AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.

Asian Journal of Agricultural Extension, Economics & Sociology

Volume 42, Issue 12, Page 296-308, 2024; Article no.AJAEES.127997
ISSN: 2320-7027

Analyzing Food Security Scales: Evidence and Methods in the FAO Context

Mohammad Amir [a++*] and Akram Ahmad Khan [a#]

[a] Department of Agricultural Economics and Business Management, Aligarh Muslim University, Aligarh 202002, Uttar Pradesh, India.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/ajaees/2024/v42i122656

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/127997

Original Research Article

Received: 08/10/2024
Accepted: 10/12/2024
Published: 18/12/2024

ABSTRACT

Food security remains a critical global challenge, necessitating robust and precise measurement tools to effectively address and mitigate issues of hunger and malnutrition. The Food and Agriculture Organization (FAO) of the United Nations has introduce a range of metrics and methodologies to assess food security across different regions and populations. This comprehensive review aims to analyze the current evidence and methodologies used in the FAO context to measure food security, identifying strengths, weaknesses, and areas for improvement. This review synthesizes data from numerous peer-reviewed studies, reports, and FAO publications, focusing on the period from 2000 to 2023. These tools are examined in terms of their conceptual frameworks, measurement techniques, data collection methods, and practical applications in

[++] *Research Scholar;*
[#] *Dean & Chairman;*
**Corresponding author: E-mail: sheikhamir5556@gmail.com;*

Cite as: *Amir, Mohammad, and Akram Ahmad Khan. 2024. "Analyzing Food Security Scales: Evidence and Methods in the FAO Context". Asian Journal of Agricultural Extension, Economics & Sociology 42 (12):296-308. https://doi.org/10.9734/ajaees/2024/v42i122656.*

diverse settings. The FIES, introduce by FAO in collaboration with the Voices of the Hungry project, offers a direct estimate of food insecurity based on individuals' experiences. This scale has been widely adopted due to its simplicity, cost-effectiveness, and ability to provide comparable data across different contexts. he study's findings might be limited by the fact that participants reported their own experiences, which could be influenced by cultural norms or a tendency to answer in a way that is socially acceptable. Despite, these challenges, the FIES remains a valuable tool for monitoring food insecurity trends globally. The GFSI, produced by the Economist Intelligence Unit with support from FAO, provides a comprehensive measure of food security by integrating data on affordability, availability, quality, and safety of food. This index is beneficial for its broad scope and ability to highlight underlying factors affecting food security. Nonetheless, the GFSI faces criticism for its heavy reliance on secondary data sources, which may not always be up-to-date or accurately reflect on-the-ground realities. Furthermore, the index's focus on national-level data may overlook intra-country disparities and localized food insecurity issues. The IPC, another key FAO tool, categories the severity and magnitude of food insecurity in different regions, providing a standardized approach to assess and compare food security situations. The IPC's strength lies in its multi-dimensional nature, incorporating various indicators such as food consumption, livelihood changes, and nutritional status. However, its complexity and resource-intensive nature can pose challenges for consistent implementation, particularly in resource-limited settings. The systematic review highlights that while FAO's food security scales offer valuable insights, there is room for enhancement. Combining qualitative and quantitative data, improving the timeliness and accuracy of data collection, and incorporating more localized assessments can strengthen these tools. Additionally, integrating new technologies such as remote sensing and mobile data collection can further improve the precision and efficiency of food security measurements.

Keywords: Food security; measurement tools; Food Insecurity Experience Scale (FIES); Integrated Food Security Phase Classification (IPC); Global Food Security Index (GFSI).

1. INTRODUCTION

Food security is one of the world's most serious issues, including the availability, accessibility, and use of food to ensure that all people have enough safe and nutritious food to live healthy lives. To address this complicated issue, comprehensive and precise assessment tools are required to identify need areas, track progress, and drive policy actions. The United Nations Food and Agriculture Organization (FAO) has been at the forefront of developing and improving methods for measuring food security, offering essential data and insights to governments, organizations, and researchers around the world. The FAO produced many significant instruments, including the Food Insecurity Experience Scale (FIES), the Integrated Food Security Phase Classification (IPC), and the Global Food Security Index (GFSI) (Maxwell et al., 2013). Each of these tools uses a unique approach to monitoring food security, including Each of these techniques takes an own approach to measuring food security, with its own set of advantages and disadvantages (Economist Intelligence Unit, 2023). The goal of this systematic review is to examine the present evidence and methodology used by the FAO to quantify food security, as well as to identify areas for improvement (United Nations Inter-Agency Group for Child Mortality Estimation, 2023). The FAO and the Voices of the Hungry project collaborated to develop the FIES, which aims to directly assess food insecurity by collecting information about people's firsthand experiences. This scale analyses survey data to determine the degree to which people have experienced food insecurity, ranging from light to severe (National Family Health Survey, 2019-2021). The FIES's simplicity and cost-effectiveness have helped it gain global usage, providing for comparable data across different contexts and demographics (Food and Agriculture Organization, 2020). However, the use of self-reported data may include biases, such as a preference to respond in a socially acceptable manner or differences in how people from different cultures characterize their experiences with food poverty (Ballard, Kepple, & Cafiero, 2013; Jolliffe & Prydz, 2016). The GFSI, developed by the Economist Intelligence Unit with collaboration from the FAO, provides a comprehensive measure of food security by combining information on food affordability, availability, quality, and safety. This index provides useful insights into the underlying causes of food security and identifies areas where interventions are required (EIU, 2020). The IPC is another important tool in the FAO's

arsenal, providing a consistent method for assessing and comparing the severity and scale of food insecurity across regions (Sethi et al., 2017). The IPC includes a variety of indicators, such as food consumption habits, livelihood shifts, and nutritional status, to provide a multidimensional view of food security (IPC Global Partners, 2019). This review synthesizes data from various peer-reviewed papers, reports, and FAO publications, focused on the decade 2000–2023 (Upton et al., 2016). The review aims to thoroughly comprehend the tools' effectiveness and potential for improvement by examining their theoretical foundations, assessment methods, data collection approaches, and real-world applications (Smith et al., 2017). The findings highlight the need to combine qualitative and quantitative data, improve data collecting speed and accuracy, and incorporate more localized assessments to boost these tools. Furthermore, using modern technologies like remote sensing and mobile data collecting might improve the accuracy and efficiency of food security metrics. The study is arranged in five sections: Introduction, Literature Review, Methodology, Results, Discussion, and Conclusion.

