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### TOTAL RETRACTION

The editorial team of Revista Ciência & Saúde Coletiva communicates the formal publication of retraction for the extraction of the review article referred to below since it contains conceptual and quotation errors, which prejudices the trustworthiness of the information throughout the entire text.

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Maria Cecília de Souza Minayo

*Editor-in-chief*



## Food security in indigenous and peasant populations: a systematic review

Marcos Restrepo-Arango <sup>1</sup>  
Lina Andrea Gutiérrez-Builes <sup>1</sup>  
Leonardo Alberto Ríos-Osorio <sup>2</sup>

**Abstract** Food security and the vulnerability among indigenous and peasant populations has become a topic of interest to public health all around the world, leading to the investigation about measurement, classification and factors that determine it. This systematic review aimed to describe the situation of food security in indigenous and peasant communities, and the methods used for evaluation. The literature search was performed on the PubMed (5), ScienceDirect (221) and Scopus (377) databases searching for publications between 2004 and 2015, a total of 603 items were located with the search engines. At the end of the screening process and after adding the items found in the gray literature, 25 papers were obtained to write the review. In the 11 years evaluated between 2004 and 2015, scientific activity around the theme was poor with just 4.54% of the publications on this subject, but for 2011 the percentage increased to 13 publications, 63%. Various factors that influence the development of food insecurity are climate change, the diversity of agriculture, globalization and market westernization.

**Key words** Food security, Indigenous population, Peasants, Agriculture, Colombia

<sup>1</sup> Grupo de Investigación Biología de Sistemas, Facultad de Medicina, Universidad Pontificia Bolivariana. Calle 78B Número 72\*/109/Bloque B/cuarto piso. Medellín Colombia. marcos.restrepo@upb.edu.co

<sup>2</sup> Grupo de investigación Salud y Sostenibilidad, Escuela de Microbiología, Universidad de Antioquia. Antioquia Colombia.

## Introduction

The concept of food security has its origin in the mid-1970s, a period when the central focus around this concept was a government's capacity to meet the energy and nutritional needs of a population through the adequate availability of food and stability in the prices of basic products at both national and international levels<sup>1</sup>. Subsequently, this concept has been presented in diverse ways by international organizations and researchers in more than 200 different definitions<sup>2</sup>, and these definitions have evolved since the commencement of the World Food Conference held by the participating governments in 1974. During the 1980s, this focus began to shift from the food security of an individual nation and from increasing supply according to demand to an approach that sought to improve access to food by the end of the decade<sup>2</sup>.

Subsequently, in 1996, these definitions were submitted to consensus at the World Food Summit, yielding the most recent concept proposed by the Food and Agriculture Organization of the United Nations (FAO), which established that food security occurs when all people have, at all times, physical and economic access to sufficient, safe, and nutritious food supplies to meet their needs and preferences and to lead an active life as well as maintain a healthy diet<sup>3</sup>.

From a conceptual point of view, food security is supported by 4 pillars: food availability, access, use, and stability<sup>4</sup>. Availability refers to the physical supply of food and is determined by the levels of production, reserves, and trade; access refers to the economic and physical capacity to acquire food, which also depends on the market and not on availability alone; the dimension of use encompasses biological forms that provide most nutrients to the body; and stability connotes the balance of the other 3 determinants over time<sup>4</sup>.

Conversely, food insecurity has been defined as the limited or uncertain availability of nutritionally adequate and safe food or as the limited capacity to acquire food in socially acceptable ways<sup>5</sup>. Consequently, food insecurity occurs when food systems are not accessible, not available, inadequate, or under stress<sup>6</sup>.

According to FAO, indigenous and peasant populations are disproportionately affected by environmental degradation; economic and political marginalization; and activities promoting economic development that adversely affect the ecosystems, lifestyle, cultural heritage, and nutritional status of these populations<sup>4</sup>.

Therefore, the development of methods to evaluate the status of food security in indigenous and peasant populations is imperative along with research into whether and how the current political, economic, social, or environmental changes affect food security in these populations. In addition, the scope of parallel concepts, such as food sovereignty, which both involves and transcends issues related to food security, must be considered. In this regard, the Forum for the Food Sovereignty of 2007 has defined food sovereignty as *the right of persons to healthy and culturally appropriate production through ecologically sustainable and rational methods and to define their own food and agricultural systems*. Consequently, it can be inferred that food security represents a set of goals to be achieved, while food sovereignty implies an approach to achieve food security<sup>4</sup>.

