not describe how.

||Study excluded the child-referenced questions.

¶'In the past 12 months, since (date one year ago) did you or other adults in your household ever cut the size of your meals or skip meals because there was not enough money in the budget for food?'

**Spanish and Portuguese Version.

††Dichotomization as reported by the study. Others studies had their data dichotomized by the author of the present review.

Table 4 Prevalence of household food insecurity and food insecurity according to female and male respondents (*n* 37)

Study	Total (<i>n</i>)	Male (<i>n</i>)	Female (<i>n</i>)	Total prevalence		Male respondent prevalence		Female respondent prevalence	
				%	95% CI	%	95% CI	%	95% CI
Álvares (2013) ⁽⁶⁰⁾	3630	2162	1468	16.69	15.52, 17.94	12.58	11.25, 14.05	22.75	20.68, 24.97
Anschau <i>et al.</i> (2012) ⁽⁴³⁾	421	316	105	74.58	70.22, 78.51	73.42	68.29, 77.99	78.10	69.27, 84.94
van den Berg and Raubenheimer (2015) ⁽⁶³⁾	1328	864	518	85.46	83.50, 87.22	87.38	85.00, 89.43	82.24	78.71, 85.29
Bittencourt <i>et al.</i> (2013) ⁽³⁹⁾	1100	580	520	71.27	68.53, 73.87	64.14	60.15, 67.94	79.23	75.54, 82.50
Cabral <i>et al.</i> (2013) ⁽⁴⁰⁾	204	18	186	91.18	86.48, 94.35	83.33	60.78, 94.16	91.94	87.12, 95.05
Pia Chaparro <i>et al.</i> (2009) ⁽²³⁾	408	177	231	21.08	17.40, 25.30	24.86	19.07, 31.71	18.18	13.74, 23.66
Dos Santos <i>et al.</i> (2010) ^{(44)*}	1018	538	480	11.98	10.13, 14.12	8.74	6.63, 11.42	15.63	12.65, 19.14
Endale <i>et al.</i> (2014) ⁽⁶²⁾	836	721	115	70.69	67.52, 73.68	67.27	63.76, 70.59	92.17	85.79, 95.83
Facchini <i>et al.</i> (2014) ^{(41)†}	10 074	7199	2975	40.98	40.02, 41.94	37.07	35.97, 38.20	49.04	47.25, 50.84
Falcão <i>et al.</i> (2015) ⁽⁵³⁾	270	157	113	53.70	47.75, 59.59	52.23	44.46, 59.90	55.75	46.56, 64.57
Ferreira <i>et al.</i> (2014) ⁽⁴²⁾	1444	1046	398	37.47	35.01, 39.99	35.66	32.81, 38.61	42.21	37.46, 47.12
Ford and Berrang-Ford (2009) ⁽²⁵⁾	50	30	20	64.00	50.14, 75.86	53.33	36.14, 69.77	80.00	58.40, 91.93
Gao <i>et al.</i> (2009) ⁽²⁶⁾	1358	402	956	12.08	10.45, 13.92	14.18	11.11, 17.93	11.19	9.35, 13.35
Godoy <i>et al.</i> (2014) ⁽⁴⁵⁾	1637	968	669	40.62	38.27, 43.02	38.64	35.62, 41.74	43.50	39.79, 47.28
Goldhar <i>et al.</i> (2010) ⁽²⁸⁾	61	28	33	8.20	3.55, 17.79	7.14	1.98, 22.65	9.09	3.14, 23.57