2. REVIEW OF LITERATURE

Food security ensures that all people have consistent access to sufficient, safe, and nutritious food that meets their dietary needs, enabling them to maintain an active, healthy, and economically secure life. (world bank). By 2050, with a projected global population of around 9 billion, meeting the food demand will be challenging, necessitating a 70% increase in food production to accommodate the population growth (King et al., 2017). Despite efforts to increase and improve food production and quality globally, many people in Africa and Asia have died, emphasizing the essential role of food as a fundamental human need (Matemilola & Elegbede, 2017). The global hunger rate, measured by the prevalence of undernourishment, remained relatively constant from 2021 to 2022 but was still considerably higher than it was before the COVID-19 pandemic. In 2022, around 9.2 percent of the global population was affected by hunger, compared to 7.9 percent in 2019 (FAO Report, 2023).

The projection suggests that nearly 600 million people will experience chronic undernourishment by 2030, a number substantially higher than what was expected without the pandemic and Ukraine conflict. This number is also about 23 million more than the projection if the Ukraine conflict had not occurred. This highlights the substantial challenge of meeting the SDG goal of eradicating hunger, especially in Africa (FAO Report, 2023). Globally, food insecurity has a greater impact on women and individuals residing in rural regions. In 2022, a higher percentage of rural adults faced moderate or severe food insecurity compared to those in peri-urban or urban areas. The gender gap in food insecurity, which had grown during the pandemic, decreased from 3.8 percentage points in 2021 to 2.4 percentage points in 2022. (FAO Report, 2023).

Worldwide in 2022, approximately 148 million children under five were stunted (22.3%), 45 million were wasted (6.8%), and 37 million were overweight (5.6%). Stunting and wasting were more common in rural areas, while overweight was slightly more prevalent in urban area (FAO Report, 2023). In India, child stunting is prevalent at 35.5%, according to the NFHS 2019-2021. The country's undernourishment rate is 16.6% (State of Food Security and Nutrition in the World report 2023). Additionally, India's child wasting rate is a worrying 18.7%. (India’s NFHS 2019-21). The mortality rate for children under five is 3.1%. Inter-Agency Group for Child Mortality Estimation of the United Nations (January 2023).

The HFSSM is the second most common assessment tool found in this research. It was designed to measure if households have sufficient food or financial resources to meet their basic food needs and to evaluate their behavioral and subjective responses to this situation (Leroy et al., 2015). The HFSSM aims to assess how often adults and children experience food insecurity, with each question directly related to the quality and quantity of their diet, considering their limited financial circumstances (Bickel et al., 2000; Carlson, Andrews, & Bickel, 1999). The HFSSM module includes 18 questions, with 8 focused on households with children. This tool assesses four dimensions of household food insecurity: (1) feelings of uncertainty and worry, (2) lack of quality food, (3) insufficient food for adults, and (4) insufficient food for children. It is available in both 18-item and 6-item formats and helps classify households into different levels of food security: high, marginal, low, and very low, based on the proposed methodology (Coleman-Jensen, Gregory, Singh, 2014). When using a food insecurity measure in a global monitoring framework, it's crucial to ensure that the

estimated prevalence rates remain comparable between countries and over time. This involves defining severity thresholds consistently on a standardized scale and maintaining their stability throughout the monitoring period. To achieve this, prevalence rates are calculated by standardizing severity measures and thresholds on a single metric, either by mapping national measures onto a global scale or vice versa. This standardization is done through a linear transformation that adjusts the mean and standard deviation of severity values for comparable items in both scales, using these items as reference points (cafero.at al 2018). The FIES is based on two commonly used scales for assessing food security through personal experiences: the US Household Food Security Survey Module and the Latin American and Caribbean Food Security Scale, known as ELCSA in Spanish. In 2013, the FAO started the Voices of the Hungry (VOH) project to provide up-to-date, policy-focused, and practical information about food insecurity.

The project devised a methodology to gauge the extent of food insecurity faced by individuals or households, ensuring comparability across different countries. The FIES, coupled with inventive analytical techniques, seeks to establish a fresh global benchmark for assessing food insecurity (access) that holds international validation, endorsement, and applicability for both global and national surveillance. A panel of experts and National Statistics Offices evaluated the methodology in 2015 and found it to be scientifically sound for generating national estimates of moderate and severe food insecurity that are comparable across countries. To expand the global reach of the FIES, VOH utilizes the Gallup World Poll® (GWP), a part of Gallup, Inc. that has been conducting nationally representative surveys in over 140 countries annually since 2005. Since 2014, the FAO has worked with Gallup to incorporate the FIES into the World Poll questionnaire. This data collection initiative seeks to generate estimates of food insecurity prevalence at various severity levels, using a nationally representative sample of adult respondents in all countries included in the World Poll. These scales aim to understand food access from a behavioral perspective by directly asking individuals about their personal experiences and behaviors related to food access. Among various experience-based food insecurity scales, the Food Insecurity Experience Scale (FIES), introduced by the Food and Agriculture Organization (FAO) in 2013 as part of the Voices of the Hungry (VoH) Project, is designed to ensure consistency and validity across diverse cultures, encompassing both developing and developed countries (FAO, 2016). The FIES includes eight yes/no questions that explore behaviors and attitudes related to food insecurity at different levels of severity, from psychological worries about food availability to actual reductions in food quality or quantity. Some of the questions in the FIES Module are similar to those used in other experience-based food insecurity scales, such as the Latin American and the Caribbean Food Security Scale, the Household Food Insecurity Access Scale, and the Household Food Security Survey Module. Using statistical methods based on Item Response Theory (IRT) allows the FIES to account for the uncertainty in responses, making it the first system to measure food insecurity through experiences and produce formally comparable measures across different countries. FIES, is included as an official indicator for tracking progress towards Sustainable Development Goals target 2.1. Therefore, the FIES is frequently recommended for inclusion in ongoing large-scale surveys (FAO, 2016; FAO et al., 2019; United Nations, 2016). The FIES-SM uses yes/no responses to questions, which can be used to create a one-dimensional measure using the Rasch model. This approach assesses the severity of food insecurity by assigning each individual in a representative sample a probability