Taking into account the diversity of existing theoretical and methodological perspectives in scientific literature for defining food security and the lack of consensus regarding the approach to study this concept in indigenous and peasant populations, we proposed a theoretical investigation with the objective of describing the status of food security and the methods used for its evaluation in these types of populations on the basis of a systematic review of the scientific literature over a period of 11 years.

## Methods

The research was developed using the adapted PICOC methodology<sup>7</sup>, whereby P stands for the study population, in this case, the indigenous and peasant populations that present vulnerability in their food security; I represents the methods used to evaluate food security; C refers to existing food safety diagnosis; and O refers to the results of the review reflecting the determinants of food security in these communities.

The problem questions defined for the research process were as follows: What are the methods used for the evaluation of food security in indigenous and peasant populations; how is the diagnosis classified; and what determinants have been described?

## Search strategy

The study was structured in accordance with the PRISMA statement<sup>8</sup>. A systematic literature search was performed in the ScienceDirect, Scopus, and PubMed databases (January 2004–Jan-

January 2015). DeCS descriptors were employed to ensure sensitivity, descriptive non-DeCS descriptors were employed to ensure completeness, and Boolean operators were combined to ensure specificity.

The search paths employed in each database are presented below. Grey literature was obtained through the Google Scholar search tool.

**ScienceDirect**  
 ("food security") AND ALL(("standard methods" OR indicators OR index) AND ("indigenous population" OR peasants OR native)).

**Scopus**  
 TITLE-ABS-KEY ("food security") AND ALL ("standard methods" OR indicators OR INDEX) AND ALL ("indigenous population" OR peasants OR native) AND PUBLISHED > 2004 AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (SRCTYPE, "j"))

**PubMed**  
 ("food security") AND ("standard method" OR indicators OR index) AND (indigenous OR native)

Search results were imported to the Mendeley Reference Management Software, and duplicates were eliminated.

### Inclusion and exclusion criteria

Only original articles published over a period of 11 years (2004-2015), written in English, containing information regarding indigenous and peasant populations, and containing descriptions or interpretations of the concept of food security from any measurement level, were included.

Articles that did not address the issue of food safety applied to the reference population of this study were excluded.

Data regarding each publication were extracted, and an information collection form, specifying the year, country, journal title, and the thematic issues of the journals, was created for the subsequent analysis.

### Results

The review of scientific literature extracted from the 3 databases revealed 603 relevant articles published between January 2004 and January 2015 (ScienceDirect, 221; Scopus, 377; and PubMed, 5). Next, 19 duplicate articles identified among the databases were eliminated using the Mendeley software. In total, 584 articles were evaluat-

ed according to their titles and abstracts. From these, 553 articles were excluded because they did not meet the inclusion criteria described above. On analyzing the remaining 31 full-text articles, 9 were eliminated on the basis of exclusion criteria. Finally, 22 articles were obtained for analysis in the present systematic review (Figure 1).

Three articles from journals not indexed in the databases and identified using the Google Scholar were added to the 25 articles mentioned above, after meeting the inclusion and exclusion criteria established for the present review (Chart 1).

The scientific literature selected for this review comprised 25 articles published between January 2004 and January 2015, which were studies conducted in 8 different countries across 5 continents (Figure 2).

Food security has become a topic of common interest worldwide, and it has been approached in the most vulnerable communities, such as the inhabitants of rural areas. This is attributable to the severity of food insecurity in such communities and its impact on the health and economy of the countries. Despite this, the research identified using our protocol was concentrated in countries such as the United Kingdom and the United States, with 31.82% of the publications each, whereas countries, such as Australia, Brazil, and South Africa, yielded only 2.70% publications (Figure 1).

These results demonstrate the importance that certain topics present for researchers as well as the capacity to consistently address such topics and to rigorously allocate resources for their research. In this sense, the high proportion of studies regarding food security in the United States indicated that 11% of the population in this country was dealing with food insecurity in 2004 and 3.9% with food insecurity and hunger during the same year<sup>9</sup>.

The journals with the highest number of publications on food insecurity were BMC Public Health of the United Kingdom, with 12.63% of the publications (corresponding to 3 articles), and The Journal of Nutrition, with 9.09%. The main thematic focus of the 19 journals whose articles were included in the present review was medicine (31.82%); followed by social sciences (18.92%); and finally, environmental, social and biological sciences (16.22%). This trend suggests that the issues regarding food insecurity that concern the scientific community the most include the impact of food insecurity on health as well as its social, biological, and environmental determinants.

