

Methodologies for assessing the household food availability in the context of food (in)security: a systematic review

Metodologias de avaliação da disponibilidade de alimentos no domicílio no contexto da (in)segurança alimentar: uma revisão sistemática

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Abstract *This article aims to identify the methods used to assess household food availability in studies on food and nutritional security and to discuss its methodological aspects. Systematic review elaborated according to the PRISMA method. We searched at PubMed; Scielo and Lilacs databases, and studies that used methods of assessing the availability of food at home were included. In the end, 19 papers composed the review. Food availability was predominantly assessed for a seven days period and from a single data measurement. Other variables were also observed in the studies, such as socio-demographic data and expenditure on food. Among the limitations to assess the food availability at home, we can highlight the difficulty in measuring the food distribution among family members and the lack of information on the variability of this availability. Such assessment can be improved by investigating the strengths and weaknesses of the instruments for greater detail and accuracy of the information. We recommend the development and validation of specific instruments capable of effectively measure the food availability at the household level.*

Key words *Food and nutritional security, Systematic review, Food and beverages*

Resumo *O objetivo deste artigo é identificar métodos empregados para a avaliação da disponibilidade de alimentos no âmbito domiciliar em estudos sobre segurança alimentar e nutricional e discutir seus aspectos metodológicos. Revisão sistemática elaborada segundo o método PRISMA. Realizou-se busca nas bases de dados PubMed, SciELO e Lilacs, tendo sido incluídos estudos que empregaram métodos de avaliação da disponibilidade de alimentos no domicílio. Ao final, 19 artigos compuseram a revisão. A disponibilidade de alimentos foi avaliada predominantemente para um período de sete dias e a partir de única medição dos dados. Outras variáveis também foram observadas nos estudos, como dados sociodemográficos e de despesas com os alimentos. Dentre as limitações para a avaliação da disponibilidade domiciliar de alimentos, destaca-se a dificuldade de mensuração da distribuição de alimentos entre os membros da família e a falta de informação sobre a variabilidade desta disponibilidade. Tal avaliação pode ser melhorada através da investigação de pontos fortes e fracos dos instrumentos para maior detalhamento e precisão das informações. Recomenda-se o desenvolvimento e a validação de instrumentos específicos capazes de mensurar efetivamente a disponibilidade de alimentos em nível domiciliar.*

Palavras-chave *Segurança alimentar e nutricional, Revisão sistemática, Alimentos e bebidas*

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Introduction

According to the Food and Agriculture Organization of the United Nations (FAO) recommendations, regular access to sufficient, safe and nutritious food information is required to ensure food security, in order to meet individual nutritional preferences and needs for a healthy and active life¹.

Therefore, food insecurity occurs when there is limited or uncertain availability and/or ability to have nutritionally adequate and safe food². Availability and access to healthy food are required for promoting individual health and nutrition³, and are achieved when enough food is available to all individuals, whether from the production for self-consumption, shopping or donations⁴. However, food may be available, but not accessible to the population, due to socioeconomic limitations or other factors such as food monopoly, leading to Food and Nutritional Insecurity⁵.

The household environment has a great implication on the food intake⁶, such that the food found in the pantries are indicators of the family's actual food consumption⁷. Different methods for measuring household food availability have been developed and applied in the last years, but frequency of observations, types of food and data collection procedures vary from one method to another⁸, and the data availability can be collected from direct observation at home, considered the "gold standard", or through self-reporting, according to instruments proposed for this purpose, by telephone or mail⁹.

Nonetheless, only with adequate measurement tools will it be possible to better understand the causes of food insecurity, identify the most vulnerable populations, determine effective mechanisms to solve the problem and assess the impact of possible interventions².

Therefore, assessing the food availability at household is essential to assess food insecurity¹⁰. For that reason, this literature review proposes to identify, the methods used to assess the household food availability in studies on food and nutritional security and to discuss its methodological aspects.