List 1. Questionnaire for analyzing food security scale

Item number	Questions
1	You felt concerned about not having adequate food?
2	You couldn't afford to consume nutritious and healthy meals?
3	You were limited to eating only few types of food?
4	You had to miss a meal due to lack of resources?
5	You consumed less food than you believed was necessary?
6	Your household depleted its food supply?
7	You experienced hunger but chose not to eat?
8	You went an entire day without eating?

of encountering a specific level of severity, enabling the estimation of food insecurity prevalence rates within the population. To maintain consistency across countries, food insecurity classification thresholds and prevalence rates are standardized by aligning measures obtained from individual datasets, which are estimated using the Rasch model, with a universal global reference scale (Cafiero, Viviani, Nord, 2018).

3. RESEARCH METHODOLOGY

There are various methods adopted by FAO for determining food security. Research conducted between 2000 and 2023 because it addresses global challenges in agriculture, food security, and sustainable development during a transformative period in human history.

3.1 Prevalence of Undernourishment

Proportion of the population whose typical food intake does not supply the necessary energy levels for sustaining a normal, active, and healthy lifestyle. We evaluate the prevalence of undernourishment by analyzing the percentage of the population in a country whose Dietary Energy Consumption (DEC) is below their Dietary Energy Requirements (DER). This measure serves as a widely used indicator for tracking changes in hunger trends over time. Other undernourishment measurement like Coefficient of Variance (CV) and Minimum Dietary Energy Requirement (MDER).

3.2 Coping Strategies

Households coping with food insecurity employed strategies such as consuming cheaper food, foraging wild fruits, cutting back on non-essential expenses, prioritizing children's meals, purchasing food on credit, taking out loans for food purchases, and occasionally skipping meals (Mukaila et al., 2021). This suggests the implementation of initiatives to enhance the food security of rural farmers. To achieve this, farmers should consider forming or joining cooperative societies, allowing them to pool resources for productive activities, access credit, and benefit from economies of scale (Mukaila et al., 2021).

3.3 Household Income and Expenditure Surveys

This approach involves conducting household interviews, during which respondents provide details regarding their expenditure on food and other essential items. Various timeframes, such as the week or month leading up to the survey, have been employed. To utilize this method effectively, some information is necessary: i) the quantity and cost of food purchased or consumed both inside and outside the household; ii) any food received by household members as gifts or in exchange for work, goods, or services; iii) food produced within the household for household consumption. By calculating the average daily calorie intake per household member, this method highlights the importance of having access to culturally relevant and accurate food composition tables (Measuring and indicating food insecurity," by Rafael Perez-Escamilla and Ana Maria Segall Correa, 2008).

3.4 Individuals Dietary Intake

Various methods can be employed to assess an individual's dietary intake, including: i) recalling food consumption over a 24 hour period; ii) Answering food frequency questions, iii) maintaining food data either independently or with the assistance of an observer. Each method requires a specific reference time frame. While some methods rely on participants' memory (such as the 24-hour recall and food frequency questionnaires), others involve the direct recording of consumed foods by the individual, a proxy, or an observer. Estimating portion sizes may involve aids like food models or weighing foods before and after consumption. These estimations are crucial for calculating food group quantities and nutrient intakes, provided reliable food composition databases tailored to the cultural context are available. Establishing cut-off values for different nutrients is essential for understanding findings on nutrient intake and identifying the portion of the sample or population at risk of deficiencies. (Measuring and indicating food insecurity," by Rafael Perez-Escamilla and Ana Maria Segall Correa, 2008).

3.5 Anthropometry

Anthropometry entails measuring the dimensions, weight, body proportions, and composition of the human body**.** It helps assess the nutritional status of individuals, reflecting both food security and health conditions. National surveys typically use weight and height (or length) measurements for infants, young children, adolescents, and adults to assess anthropometric indicators. The effectiveness of these indicators is assessed using predetermined cutoff points.

3.6 The Household Food Insecurity Access Scale (HFIAS)

The Household Food Insecurity Access Scale (HFIAS) is designed for cross-cultural application and consists of nine questions that inquire about the frequency of experiencing food insecurity conditions**.** Responses are scored from 0 for "never" to 3 for "often," resulting in a total score ranging from 0 to 27. (McKay, Sims, van der Pligt, 2023). Higher scores reflect greater food insecurity, with the scores generally divided into four categories: food-secure households and those facing mild, moderate, and severe levels of food insecurity, based on the framework suggested by the HFIAS Indicator (Coates, Swindale, Bilinsky, 2007). The scale reflects a household's encounters with challenges related to accessing food and encompasses three fundamental aspects of food insecurity that are identified as common across various cultures. (Coates et al., 2006). This scale evaluates feelings of uncertainty or concern about the availability of food in the household, perceptions of poor food quality, and inadequate food consumption (Coates, Swindale, Bilinsky, 2007).