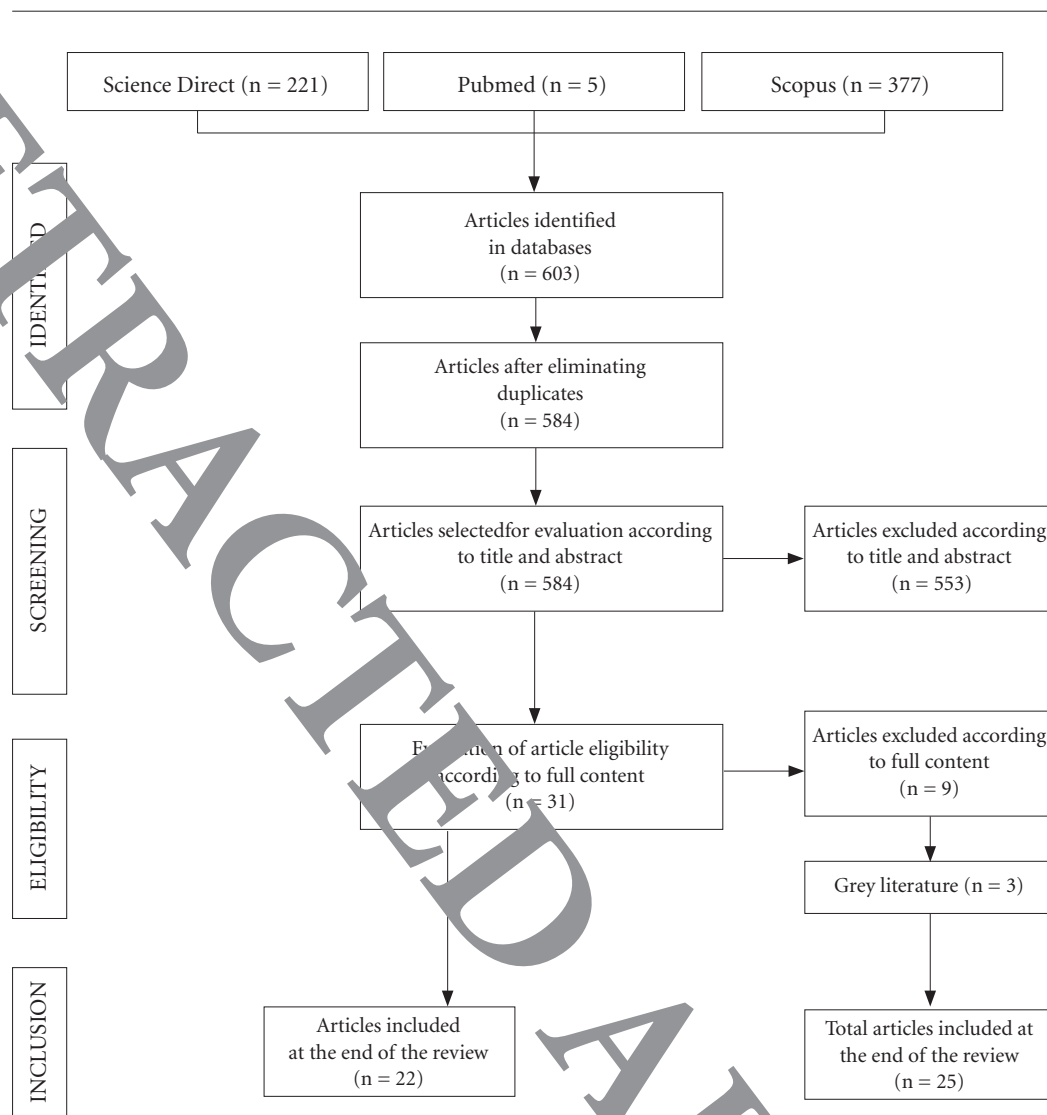


Figure 1. Search protocol flowchart.

Regarding the year of publication, the year with greatest scientific production around this subject over the period of 11 years was 2013 (24.32%). With respect to production trends, production was low (2.56%) during the first 4 years (2004-2007), but as of 2008, with a production of 10.81%, the number of publications showed an increasing trend until reaching the aforementioned maximum point (Graphic 2).