Methods

It is a systematic review of the literature, arranged according to the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRIS-

MA) Guide¹¹ based on food safety studies that used methods of assessing the food availability at home. The PICO strategy (Problem, Intervention, Comparison, Outcomes) was employed for the construction of the guiding question of the research which was: "What are the methods employed for the assessment of the availability of household foods in studies in the context of food and nutritional security?" The literature review was done independently, in September 2018, from the selection of studies published in PubMed; SciELO and Lilacs databases, using the same search criteria for all bases. The following combinations were used to search the articles: "food availability" OR "food available" AND "food security" and "food availability" OR "food available" AND "food insecurity", including articles published in English and Spanish, without limitation regarding the period of publication, in order to contemplate the scientific production until the moment of the research. For the manuscripts that did not provide sufficient information from their title and abstract, we proceeded to full reading, where we extracted information about the population and the type of study, the methods and limitations. Subsequently, we searched the gray literature, employing the same terms described, in databases that index this type of literature (<http://www.dominiopublico.gov.br> and <http://www.periodicos.capes.gov.br>). The references of the eligible studies were analyzed to find other publications of interest.

The quality of the studies was not analyzed, since the review does not intend to assess the results, and only, identifies the methods proposed by them. The original articles, as well as dissertations and theses that used methods of assessing the availability of food at home were included in the review. Review studies, experimental studies with animals or plants, and studies assessing the availability of food outside home were excluded.

In order to verify the methods of assessing the availability of food at home, we elaborated an instrument that could synthesize the main data extracted from each study in a descriptive way (Chart 1), containing the following components: author, year and local of publication, study design, sample size, method and period of assessing food availability.

Results

The Figure 1 shows the flowchart of the studies selection to compose the research. The search re-

Chart 1. Summary of the methodological aspects of the studies that assessed food availability at the household level (n = 19).

Author/year	Local	Study design	Sample size	Method of assessing food availability	Time of assessing the availability
Dutra, et al. 2018	Brazil	cross-sectional study	79 households	Questionnaire applied by the interviewer containing a food list used to estimate the household food availability, recording the quantity and the origin of this acquisition.	Thirty days
Bruening et al. 2017	United States	cross-sectional study	54 households	Inventory applied by the interviewer to estimate the household food availability (yes/no). 29 items divided into 10 subgroups.	At the time of the interview
Nunnery; Labban; Dharod 2017	United States	cross-sectional study	198 individuals	Inventory applied by the interviewer to estimate the household availability of fruits and vegetables (yes/no). 44 items divided into subgroups: fresh, dried, canned or frozen products.	Seven days
Peter, 2016	Brazil	cross-sectional study	1126 households	Self-administered questionnaire answered by parents/guardians to assess the food availability (never; almost never; sometimes; almost always; always), recording the origin and form of acquisition. 14 food items divided into 4 subgroups.	Thirty days
Emery, et al. 2015	United States	cross-sectional study	100 individuals	Inventory applied by the interviewer to estimate the availability of household stored food.	At the time of the interview
Dutra, et al. 2014	Brazil	cross-sectional study	10 households	Questionnaire applied by the interviewer containing a food list used to estimate the household food availability, recording the quantity and the origin of this acquisition.	Thirty days
Soares, et al. 2014	Brazil	cross-sectional study	1555 households	Self-administered questionnaire answered by the head of the family to assess the food availability, (never; occasionally; sometimes; usually; always) and origin of the acquisition of fruits and vegetables. 8 food items	Thirty days
Valencia-Valero; Ortiz-Hernández. 2014	Mexico	descriptive (database analysis)	27445 households	Daily record of expenditure information on food and beverages purchased; food and beverages obtained as work payment or donation. The person responsible for the purchase registered the name and quantity of each food or beverage.	Seven days
Wilson, et al. 2014	New Zealand	prospective longitudinal study	216 individuals	Self-administered questionnaire answered by the participant to assess the household food availability. 351 food items divided into 13 subgroups.	At the time of the interview
Martins, 2013	Brazil	quasi-experiment study (database analysis)	11326 households	Self-administered questionnaire answered by the household residents, and when necessary, by the interviewer, to assess the availability, quantity, origin and expenditure of food and beverages.	Seven days

it continues

Chart 1. Summary of the methodological aspects of the studies that assessed food availability at the household level (n = 19).