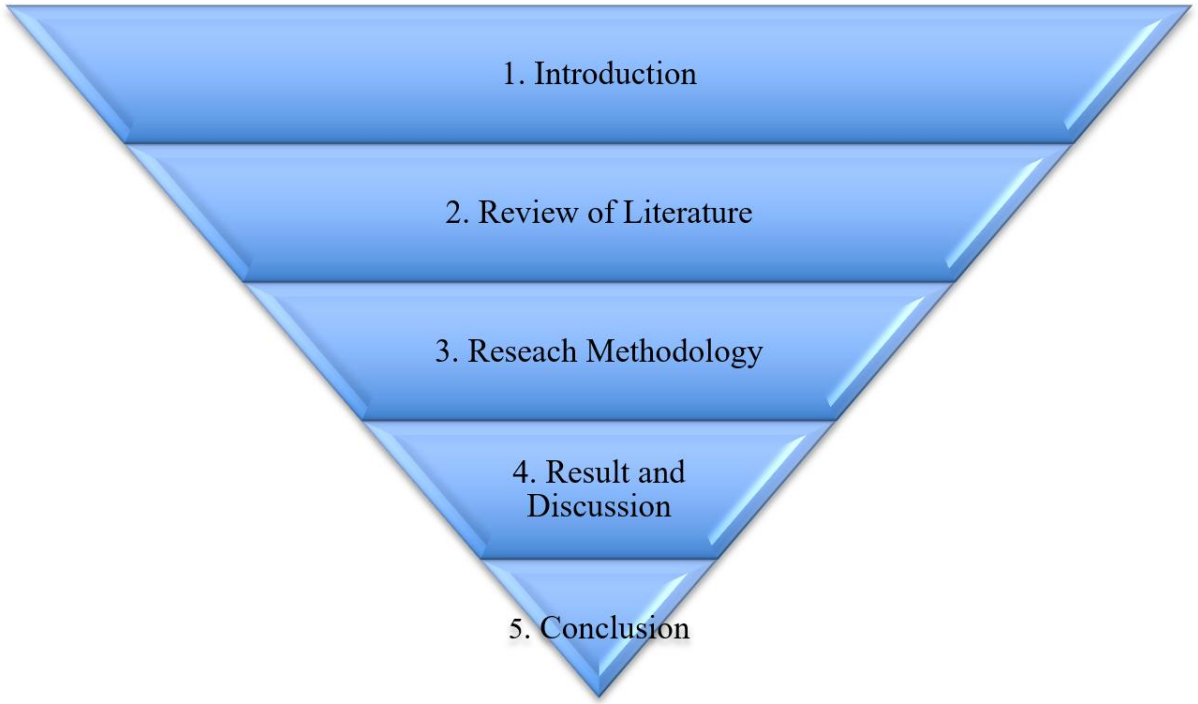

Fig. 1. Framework of the study

No. of severely food insecure people in India (2014-2016) = Estimate for Southern Asia – Estimate for Southern Asia excluding India
= 241.0 – 38.2
202.8 million

Prevalence of severe food insecurity in India (2014-2016) = (Percentage of severely food insecure people in India) * 100
= (202.8/1310) * 100
= 15.4 %

Prevalence of severe food insecurity in India (2020-2022) = 392.8-70.8
322 (millions)

Prevalence of severe food insecurity in India (2020-2022) = (322/1417) * 100
= 22.72%

Proportion of moderately and severely food insecure individuals in India (2014- 2016) = 505.5 – 141.1
= 364.4(millions)

Proportion of moderately and severely food insecure individuals in India (2014- 2016) = (364.4/1310) * 100
= 27.81%

Proportion of moderately and severely food insecure individuals in India (2020-2022) = 822.2-232.2
= 590 (millions)

Proportion of moderately and severely food insecure individuals in India (2020-2022) = (590/1417) * 100
= 41.63 %

4. RESULTS AND DISCUSSION

The data outlines trends in undernourishment and food insecurity from 2004-06 to 2020-22 across various regions. Globally, undernourishment decreased from 12% to 9.2%, Meanwhile, severe food insecurity increased from 7.8% to 11.3%, and moderate to severe food insecurity rose from 21.9% to 29.5%.

In Africa, undernourishment slightly declined from 19.9% to 19.3%, but severe food insecurity grew from 17.8% to 23.4%, and moderate to severe food insecurity surged from 46.6% to 58.9%. Latin America and the Caribbean saw a decrease in undernourishment from 9.3% to 6.7%, but severe food insecurity increased from 7.9% to 13%, and moderate to severe food insecurity rose from 27.6% to 39%.

Europe maintained low levels of undernourishment (<2.5%), with slight increases in severe food insecurity from 1.5% to 1.7%, and a decrease in moderate to severe food insecurity from 8.7% to 7.8%. Oceania showed a slight decrease in undernourishment from 6.8% to 6.6%, with increases in severe food insecurity from 2.8% to 3.5%, and moderate to severe food insecurity from 11.1% to 12.7%.

In Asia, undernourishment decreased significantly from 13.6% to 8.6%, but severe food insecurity increased from 6.7% to 9.9%, and moderate to severe food insecurity rose from 17.7% to 24.8%. In India, undernourishment dropped from 21.4% to 16.6%, while severe food insecurity increased from 15.4% to 22.72% and moderate to severe food insecurity surged from 27.81% to 41.63%.

The Fig. 2, titled "Prevalence of Undernourishment" compares the percentage of undernourished populations in various regions of the world during two different time periods. The blue bars indicate period (2014-16), and the red bars indicate a period (likely 2020-22).