#### Food security in rural populations

Food security is an issue that has not escaped the interest of indigenous and peasant popula-

tions. In fact, Briggs & Moore have suggested that food security, together with soil fertility, is considered to be "very important" in the economic and nutritional development of the farming communities in the Zombwe area (Malawi)<sup>10</sup>. This report proves that both the data and the perception of the population are important when dealing with food security.

Food insecurity is a predominant status in the indigenous populations, and Canadian communities, particularly those inhabiting the Arctic, are no exception<sup>3</sup>. This public health problem is caused by multiple determinants, including high levels of poverty, climate change, environmental

Chart 1. List of articles included in the present study.

Author	Year	Country	Community
Mitchell M et al. (1)	2014	United Kingdom	Peasant
Manor H et al. (2)	2005	South Africa	Indigenous
Muet C et al. (3)	2012	United States	Indigenous
Calix de Lajas H et al. (4)	2014	United Kingdom	Indigenous
Brown B et al. (5)	2008	United States	Peasant
Wakegill J et al. (6)	2013	United States	Peasant/Indigenous
Gundersen C. (9)	2007	United States	Indigenous
Briggs J y Moyon (10)	2012	Scotland	Rural
Rudolph K y McLachlan SM (11)	2013	United Kingdom	Indigenous
Skinner K (12)	2013	United Kingdom	Indigenous
Hofmeijer I et al. (13)	2012	The Netherlands	Indigenous
Gilles JL y Vardivia C (14)	2009	United States	Peasant
Skinner K et al. (15)	2013	United Kingdom	Indigenous
Negi VS y Maikhuri RK (16)	2012	The Netherlands	Rural
Asher W. (17)	2015	United States	Indigenous
Ortiz R y Nowak A. (18)	2015	--	Indigenous
Piperata BA et al. (19)	2011	United States	Peasant
Olasunbo OI y Olubode KA. (20)	2006	Australia	Indigenous
Ford JD y Beaumier M (21)	2011	United Kingdom	Indigenous
Ford JD et al. (22)	2013	United Kingdom	Peasant
Harder MT y Wenzel GW (23)	2012	Canada	Indigenous
Ifeoma I y Agwu A. (24)		Croatia	Rural
Cordeiro MM et al. (25)	2014	Brasil	Indigenous
Jamieson JA et al. (26)	2013	United Kingdom	Indigenous
Egeland GM et al. (27)	2011	United States	Indigenous

pollution, the introduction of processed foods, the reduction of crop products consumption, and restrictive policies<sup>11</sup>.

For the specific communities of the Arctic, climate change, increases in the prices of the materials needed for hunting, and unemployment have Westernized their culture, and these communities have thus been forced to consume high-cost commercial foods with low nutritional value, leaving aside traditional food and putting food security at risk<sup>3</sup>. This indicates that traditional food systems are increasingly threatened by factors ranging from climate change to the insertion of the nontraditional market; therefore, the affected communities are suffering from long-term food insecurity<sup>12</sup>.

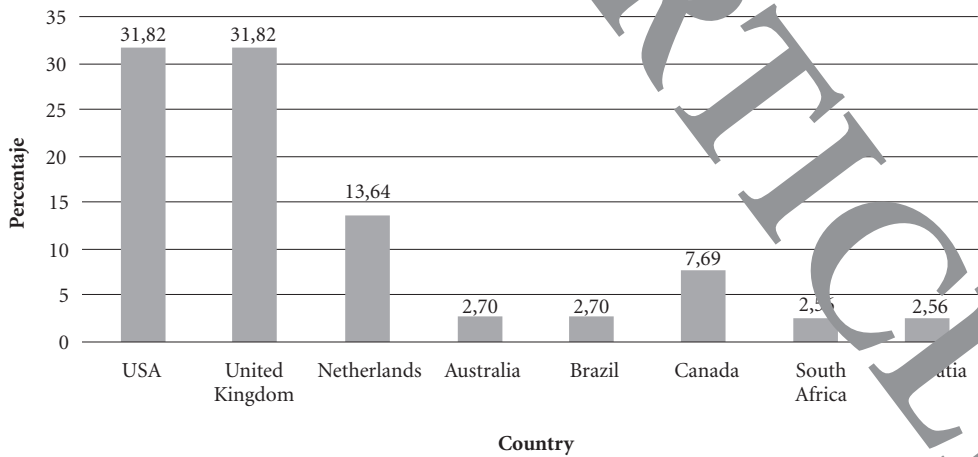
Climate change and its consequences are not exclusively the problem of Arctic communities. For example, the Amazonian population of Peru also suffers from its consequences and the vulnerabilities that the phenomenon generates. Hofmeijer et al. have identified 3 factors arising from climate change that represent health risks

to these communities: the generation of food insecurity, water insecurity, and the risk of vector-transmitted diseases<sup>13</sup>. These communities are particularly susceptible to these circumstances, given their poor living conditions and inadequate public health policies to cope with it<sup>13</sup>.