Author/year	Local	Study design	Sample size	Method of assessing food availability	Time of assessing the availability
Levy, et al. 2012	Brazil	descriptive (database analysis)	55970 households	Self-administered questionnaire answered by the household residents, and when necessary, by the interviewer, to assess the availability, quantity, origin and expenditure of food and beverages. 334 items, divided into 15 subgroups.	Seven days
Bauer, et al. 2012	United States	randomized controlled trial	432 households	Inventory applied by the interviewer to estimate the household availability of fruits, vegetables, beverages, snacks and food with high energy density (yes/no).	Seven days
Sharkey, et al. 2010	United States	cross-sectional study (pilot)	06 households	05 Inventories applied by the interviewer to estimate the household availability and quantity of food and beverages. 252 items.	Thirty days
Sisk, et al. 2010	United States	cross-sectional study (pilot)	09 households	05 Inventories applied by the interviewer to estimate the household availability and quantity of food and beverages. 251 items	Thirty days
Baranowski, et al. 2008	United States	cross-sectional study	162 individuals	The availability of fruit, juice and vegetables was assessed. 35 items were identified as (yes or no).	Seven days
Hackett, et al. 2007	Ecuador	cross-sectional study	52 households	Inventory applied by the interviewer to estimate the household food availability. Divided into 11 subgroups.	At the time of the interview
Pérez-Cueto, et al. 2006	Bolivia	cross-sectional studies (database analysis)	19483 households	Frequency questionnaire applied by the interviewer recording quantity and expenses on purchases and own production of food and beverages. 60 items.	Four weeks
Lorenzana; Sanjur. 1999	Venezuela	cross-sectional study	238 households	Checklist applied by the interviewer to estimate the household food availability	Seven days
Kendall, et al. 1996	United States	cross-sectional study	193 individuals	02 Inventories applied by the interviewer to estimate the household availability and quantity of food. 51 items	At the time of the interview

sulted in 139 papers. The titles and abstracts of the papers were read to identify those that met the inclusion criteria to assess eligibility. In total, 129 papers were excluded, of which 30 were repeated papers, 11 were clinical studies, with food or animal, 21 were review or report papers, 40 took a broad approach to food security, but without assessing the availability or assess it outside the home.

After reading the full text manuscripts assessed for eligibility, we verified that 27 studies were conducted in households, but did not address the food availability. With this, there were

10 eligible papers. Subsequently, the research in the gray literature resulted in the inclusion of 02 documents. Ultimately, a reverse search was performed based on the references of the selected papers, and with that 07 studies were included. Thus, 19 studies met the established selection criteria and composed this review.

Of all eligible studies, one was conducted in Mexico¹², one in Venezuela¹³, one in Bolivia¹⁴, eight in the United States^{7,15-21}, six in Brazil²²⁻²⁷, one in Ecuador²⁸, and one in New Zealand²⁹. Twelve of them once applied the instrument to assess food availability^{13,14,17-20,22,23,26-29}, two