The graph shows a general trend of decreasing undernourishment across most regions, with the most significant reductions seen in Asia, and India, Latin America and the Caribbean region, Europe maintains the lowest prevalence of undernourishment, with minimal changes over the periods observed. Africa and Oceania show smaller decreases, indicating persistent challenges in these regions.

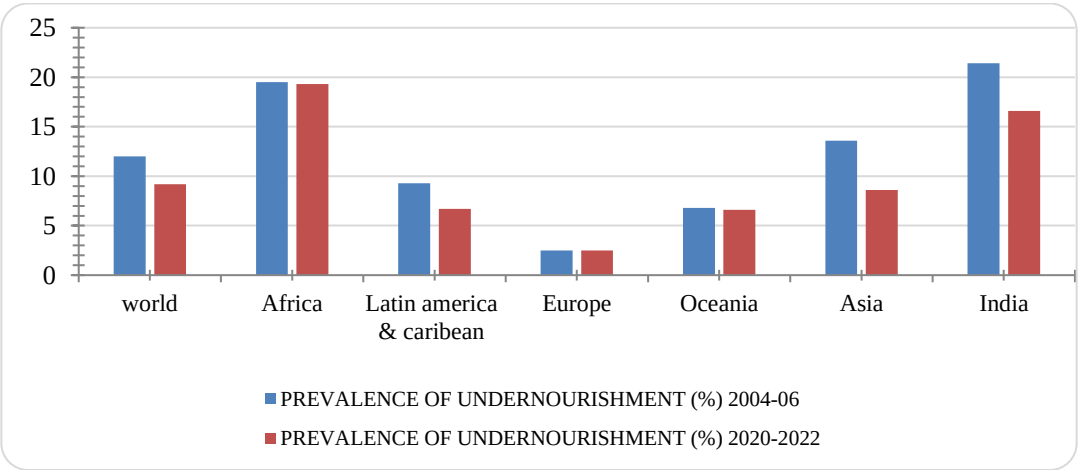

Fig. 2. Prevalence of undernourishment

Table 1. Proportion and number of individuals affected by undernourishment, moderate or severe food insecurity

Region/Subregion/Country	Proportion of individuals with undernourishment in the total population		Proportion of individuals with severe food insecurity in the total population		Proportion of individuals with moderate or severe food insecurity in the total population	
	2004-06	2020-2022	2014-2016	2020-22	2014-2016	2020-22
World % (millions)	12 (786.7)	9.2 (725.1)	7.8 (575.7))	11.3 (892.7)	21.9 (1626.1)	29.5 (2335.5)
Africa% (millions)	19.9 (181)	19.3 (269)	17.8 (213.3)	23.4 (326)	46.6 (559.7)	58.9 (821.5)
Latin America and the Caribbean% (millions)	9.3 (51.8)	6.7 (43.7)	7.9 (49.1)	13 (85.4)	27.6 (172.1)	39 (256.2)
Europe% (millions)	<2.5	<2.5	1.5 (11.1)	1.7 (12.1)	8.7 (64.9)	7.8 (58.4)
Oceania% (millions)	6.8 (2.3)	6.6 (2.9)	2.8 (1.1)	3.5 (1.6)	11.1 (4.5)	12.7 (5.6)
Asia (%) (millions)	13.6 (542.6)	8.6 (404)	6.7 (297.4)	9.9 (464.2)	17.7 (789.2)	24.8 (1164.4)
India (%) (millions)	21.4 (247.2)	16.6 (233.9)	15.4 (202.8)	22.72 (322))	27.81 (364.4)	41.63 (563.6)

Source – FAO(SOFI-2023)

Total population of India in 2014-2016 = 1310 million (World Bank)

Total population of India in 2020-2022 = 1417 million (World Bank)