Agricultural systems are highly sensitive to climate change, and this problem is more serious in developing countries that do not have the necessary tools to minimize the damage caused by the climate-driven deterioration of their agricultural systems. Gilles & Vardivia have identified a lack of connection between the indigenous producers of the Altiplano and the scientific community that makes climate predictions in 2 Aymara-speaking communities in Bolivia and Peru, in the years 1999–2001, 1999–2000, and 2000–2001, respectively. Therefore, despite efforts to provide increasingly accurate weather forecasts, if there is ineffective communication between the parties, there may be improvements to food security<sup>14</sup>. Thus, biodiversity sustainability is important for some Canadian aboriginal

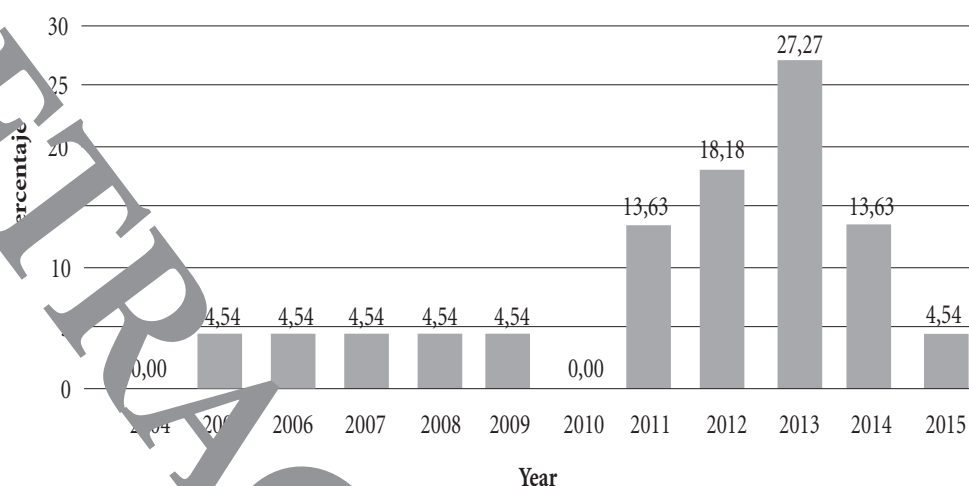


**Figura 2.** Distribución y localización geográfica de las publicaciones encontradas sobre seguridad alimentaria en poblaciones rurales.



**Graphic 1.** Percentage of articles pertaining to food security in rural populations published per country.





**Graphic 2.** Percentage of articles pertaining to food security in rural populations published per year.

communities, wherein food insecurity is a major problem<sup>15</sup>, and for the indigenous communities of Nepal, livestock biodiversity is of critical importance for sustaining food security and growth and for reducing poverty<sup>16</sup>.

In other regions of the world, several studies have indicated that 41% of the population in Ethiopia lives below the poverty line, with 31.6 million undernourished individuals. In Ethiopia, cases of malnutrition and food insecurity are prevalent in rural areas, with a population of 6 to 7 million people in a chronic state of food insecurity and more than 13 million in variable conditions<sup>1</sup>. Kidane et al. have reported different data, with 50% of the population in a state of food insecurity and 60% below the poverty line, on the basis of the daily caloric intake of 2100 per day recommended by the Federal Democratic Republic of Ethiopia<sup>2</sup>.

Low economic status is considered one of the primary predictors of food insecurity, and indigenous communities in the Americas have some of the highest rates of poverty and unemployment. Thus, the scarcity of prevalence data on the status of food insecurity is a cause for concern<sup>5</sup>. An example of the effort being made to face this problem is “The Shoulder-to-Shoulder Global Clinic” located in Santo Domingo, Ecuador, which was established at the University of Kentucky and sought to address the nutritional deficit caused by food insecurity<sup>17</sup>.