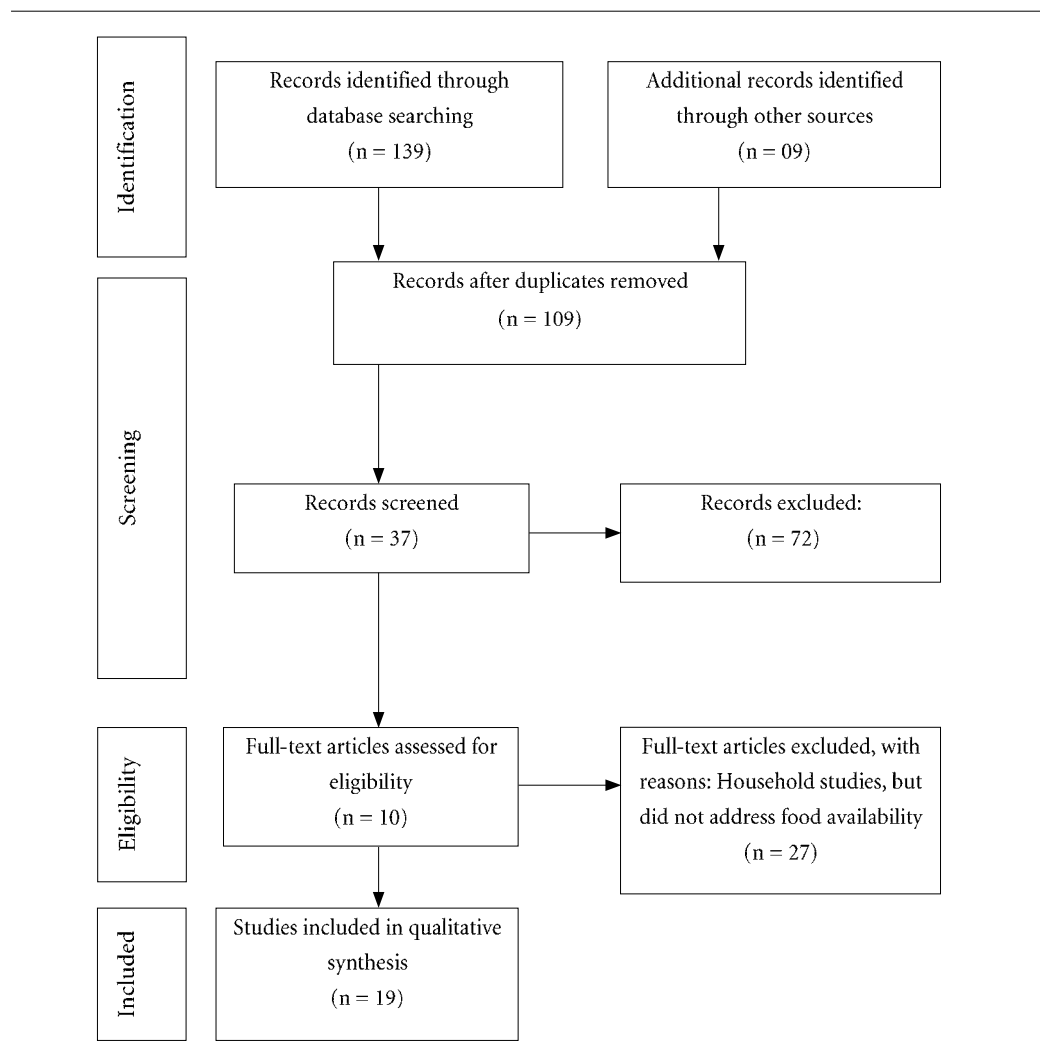


Figure 1. Flowchart of the search and selection of the papers for the systematic review.

studies performed 5 availability records for 30 days, with a 7-day interval^{15,16}, one study applied the instrument twice, with a 6-week interval⁷, one study applied the instrument twice, with a 3-week interval²¹ three studies used record to assess availability for 7 days^{12,24,25}. Food availability was predominantly assesses for a period of seven days^{7,12,13,17-20,24,25}.

The information obtained by the authors from the instruments used is summarized as: food and/or beverages availability at home^{13,15-18,20-23,26-29}, availability and expenses with food and/or beverages at home^{12,14,24,25}, fruits and vegetables availability at home^{7,19}.

Regarding the number of items assessed, five studies verified the availability of all food

stored at home^{12,13,17,18,24} and fourteen studies used instruments with a certain number of food and beverages, in eleven ranging from 14 to 351 items^{7,14-16,19-21,25-27,29}, and three studies did not present the number of items contained in the instrument^{22,23,28}. In thirteen studies the instruments were applied by the interviewer^{7,13-23,28}, and in six, the record was filled by the person responsible for buying food/beverages at home^{12,24-27,29}. Ten studies reported availability and quantity of food and/or beverages at home^{12,14-16,21,23-25,28}, others focused only on availability^{7,13,17-20,26,27,29}.