Guerrero <i>et al.</i> (2014) ⁽²⁹⁾	2552	1268	1284	11.99	10.79, 13.31	10.41	8.85, 12.21	13.55	11.79, 15.53
Gulliford <i>et al.</i> (2003) ⁽³⁶⁾	525	392	133	24.95	21.44, 28.83	22.45	18.60, 26.84	32.33	24.97, 40.68
Guo <i>et al.</i> (2015) ⁽³⁸⁾	254	89	165	45.67	39.65, 51.81	46.07	36.09, 56.37	45.45	38.05, 53.07
Hackett <i>et al.</i> (2010) ⁽⁴⁶⁾	2784	2258	525	51.80	49.94, 53.65	49.11	47.06, 51.18	63.43	59.23, 67.44
Kim <i>et al.</i> (2011) ⁽⁵⁵⁾	6238	5071	1167	5.31	4.78, 5.89	3.87	3.37, 4.43	11.57	9.86, 13.53
Gustavo and Alejandro (2008) ⁽⁴⁷⁾	126	71	55	54.76	46.06, 63.18	50.70	39.34, 61.99	60.00	46.81, 71.88
Leung <i>et al.</i> (2012) ⁽³⁰⁾	35 747	13 643	22 104	37.62	37.12, 38.13	36.20	35.40, 37.01	38.50	37.86, 39.14
Mallick and Rafi (2010) ⁽¹⁾	2530	2383	147	71.86	70.07, 73.58	71.17	69.32, 72.95	82.99	76.10, 88.21
Marin-Leon <i>et al.</i> (2011) ⁽⁴⁸⁾	51 356	38 158	13 198	31.36	30.96, 31.76	29.10	28.65, 29.56	37.90	37.08, 38.73
Martin and Lippert (2012) ^{(18)‡}	7931	3594	4337	4.83	4.38, 5.32	3.90	3.31, 4.58	5.60	4.96, 6.33
Martin Fernandez <i>et al.</i> (2013) ⁽⁵⁸⁾	3005	2286	719	6.30	4.99, 7.97	5.73	4.26, 7.70	8.07	6.23, 10.56
Matheson and McIntyre (2014) ^{(35)§}	65 190	31 126	34 064	6.41	6.22, 6.60	5.02	4.78, 5.27	7.67	7.40, 7.96
Mayer <i>et al.</i> (2011) ⁽³⁷⁾	11 599	5138	6461	16.76	16.09, 17.45	15.20	14.24, 16.21	18.00	17.08, 18.96
Neter <i>et al.</i> (2014) ⁽⁵⁹⁾	251	93	158	72.91	67.10, 78.03	63.44	53.30, 72.51	78.48	71.44, 84.17
Omidvar <i>et al.</i> (2013) ⁽⁵⁶⁾	310	285	25	77.10	72.10, 81.43	75.44	70.12, 80.08	96.00	80.46, 99.29
Omumu <i>et al.</i> (2012) ⁽⁶¹⁾	416	364	52	61.78	57.02, 66.32	59.89	54.78, 64.80	75.00	61.79, 84.77
Maria do Rosário Gondim <i>et al.</i> (2014) ⁽⁵⁰⁾	356	52	304	51.40	46.10, 56.70	50.00	35.80, 64.10	51.60	45.80, 57.30
Robaina and Martin (2013) ⁽³²⁾	212	87	125	83.96	78.43, 88.29	86.21	77.42, 91.93	82.40	74.79, 88.08
Santos (2012) ⁽⁵¹⁾	774	188	586	79.59	76.60, 82.28	79.26	72.90, 84.44	79.69	76.25, 82.75
Sobrinho <i>et al.</i> (2014) ⁽⁵²⁾	1657	480	1117	27.64	25.54, 29.84	33.33	29.26, 37.67	26.68	24.17, 29.35
Vahabi <i>et al.</i> (2011) ⁽³¹⁾	70	13	57	55.71	44.08, 66.75	53.85	29.14, 7679	56.14	43.28, 68.23
Vuong <i>et al.</i> (2015) ⁽⁵⁷⁾	250	28	222	34.40	28.79, 40.48	21.43	10.21, 39.54	36.04	30.01, 42.54