### Strategies and methods to measure food security and its determinants in rural populations

Because the Amazon is the largest tropical forest in the world, it is the main focus of the world's biodiversity conservation. Amazonian ecosystems are continuously threatened by human intervention and climate change, both of which seriously affect the food security of the Amazonian population. Thus, economic and social activities of these populations have always been a matter of interest and concern. Several studies have demonstrated that market integration has affected the health and nutrition of the Amazonian communities, increasing the incidence of chronic diseases such as overweight, obesity, diabetes, and hypertension<sup>18</sup>.

Piperata et al. have conducted a study with 469 participants in 2002, ranging in age from birth to 77 years; in 2009, 429 individuals participated under the same conditions. Out of the participants evaluated in 2009, 204 had already been evaluated in 2002, meeting the characteristics of a follow-up group. The data were collected through interviews directed at the household heads, asking them to list all incomes and contributions to the monthly expenditure. Information on housing and access to basic health services was also collected. Regarding the anthropometric measurements, height, weight, tricipital skin

fold, upper waist circumference, and body mass index were measured to evaluate nutritional status. The entire process was aimed at determining how communities were being affected by lifestyle changes associated with pathologies, which is also known as “nutritional transition”<sup>19</sup>.

Interviews, questionnaires, and checklists are some of the most common measurement techniques. Olanbo & Olubode<sup>20</sup> have assessed the nutritional vulnerability and the status of the Yorubalanders in Nigeria. In that study, they used a structured interview for non-demographic data and a questionnaire for demographics; the socio-economic level was ranked as high, medium, or low, and health status was evaluated according to the number of ailments. Nutritional vulnerability was evaluated with a modified checklist from “The Nutrition Screening Initiative”<sup>20</sup>. Conversely, Brown et al.<sup>5</sup> have used a survey with 76 items that collected food safety, health status, and sociodemographic information of communities between September and December 2005. For health status, they used the “SF-12 Item Health Status,” which is a validated adaptation of the SF-36, and for the measurement of food safety they used the “US Household Food Security Survey Module,” which evaluates food safety at homes. Together, these studies demonstrate how 2 different methodologies are used to evaluate these aspects.

Another example of the use of interviews was noted in the research conducted by Ford & Beaumier, who sought to characterize food insecurity in the members of the Inuit community in Igloodik<sup>21</sup>, Nunavut, and to examine the conditions and processes that limited access to food as well as the availability and quality of the food. In that study, 66 semi-structured interviews were conducted at homes, 10 with focus groups comprising community members and the other 19 with local informants and political actors. The focus groups were used to evaluate local strategies and the impact of external stress. According to the information collected, the lack of affordability of food, the low income, the lack of food preferences and knowledge, the low quality and insufficient availability of food products, environmental stress, decreased hunting activity, and elevated harvest costs were factors contributing to food insecurity in this population<sup>21</sup>. However, not all authors agree with the usefulness of predesigned interviews. In the case of “The 18-item Core Food Security Module,” Gundersen<sup>9</sup> has argued that the use of this tool to classify the state of food security leads to inaccurate results, given the substantial amount of information that

is overlooked; for example, if 2 households are evaluated and one has 8 positive answers and the other has 18 positive answers, both will be categorized under the category of food insecurity with hunger even if there are evident differences in the severity of the situation between the 2 families.

An alternative and rather interesting method has been used by Ford et al.<sup>22</sup> to assess the use of community food programs in the Canadian Arctic population. The method is called photo-voice workshops, where participants are given a camera to photograph their daily life experiences for later evaluation. The participants were asked to present with their photographs the aspects of their day-to-day life that affect their food preferences and the amount of food consumed. This method was effective for the researchers in order to overcome the difficulty of conducting interviews with these communities and also proved to be an interesting experience as the participants themselves were researchers<sup>22</sup>.

Incomes and expenses of families are other useful sources of information for assessing household food security. This aspect was evaluated by Harder & Wenzel<sup>23</sup>, who examined the flow of money and food resources of an extended family at the Inuit community in Clyde River, Scotland, to understand the effects of wages and hunting economics on food security. They evaluated employment status, categorized as fulltime, part time, temporary, or unemployed, and the income in dollars, without any specific scale. Assets were recorded according to the possession of snowmobiles, boats, cabins, and truck and home ownership<sup>23</sup>. While Harder & Wenzel did not include income in their study, in a similar study, Brown et al. classified income as follows: < 10,000 annual dollars as below the national poverty index, between 10,000 and 20,000, as close to poverty, and greater than > 30,000 as a normal poverty level<sup>5</sup>. Ifeoma and Igwu<sup>24</sup> considered that house size and access to bank credit are determinants of food security because any activity that increases income, even the one other than agriculture, is a good strategy for dealing with food insecurity<sup>24,25</sup>.