In addition to assessing food availability, other variables of interest were observed in the studies, which include sociodemographic data, such as information on the head of the fam-

ily/interviewee^{7,12-19,21,22,24,25,27-29}, family members^{12-18,20-24,26-28}, employment and/or family income^{12-17,21,22,24,25,27,29}, food expenses^{13,14,24}, participation of the individuals and families in welfare programs or government aid^{12,15-19,21,22,24,28,29}, food consumption^{14,18,19,21}, food habits^{13,15-17,21}, body composition of the individuals^{17,18,20,22,23,29}, biochemical tests¹⁸, household conditions^{22,24,28}, basic sanitation²², geographical locations of households^{24,25}, food and animal cultivation²⁸, and life standard²⁹.

In relation to the assessment of household Food and Nutrition Security, of the selected papers, one made use of the Latin American and Caribbean Food Security Scale (ELCSA)¹², two used the Household Food Security Survey (HFSS)^{19,28}, four used the HFSS reduced version¹⁵⁻¹⁸, one used the Community Childhood Hunger Identification Project (CCHIP)¹³, and one used the Radimer/Cornell food insecurity items²¹. All are validated psychometric scales that indicate whether adults or children in the same family experience food shortages or deprivation and modify food intake due to financial resource limitations^{12,13,16}.

Other studies did not directly assess household food security from psychometric scales^{7,13,15-19,21,28}, whereas, one used family expenditure on food as a proxy for income, considering it a measure of intra-familial food security¹⁴, e two assessed the situation of food insecurity in households using the concept of “household food energy availability” according to the method proposed by FAO^{22,23}. Since food availability varies according to socioeconomic conditions, family composition, household location, and may compromise Food and Nutritional Security²⁶, the other studies were included for assessing these aspects, such as the availability of fruits and vegetables at homes with children⁷, or food availability in households with children in rural areas²⁶, the food availability of families receiving a supplementary nutritional assistance program^{20,24} and household availability of food according to socioeconomic and demographic factors^{25,27,29}.

Discussion

It was observed a predominance of only a single measurement of food availability^{7-9,14,17,18,20,22,23,26-29}. Some methods of assessing household food availability are sometimes impracticable due to their extension and the need for sufficient human and financial resources. Therefore, reduced instruments may be useful

for this analysis^{13,15}. On the other hand, a single application can generate biases and misinterpretations about household food availability, presenting an imprecise description of the food available for consumption^{15,16}, furthermore, the use of instruments with a limited number of items does not reliably determine the quantity or quality of the food available^{16,17}.

Food availability may be affected by a series of irregular events including family parties, acute illness, and times of family difficulty. Using several measures, it is possible to better observe the impact of these events, as well as intra-family variability¹⁶. Researches investigating, in greater detail, the food availability may improve the assessment of these aspects, which are susceptible to variations according to the family situation^{16,17}.

This highlights the importance of multiple measures of food availability and the feasibility of more extensive assessments¹⁶. Which allows information obtainment on the weekly change in availability and the presence and quantity of specific foods, noting that the number of measures and the most appropriate period of time for application of the instruments depend on their purpose¹⁵.

Other authors focus their instruments on assessing the availability of certain types of food to achieve a specific objective, such as the household availability of fruit and vegetables^{7,19}, or special situations, such as the availability of food for cancer prevention, cardiovascular diseases³⁰, Human Immunodeficiency Virus (HIV) care³¹. However, due to data limitations, the measurement of a greater variety of foods seems to be more complete and with satisfactory validity⁹.