*The analysis of 'both' being the household head was not used.

†Data from the South and Northeast region have been grouped.

‡The prevalence for the year 2003 was considered.

§Data from married and non-married have been grouped.

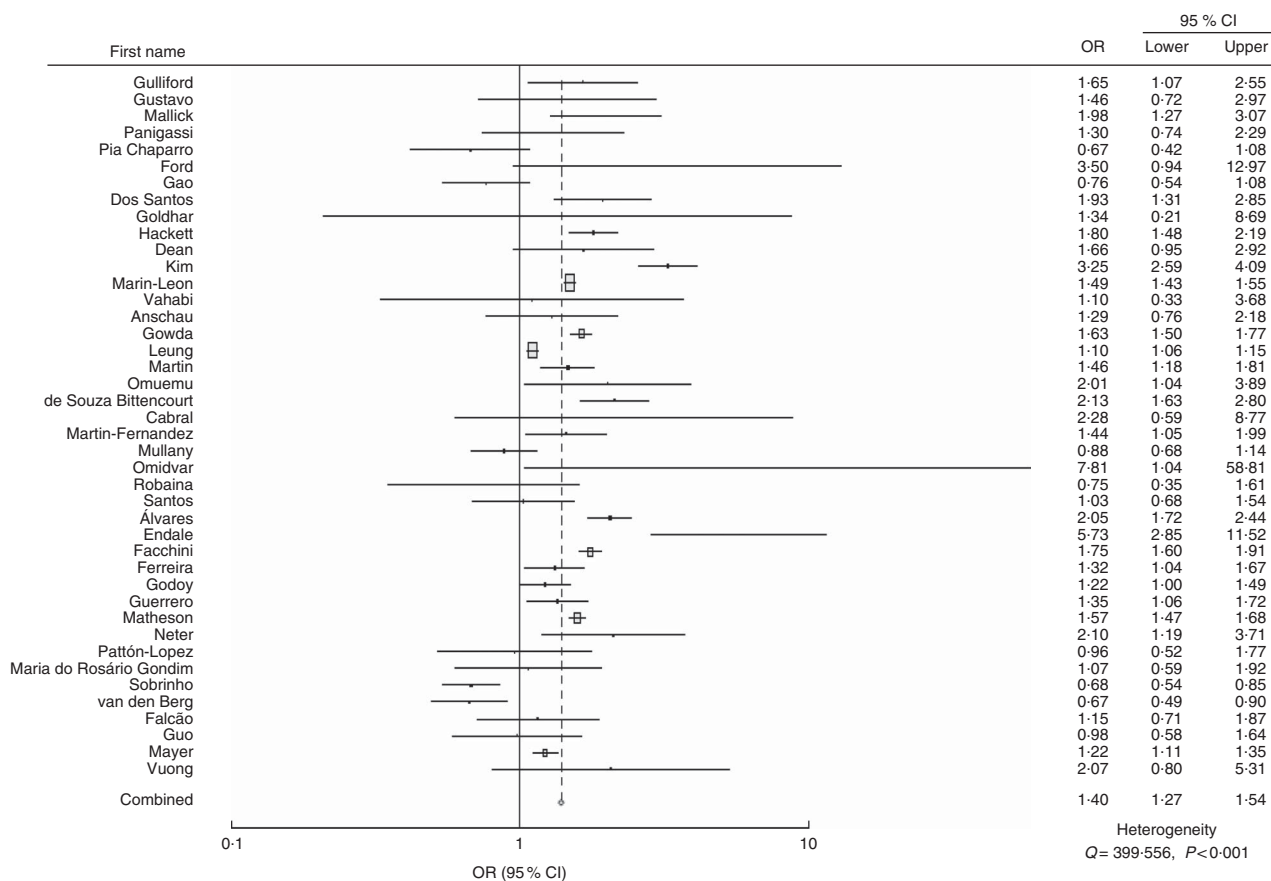


Fig. 2 Forest plot of the odds ratio of food insecurity prevalence in women v. men from forty-two studies. The study-specific OR and 95 % CI are represented by the grey square and horizontal line, respectively; the area of the grey square is proportional to the specific-study weight to the overall meta-analysis. The circle and dashed line represent the pooled OR

significant predictor of food insecurity. However, subgroup analysis demonstrated that food insecurity was higher when the female respondent was the head of household but not when women were only respondents without considering if they were the head of household or not. This finding is consistent with the worldwide phenomenon of female-headed households. For example, the results of American household food security showed that the prevalence of food insecurity in households headed by women was higher than the national average⁽⁶⁵⁾.