Despite the usefulness of income assessment as an indicator of food security, it is generally accepted that measuring individual economic activities is insufficient for understanding the complete economic situation of the communities as a whole because factors, such as sporadic work and household organization, also influence family dynamics<sup>23</sup>.

Another type of measurement associated with the assessment of food security makes use of anthropometric measures and blood biomarkers. A recent study conducted in Quilimbola, Brazil, has evaluated obesity in young population and food insecurity in their families by assessing measures, such as height, weight, and body mass index (BMI) as indicators of nutritional status. Weight was evaluated using a solar-powered scale, size with a compact stadiometer, and BMI was assessed according to the z-scores given by the World Health Organization<sup>25</sup>. Conversely, Jamieson et al.<sup>16</sup> have used bioelectrical impedance analysis to measure weight and body composition, whereas Egeland et al.<sup>27</sup> have measured blood biomarkers, such as 25-hydroxyvitamin D [25(OH)D], complete blood counts with greater emphasis on hemoglobin evaluation and erythrocyte count, serum ferritin, and the serum concentration of saturated fatty acids and trans-fatty acids<sup>26,27</sup>.

#### Classification of food security in rural populations

Food security can be classified in diverse ways depending on the method used to measure it evaluation. Egeland et al. have used the “18-item USDA Food Security Survey Module” survey; to interpret the obtained data, they added the following answers: “yes,” “often,” “sometimes,” “almost every month,” “some months,” and “one or two months.” The authors conducted their study according to the food safety classification recommended by Canada’s health system as follows: 0–1 positive response referred to as food security status, 2–5 positive answers to moderate food insecurity, and greater than or equal to 6 positive answers to severe food insecurity<sup>27</sup>. Another version of this survey, directed at children, comprised 10 questions, with categories, such as food security, food insecurity without hunger, and food insecurity with hunger.

An additional scale that has been used for classifying food security in indigenous and peasant populations is the Brazilian scale of food security, which considers households to be at a mild level of food insecurity when the inhabitants have a poor diet or a constant concern of running out of food in little weather at a moderate level when there is a quantitative restriction of food; and at severe levels when there is food deficit or hunger among adults or children in the family<sup>25</sup>. Thus, it is evident how diverse methods, both objective and subjective, can be used to

evaluate food security in rural populations; other than their objective, there are no significant similarities among the methods, which hinders the establishment of a consensus method for assessing food security.

#### Discussion

Food insecurity in indigenous and peasant populations is a significant public health concern for the scientific community, and over the last 5 years, research in this area has increased. In a period of 11 years evaluated in the present study (2004–2015), there was little scientific activity around this topic, with only 4.54% of the total publications on this topic; however, for the year 2011, the percentage of publications increased up to 13.63% in response to the Forum for Food Sovereignty, which had taken place the previous year. Thereafter, scientific production increased encouragingly up to 27.27% in 2013, suggesting a surge in research initiatives on this topic. Regarding the amount of production by country, although there were some countries, such as the United Kingdom and the United States with 18.82% of the publications each, the general panorama is discouraging, with countries, such as South Africa and Croatia, producing only 2.56% of publications each.

The impact of climate change on the food security of the rural population is an important factor, and this is expected considering the effect of industrialization on the environment and ecosystems<sup>8</sup>. The importance of climate change lies in the unfavorable conditions it generates for hunting as well as in the alteration of migration cycles of species and the vulnerability of agricultural activities<sup>9</sup>. In addition, the phenomenon also compromises the health of populations and the sustainability of food security. Different studies have demonstrated the effect of climate change on the availability, access, utilization, and stability of food products, therefore, it now threatens all aspects of food security in the general population<sup>15,16</sup>.

In terms of agricultural diversity, for some communities, the maintenance of a wide variety of crops, through numerous small-scale cultivation plots, is the way to achieve food security, because variation ensures adaptation to climate change<sup>10</sup>.

The process of globalization has also hindered the achievement of food security in indigenous and peasant populations because of the adoption

of Westernized diets and lifestyles. In addition, the economic system increasingly depends on salaried jobs, putting aside the traditional activities of the regions. The introduction of the Western market has also led to a greater dependence of food stability on purchased foods than on traditional products. Notably, food security is not about access to food alone but also about its quality and sufficient nutritional content, which are the requirements that most commercial food products do not meet. Further, better nutritional quality can be correlated with higher market prices. Another consequence of globalization is an increasingly sedentary lifestyle and less balanced diets, which result in a higher incidence of chronic diseases such as obesity, hypertension, and diabetes. All these factors, which are often regarded as economic and social development, negatively affect food security and the health of populations.