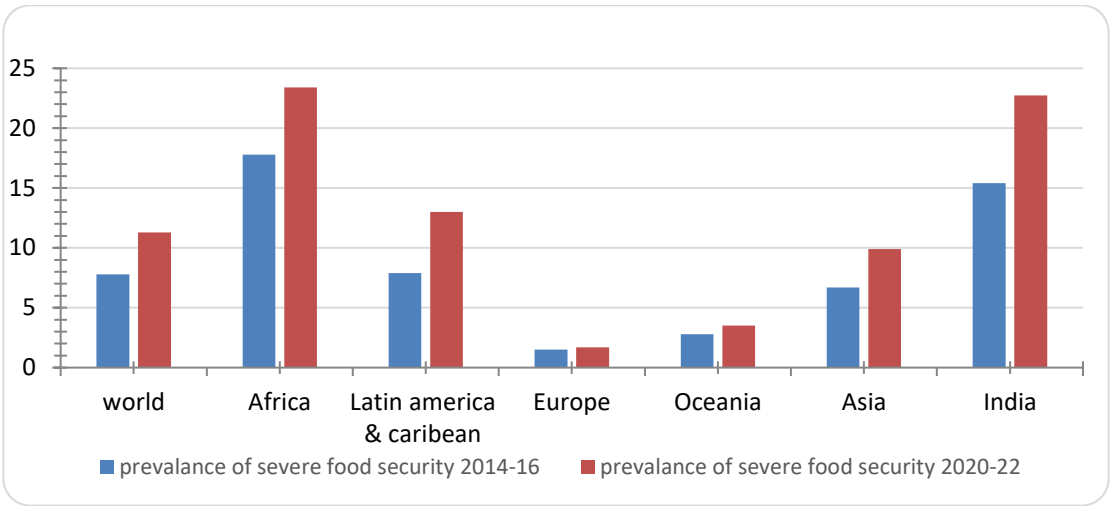

Fig. **3. Prevenance of severe food security**

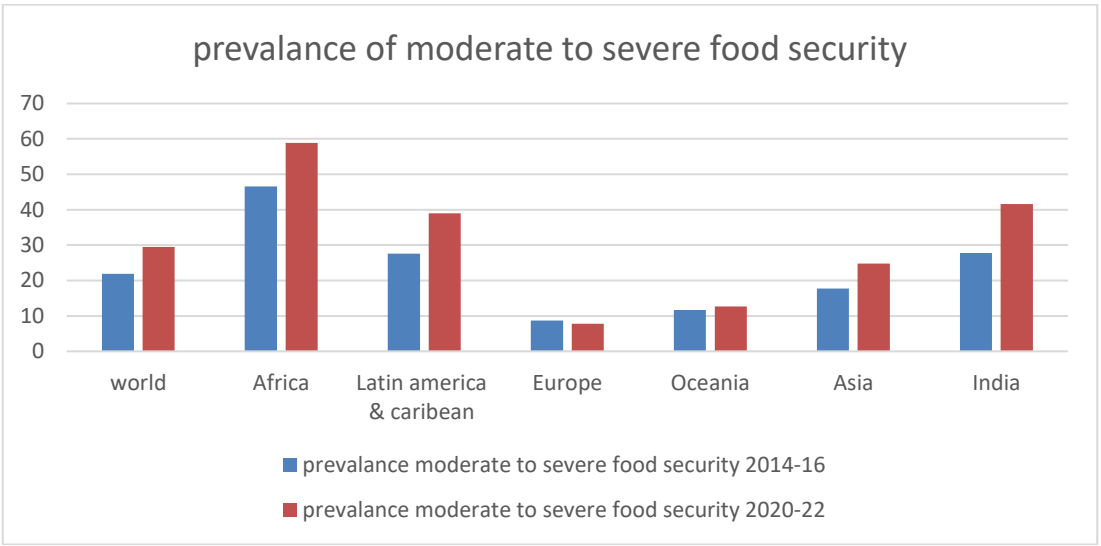

Fig. 4. Prevalence of moderate to severe food security

The Fig. 3 titled "Prevalence of Severe Food security" compares the percentage of populations experiencing severe food insecurity in various regions of the world during two different time periods. The blue bars show period (2014-16), and the red bars show period from (2020-22). The graph shows an overall increasing trend in severe food insecurity across most regions. The most significant increases are observed in Africa, India, Latin America and the Caribbean region. Asia also shows a considerable increase, while Oceania and Europe have smaller but noticeable increases. The global rise in severe food insecurity suggests worsening conditions and challenges in achieving food security in recent years.

The Fig. 4, compares the percentage of populations experiencing moderate to severe food insecurity in various regions of the world during two different time periods. The blue bars show period (2014-16), and the red bars show a period (2020-22). The graph shows a general trend of increasing moderate to severe food insecurity across most regions, with the most significant increases observed in Africa, Latin America and the Caribbean region Asia, and India. Europe is the only region where there has been a slight decrease in moderate to severe food insecurity. The worldwide increase in moderate to severe food insecurity reflects deteriorating food security conditions, particularly significant challenges in Africa and India.

Table 2. Forms of malnutrition

Region/ Subregion/ Country	Rate of stunting in children under five years old		Rate of overweight in children under 5yrs of age	
	2012	2020	2012	2020
World	26.3 (173.9)	22.3 (148.10)	5.5 (37.0)	5.6 (37.0)
Africa	34.4 (61.3)	30.0 (63.10)	5.0 (8.8)	4.9 (10.2)
Latin America and the Caribbean region	12.7 (6.8)	11.50 (5.70)	7.4 (3.9)	8.6 (4.2)
Europe	5.1 (2.1)	4.0 (1.40)	9.2 (3.7)	7.3 (2.6)
Asia	28.2 (103.8)	22.3 (76.60)	4.8 (18.2)	5.1 (17.7)
India	41.6 (52.5)	31.7 (36.10)	2.2 (2.8)	2.8 (3.2)

Source- *FAO (SOFI 2023)*

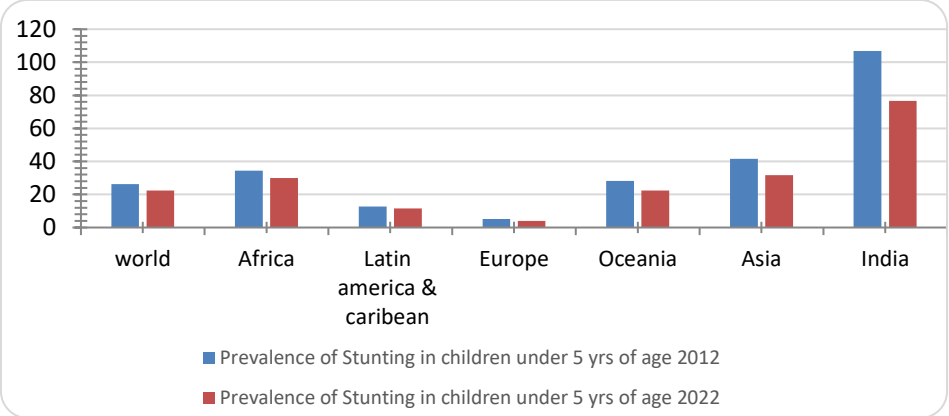

Fig. 5. Prevalence of stunting in children under 5 yrs. of age

The Table 2, reveals trends in child stunting and overweight prevalence from 2012 to 2020. Globally, stunting in children under 5 decreased from 26.3% (173.9 million) to 22.3% (148.1 million), while overweight prevalence remained steady around 5.5-5.6% (37.0 million). In Africa, stunting also decreased from 34.4% to 30%, with a slight increase in overweight prevalence from 5% to 4.9%. Latin America and the Caribbean region saw reductions in both stunting as well as overweight prevalence. Europe experienced decreases in both stunting and overweight prevalence, with stunting dropping from 5.1% to 4% and overweight from 9.2% to 7.3%. In Asia, stunting decreased significantly from 28.2% to 22.3%, with a slight increase in overweight prevalence. India showed significant improvements in reducing stunting from 41.6% to 31.7%, with a modest increase in overweight prevalence from 2.2% to 2.8%.