It has been argued that this gender difference may be related to economic and cultural factors. As for economic factors, women tend not to receive the same employment opportunities as men, a situation that imposes some restrictions. Women often have jobs with lower pay either because they face discrimination in the labour market or because the obligations of housework and childcare force them to choose jobs that are suited to their responsibilities^(15,66). For example, a population-based study among families living in the Northeast and South of Brazil found lower earning power in female-headed households. The authors reported that the average income per capita in households headed by women was about 30 % lower than in those headed by men. Since males earn more than

females, a household lacking male-earned income has a higher probability of being poor⁽⁴¹⁾. In addition, in some societies, sociocultural factors can prohibit women's participation in the labor force. In some of the poorest areas of South Asia, cultural restrictions on women's ability to participate fully in food production activities have left them particularly vulnerable in times of economic crisis⁽¹⁾.

The association between female gender and food insecurity has been addressed in debates about poverty and gender. Women constitute 70 % of the world's poor⁽¹⁴⁾, a phenomenon known as the feminization of poverty^(16,39). Some reasons for this are attributed to the lower income earned by women compared with men in the workplace^(16,39,67). The factors that could explain this income gap include: (i) fewer hours worked by women; and (ii) the tendency for women to work in occupations that pay lower salaries or in lower positions within other occupations⁽⁶⁷⁾. Thus, gender equality remains an elusive goal in many countries and a transformation of traditional gender roles is urgently needed. Such a transformation can be enhanced with improved information about the range of inequalities and specific constraints facing women in the field of food security⁽¹⁵⁾.

Table 5 Odds ratio of household food insecurity in women v. men respondents according to subgroups

Variable	Number of studies	Size of the sample	OR*	95 % CI	P value	Heterogeneity P value
Response rate (%)						
≥90	17	40 447	1.58	1.31, 1.90	<0.001	<0.001
80–89	5	4904	1.30	0.86, 1.97	0.216	0.008
70–79	2	4808	1.49	1.13, 1.97	0.005	0.673
50–69	5	1609	1.19	0.94, 1.51	0.184	0.291
≤49	4	13 743	0.87	0.58, 1.29	0.486	<0.001
Unclear	9	167 742	1.43	1.21, 1.69	<0.001	<0.001
Measurement tool						
EBIA	12	69 749	1.31	1.12, 1.53	0.001	<0.001
Original HFSSM/USDA	5	85 778	1.58	1.50, 1.65	<0.001	0.090
Adapted/Short Form HFSSM/USDA	14	54 451	1.33	1.02, 1.73	0.032	<0.001
Isolated questions or unclear	4	18 484	1.27	1.17, 1.40	<0.001	0.138
CHFSS	3	2979	1.75	1.45, 2.11	<0.001	0.639
HFIAS	3	1562	3.46	2.17, 5.51	<0.001	0.073
ELSCA	1	250	2.06	0.80, 5.30	<0.001	–
Probabilistic sample						
Yes	31	186 307	1.51	1.37, 1.66	<0.001	0.04
No	9	3268	1.02	0.78, 1.33	0.873	0.020
Unclear	2	43 678	1.25	0.95, 1.64	0.117	0.011
Gender						
Head of household†	20	95 043	1.75	1.55, 1.98	<0.001	<0.001
Respondent	22	138 210	1.12	0.98, 1.29	0.084	<0.001
Human Development Index						
High	20	149 873	1.31	1.15, 1.49	0.001	<0.001
Medium	21	82 544	1.45	1.24, 1.69	<0.001	<0.001
Low	1	836	5.73	2.85, 11.52	<0.001	–
Continent						
Africa	3	2634	1.92	0.52, 7.13	0.330	<0.001
Europe	2	3881	2.05	1.73, 2.43	<0.001	0.93
Asia	4	9328	2.91	2.39, 3.54	<0.001	0.150
Oceania	1	3005	1.44	1.05, 1.99	0.025	–
South America	15	73 676	1.39	1.21, 1.59	<0.001	<0.001
Central America	1	525	1.65	1.07, 2.55	0.024	–
North America	16	130 204	1.19	1.03, 1.37	0.016	<0.001

EBIA, Brazilian Food Insecurity Scale; HFSSM, Household Food Security Survey Module; USDA, US Department of Agriculture; CHFSS, Colombia Household Food Security Survey; HFIAS, Household Food Insecurity Access Scale; ELCSA, Latin American and Caribbean Household Food Security Scale.

*Fixed-effects models were used when the heterogeneity test was statistically non-significant ($P \geq 0.05$) and random-effects models when the test was statistically significant.