In terms of local, national, and international initiatives addressing the problem of food insecurity, it can be inferred that such initiatives remain a scarcely explored topic, with few initiatives from the governments worldwide. Some initiatives have been undertaken by countries, such as Ecuador, Brazil, and the United States, that seek to combat hunger and food insecurity. The facts that food insecurity is a prevalent status in most of the studies populations and that such a small number of initiatives has been undertaken in few countries are a matter of concern because they demonstrate a possible lack of funding or interest by governments.

According to the literature reviewed, the measurement, evaluation, and classification techniques applied to the analysis of food security in indigenous and peasant populations widely vary. They range from diverse types of interviews and questionnaires to more interactive methods, such as the use of follow-up photographs. Other authors did not use predesigned formats but created their own methods with the aim to achieve the purpose of the study. Some examples of such models and methods created by organizations include the *SF-12 Item Health Status*, the *U.S. Household Food Security Survey Module*, and the *18-item Core Food Security Module*. The lack of homogeneity in the measurement methods and the absence of an internationally validated strategy make it difficult to evaluate food security adequately, and concept unification is almost impossible. For example, if food security were to be measured in the indigenous populations of Colombia, there would be no validated method

for this group of people, let alone any method created for them, at least in the reports to date. The problem lies in the fact that it is not possible to generate a complete and concise overview of the status of food security of certain populations because there is not a universal instrument that can be applied to evaluate diverse populations. Another limitation is the lack of consensus among authors regarding the variables that should be evaluated to accurately describe the status of food security. Some authors prefer the amount of food, whereas others prefer the type of food or the amount of income and the flow of money. The lack of unification of these concepts is another obstacle faced when attempts are made to generate a single method. Further, there is less information regarding classification; however, it is as divergent as the measurement methods. After examining the different results reported in the reviewed published literature, understanding the basis of the classifications presented by their authors remains challenging owing to the dependency of results on the tool used.

## Conclusions

The maintenance of food security is an increasingly challenging task for indigenous and peasant populations because of various aspects, such as climate change, the Westernization of diets and lifestyles, and the loss of biodiversity protection by these populations. The lack of strategies for coping with food insecurity reflects the absence of a universally accepted and validated tool to generate an accurate overview of the status of food security.

The populations studied in the reviewed research maintained a level of marginality that prevented them from accessing better food resources and the basic levels of education required to raise awareness regarding the importance of self-care, which is one of the least discussed elements related to nutritional aspects.

The present review demonstrated how methods used to assess food security in rural populations differ in basic aspects, such as the measures to classify the level of food security, as well as the ranges considered to establish variations between levels. Regarding this, there are no theoretical references that allow for an adequate interpretation of the measurements performed. This heterogeneity, both in the evaluation methods and measurements, as well as in their interpretation, demonstrates the importance of research for the

development of homologous tools and the simultaneous performance of validation processes that allow for the recognition of food security in rural populations as an affordable and comparable phenomenon, thus leading to the development of policies and strategies focused on the particularities of the specific communities while also considering the possibilities of local intervention in an assertive and efficient manner.

In fact, in many cases, difficulties in accessing these communities as a result of their remoteness or the geographical characteristics of their territories do not allow for the establishment of strategies and food security plans that are sustainable and that can ensure access to the minimum food requirements in addition to the development of evaluation and monitoring systems for these programs, which are the basis for making decisions that affect communities and improve their health conditions.

Therefore, there is a need for food insecurity assessment tools that can be used to provide a basis for the design, evaluation, and monitoring of strategies seeking to promote healthy eating habits, to determine the impact of such strategies. Simultaneously, together with local governments, it is necessary to foster programs that support healthy local food habits from an intercultural perspective, encourage self-care awareness, and promote endogenous processes for the development of public policies appropriate to the actual conditions of these populations.

Finally, the researchers need to participate more decisively in the development of more affordable food security measurement systems that can be adjusted to the genotypic and cultural characteristics of specific rural populations.

### Collaborations

M Restrepo-Arango, LA Gutiérrez-Builes and LA Osorio participated in the various stages necessary to conduct this research, both in the collection of information and the processing, analysis and writing of the final manuscript.

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