The image you provided does not include any information about the frequency of stunting in children under five years old. However, I can notify you that, according to the most recent National Family Health Survey (NFHS-5) conducted in India from 2019 to 2021, 35.5% of children under the age of five were stunted. Stunting occurs when a child's height is insufficient for their age. It results from chronic malnutrition and can lead to significant long-term impacts on a child's health and development. The prevalence of stunting in India has been declining in recent years, but it remains a significant public health problem. The Indian government has launched several initiatives to enhance child nutrition, including the Integrated Child Development Services (ICDS) scheme. which provides pregnant and lactating mothers and children under 6 years of age with hot cooked meals, supplementary nutrition, and health and nutrition education.

The graph you supplied shows the prevalence of overweight in children under five years old. Likely in two different years. Unfortunately, the years aren't labelled on the graph itself. Red bars indicate the percentage of overweight children. Blue bars represent the percentage of underweight children. Overall, the graph shows the distribution of weight categories for children under 5 years of age.

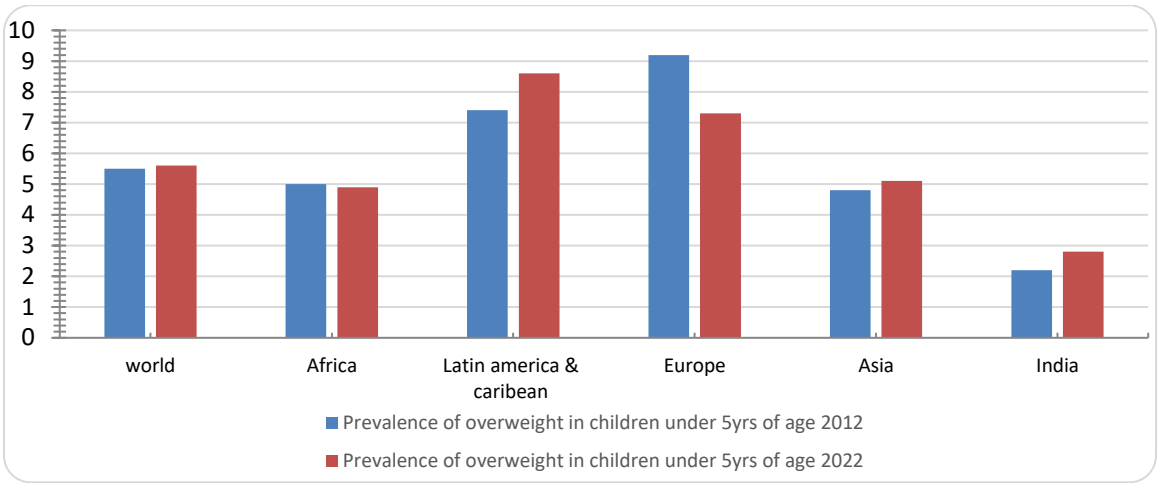

Fig. 6. Rate of stunting in children under five years old

5. CONCLUSION

The systematic evaluation of FAO's food security measurement tools highlights their importance in combating global hunger and malnutrition. Each of the FIES, GFSI, and IPC has strengths and flaws that indicate opportunities for improvement in order to boost their effectiveness and reliability. FIES, developed by the FAO in partnership with the Voices of the Hungry initiative, has been acclaimed for its simplicity, cost-effectiveness, and capacity to yield similar data in a variety of settings. Its strength is in its direct measurement approach, which captures people's experiences with food insecurity. The ease of this method makes it more widely adopted, enabling for more comprehensive monitoring of global food insecurity trends. However, FIES is heavily reliant on self-reported data, which can be influenced by culture differences and respondents' desire to produce socially desirable responses. This reliance on subjective data may result in discrepancies and errors, especially when comparing different cultural situations. The GFSI, developed by the Economist Intelligence Unit with help from FAO, provides a comprehensive measure of food security by combining data on affordability, availability, quality, and food safety. This indicator is useful because of its broad reach, providing insights into the fundamental variables affecting food security. However, its reliance on secondary data sources, which may not always be current or adequately reflect on-the-ground realities, is a serious constraint. Furthermore, the GFSI's national-level concentration may miss intra-country differences and localized food insecurity issues, limiting its ability to effectively address specific area challenges. The IPC is an important FAO tool for determining the severity and degree of food insecurity in different locations. Its multidimensional approach, which includes variables such as food intake, livelihood shifts, and nutritional status, provides a full picture of food security problems. Despite its virtues, the IPC's complexity and resource-intensive implementation can be difficult, especially in resource-constrained environments. Consistent application of the IPC takes significant resources, skill, and coordination, which may not always be possible in all regions.

5.1 Recommendations for Improvement

The evaluation identifies many ways to improve the effectiveness of FAO's food security measurement tools. Combining qualitative and quantitative data can lead to a more comprehensive understanding of food insecurity. Improving the timeliness and accuracy of data collection is critical to ensuring that actions are grounded in current and trustworthy information. Incorporating more localized evaluations can also assist solve intra-country discrepancies and give tailored solutions for certain regions. Integrating new technology like remote sensing and mobile data collecting can help to increase the precision and efficiency of food security metrics. These technologies can give real-time data and lessen reliance on self-reported information, thereby eliminating some of the biases inherent with existing methodologies. By using technological breakthroughs, FAO can improve the robustness and accuracy of its food security assessments, resulting in more effective interventions and policies to alleviate global hunger and malnutrition.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

Ballard, T. J., Kepple, A. W., & Cafiero, C. (2013). *The food insecurity experience scale: Development of a global standard for monitoring hunger worldwide*. FAO Technical Paper.