†The comparison group to female-headed household was male-headed household.

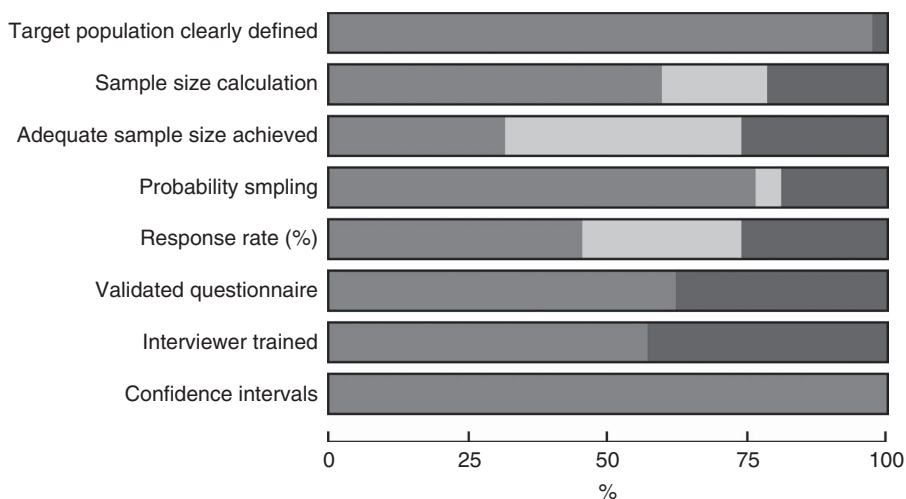


Fig. 3 Summary of quality assessment of studies included in the review (n 42), according to the risk of bias (■, low risk; □, unclear risk; ▨, high risk) in each domain assessed by the instrument proposed by Boyle⁽¹³⁾

From the point of view of cultural issues, it may be assumed that men and women perceive and react to situations differently given their roles in society. The fact

that women exhibit greater sensitivity to household needs than men is supported by the observation that women exhibit greater concern than men for the well-being of

others⁽³⁵⁾. Since females are responsible for a large part of the tasks connected with food, they would likely be more attuned to food security problems of their family^(6,14,16,20). Women could be considered as the forefront of households to remove poverty and hunger⁽⁶⁵⁾. For example, mothers are often the first to cut or skip meals when food access is constrained to ensure that other family members, particularly children, have access to sufficient food^(16,20,25,65).

Despite the fact that women contribute to one-half of the world's food production, in terms of lack of access to productive factors, such as land, credit, inputs, storage and technology, women also face many inequities and constraints, often embedded in norms and practices and encoded in legal provisions^(14,15,62). Besides that, in many developing countries, most resources, including land, are owned by males. Social and cultural norms and gender roles that are imposed must be challenged so that a greater role for women in decision making at all levels can be attained. Women's empowerment, besides being a priority goal in itself, is an intrinsic human right⁽¹⁵⁾.

To the best of our knowledge, the present article is the first to investigate gender differences in the prevalence of household food insecurity through a systematic review and meta-analysis. The study's generalizability is strengthened by a large number of included studies from various countries. However, the absence of representative studies from Asia and Africa can be considered an important limitation. We believe this is due to the fact that most of the studies on food insecurity conducted in these continents were with sick populations, which was an exclusion criterion of our study. This skewed distribution of studies might have biased the gender differences in the reporting of food insecurity. A further limitation of our review was the substantial heterogeneity that could not be totally explained by subgroup analysis. Food insecurity was assessed and defined differently across studies, which can be explained by the fact that food insecurity is a multi-dimensional concept⁽¹⁰⁾. Different measurement tools have different strengths and weaknesses and can often result in estimations or interpretations that differ significantly⁽¹⁴⁾. A more in-depth understanding of the concept of food insecurity and its measurement would require further studies, potentially using qualitative approaches.

Conclusion

In conclusion, our results confirm the existence of gender differences in reporting household food insecurity. Furthermore, they indicate that households headed by women constitute a segment of the population that is particularly vulnerable to food insecurity. Given the magnitude of the burden of food insecurity, this information is an important element to be incorporated into policies to promote food security and gender equity.

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