Regarding the relationship between food security and food availability, the availability, access, use of the food and the stability are recognized as the pillars of food security³² and when one of these aspects is violated, it is characterized food and nutritional insecurity³³. Besides being among the main determinants of the food system³⁴, household availability is influenced by several factors, such as composition and family income, storage conditions and access to food commercialization establishments¹⁶, production for self consumption²², regional production and infrastructure of the food system such as stock and transportation³².

Unsatisfactory socioeconomic conditions such as low income^{13,15,17,25,29} and low education of the head of the family^{12,25} are also negatively related to food security and food availability. Insecure food households have less availability of

most food^{12,17,19,28,29}. In contrast, the food production for self-consumption positively influences the food availability at home^{22,35}.

We also emphasize that four studies assessed secondary data on household food availability from food surveys of national representativity^{12,14,24,25}. Surveys such as these that produce information at the national level, regarding household food availability enable the characterization of the temporal changes in the population's feeding, and contribute with information on the adequacy of the composition of families' feeding²⁵, in addition to its use for nutritional surveillance, elaboration and assessment of public policies¹⁴.

We can highlight the importance of the use of validated methods for assessing the household food availability is highlighted. The development of several household measurement instruments does not include comprehensive validity tests, and validity is a fundamental criterion, since an instrument should be associated with the expected results of the study¹³.

A suggested method for assessing the validity of food availability instruments is the completion of the instrument by the research participants, and then their answers are compared with the questionnaire applied by the researcher (gold standard). The comparisons are assessed regarding the consistency of the results, using statistical method or through the analysis of sensitivity and specificity³⁰.

Household food availability is associated with ingestion, habit and dietary patterns^{19,30}, and, although important results of home-based surveys are observed, they have the limitation of not knowing the individual food consumption^{22,24}, since they do not assess the dietary intake of each family member or characteristics such as weight, height and level of physical activity in order to determine the appropriate individual intake. Such information could point to a more accurate perspective of the Food and Nutrition Security situation^{12,36}.

Other limitations observed in methods of assessing food availability are the short assessment period and the variety of foods covered in the instruments, since from a food and nutritional security perspective, feeding is adequate when offered in sufficient quantity and quality and permanently, thus, a less comprehensive assessment may be a bias in determining the food available and its variation at home over a longer period. Moreover, socioeconomic and cultural aspects, not always addressed in the studies, are determinants on food and nutritional security, therefore,

besides food availability, assessing these factors becomes important for a better understanding of the conditions and consequences of feeding and food and nutritional (in)security of the population.

The use of only three databases is considered a limiting factor of this review, with this, possible eligible publications may not have been identified. Despite the gray literature survey, it was restricted to the bases indicated in the methodology. As the gray literature is difficult to systematize the search, it is possible that some study related to the theme of the review has not been contemplated. However, despite the limitations, we believe that it was possible to critically demonstrate and discuss the main methods employed in the assessment of food availability in the households in studies related to Food and Nutritional Security.

Considerations and recommendations

It was observed that the majority of the studies opted for assessing the food availability from a single application of the instrument, containing as main information the quantity and quality of the food purchased in the households, almost always followed by the Food Security measurement.

Among the limitations to assess the household food availability, the difficulty of measuring the food distribution between family members is highlighted, as well as the lack of information on monthly, intra- and inter-personal variability of food availability. However, the availability assessment can be improved by investigating the strengths and weaknesses of the instruments for further detail and accuracy of the information.

As the household food availability is influenced by several factors, it is of extreme importance that these are also taken into account in the studies. The relevance of household food availability assessment is due both to its close relation with food security and to its determinant role in the family choices, habits and food consumption.

Whenever possible, we recommend the use of methods involving a wide variety of food and a longer time to assess availability, in order to better observe the variability and stability of food availability at home. The importance of the development and validation of specific instruments for the different populations capable of effectively measuring the availability of food at the household level is also emphasized.

Collaborations

E Schott worked on the design, research, methodology and final writing; FAC Rezende worked on the design, methodology and final writing; SCC Franceschini worked on the design; methodology, final writing and on the approval of the version to be published; SE Priore and AQ Ribeiro worked on the final revision to be published.

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