Bickel, G., Nord, M., Price, C., Hamilton, W., & Cook, J. (2000). *Guide to measuring food insecurity*. Alexandria, VA: United States Department of Agriculture, Food and Nutrition Service. Retrieved from http://hungerfreecommunities.org/wp-content/uploads/2011/04/USDA

Cafiero, C., Viviani, S., & Nord, M. (2018). *Food security measurement in a global context: The food insecurity experience scale*.

Carlson, S. J., Andrews, M. S., & Bickel, G. W. (1999). Measuring food insecurity and hunger in the United States: Development of a national benchmark measure and prevalence estimates. *The Journal of Nutrition*, *129*(2), 510S-516S.

Coates, J., Frongillo, E. A., Rogers, B. L., Webb, P., Wilde, P. E., & Houser, R. (2006). Commonalities in the experience of household food insecurity across cultures: What are measures missing? *Journal of Nutrition*, *136*(5), 1438S-S1448S.

Coates, J., Swindale, A., & Bilinsky, P. (2007). *Household Food Insecurity Access Scale (HFIAS) for measurement of food access: Indicator guide: Version 3*.

Coleman-Jensen, A., Gregory, C., & Singh, A. (2014). *Household food security in the United States in 2013*. USDA-ERS Economic Research Report, (173).

Cafiero, C., Viviani, S., & Nord, M. (2018). Food security measurement in a global context: The food insecurity experience scale. *Measurement*, *116*, 146-152.

Economist Intelligence Unit (EIU). (2020). *Global Food Security Index 2020: Addressing structural inequalities to build strong and sustainable food systems*.

Economist Intelligence Unit (EIU). (2023). *Global Food Security Index 2023*. Retrieved from https://foodsecurityindex.eiu.com/

Food and Agriculture Organization (FAO). (2016). *Methods for estimating comparable rates of food insecurity experienced by adults throughout the world*. Rome. Retrieved from http://www.fao.org/3/a-i4830e.pdf

Food and Agriculture Organization (FAO). (2020). *The State of Food Security and Nutrition in the World 2020*. Retrieved from http://www.fao.org/publications/sofi/2020/en/

Food and Agriculture Organization (FAO). (2023). *The State of Food Security and Nutrition in the World 2023*.

Food and Agriculture Organization, International Fund for Agricultural Development, United Nations International Children's Emergency Fund, World Food Programme, & World Health Organization (FAO, IFAD, UNICEF, WFP, & WHO). (2019). *The State of Food Security and Nutrition in the World 2019: Safeguarding Against Economic Slowdowns and Downturns*. Rome: FAO.

India's National Family Health Survey (NFHS). (2019-2021). *National Family Health Survey of India*.

Integrated Food Security Phase Classification Global Partners (IPC). (2019). *Integrated Food Security Phase Classification Technical Manual Version 3.0: Evidence and Standards for Better Food Security Decision*. Retrieved from http://www.ipcinfo.org/ipcinfo-website/resources/manuals/en/

Jolliffe, D., & Prydz, E. B. (2016). Estimating international poverty lines from comparable national thresholds. *Journal of Economic Inequality*, *14*(2), 185-198.

King, T., Cole, M., Farber, J. M., Eisenbrand, G., Zabaras, D., Fox, E. M., & Hill, J. P. (2017). Food safety for food security: Relationship between global megatrends and developments in food safety. *Trends in Food Science & Technology*, *68*, 160-175. https://doi.org/10.1016/j.tifs.2017.08.014

Leroy, J. L., Ruel, M., Frongillo, E. A., Harris, J., & Ballard, T. J. (2015). Measuring the food access dimension of food security: A critical review and mapping of indicators. *Food and Nutrition Bulletin*, *36*(2), 167–195.

Matemilola, S., & Elegbede, I. (2017). The challenges of food security in Nigeria. *Open Access Library Journal*, *4*(12), 1-22. https://doi.org/10.4236/oalib.1104185

Maxwell, D., Coates, J., & Vaitla, B. (2013). *How do different indicators of household food security compare? Empirical evidence from Tigray*. Medford, MA: Feinstein International Center.

McKay, F. H., Sims, A., & van der Pligt, P. (2023). Measuring food insecurity in India: A systematic review of the current evidence.

Mukaila, R., Falola, A., & Omotesho, O. A. (2021). Food security status: Its drivers and coping strategies among vegetable farming households.

Pérez-Escamilla, R., & Segall-Corrêa, A. M. (2008). Food insecurity measurement and indicators. *Revista de Nutrição*, *21*, 15S-26S.

Sethi, V., Maitra, C., Avula, R., Unisa, S., & Bhalla, S. (2017). Internal validity and reliability of experience-based household food insecurity scales in Indian settings. *Agriculture & Food Security*, *6*(1), 1–17.

Smith, M. D., Rabbitt, M. P., & Coleman-Jensen, A. (2017). Who are the world's food insecure? New evidence from the Food and Agriculture Organization's Food Insecurity Experience Scale. *World Development*, *93*, 402-412.

United Nations Inter-Agency Group for Child Mortality Estimation (UN IGME). (2023). *Child Mortality Report*.

Upton, J., Cissé, J. D., & Barrett, C. B. (2016). Food security as resilience: Reconciling definition and measurement. *Agricultural Economics*, *47*(S1), 135-147.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of the publisher and/or the editor(s). This publisher and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

© Copyright (2024): Author(s). The licensee is the journal publisher. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/127997