

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

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 introduced 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 diverse settings. The FIES, introduced 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. The 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, categorizes 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

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Phrases like "Despite, these challenges" are grammatically incorrect.
Acronyms are often introduced without proper explanation in the text (e.g., HFSSM, HFIAS).

Structure:

The Introduction section is overly broad. It should concisely set up the context and focus on the FAO tools discussed.

The Review of Literature lacks clear subsections or thematic organization. Grouping related tools and concepts would improve readability.

The Results and Discussion section should integrate tables and figures more fluidly into the text. References to figures (e.g., Figure 2) should be specific, with critical analysis directly linked to them.

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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 one of the most pressing global challenges, encompassing the availability, accessibility, and utilization of food to ensure that all people have enough safe and nutritious food to lead healthy lives. Addressing this complex issue requires robust and precise measurement tools to identify areas of need, track progress, and guide policy interventions. The United Nations' Food and Agriculture Organization (FAO) has played a leading role in creating and improving ways to measure food security, providing critical data and insights for governments, organizations, and researchers worldwide. Among the key tools developed by the FAO are the Food Insecurity Experience Scale (FIES), Integrated Food Security Phase Classification (IPC), Global Food Security Index (GFSI). Each of these tools offers a unique approach to measuring food security, with specific strengths and limitations. This systematic review objective to analyze the current evidence and methodologies used in the FAO context to measure food security, identifying areas for improvement and enhancement. The FIES, developed jointly by the FAO and the Voices of the Hungry project, aims to directly assess food insecurity by gathering information about people's personal experiences. This scale uses survey data to assess the extent to which people have experienced food insecurity, ranging from mild to severe levels. The simplicity and cost-effectiveness of the FIES have contributed to its widespread adoption, allowing for comparable data across different contexts and populations. However, the use of self-reported data may introduce biases, such as a tendency to answer in a socially acceptable way or variations in how people from different cultures describe their experiences of food insecurity. (Ballard, Kepple, & Cafiero, 2013).

The GFSI, produced by the Economist Intelligence Unit with support from the FAO, offers a comprehensive measure of food security by integrating data on food affordability, availability,

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quality, and safety. This index provides valuable insights into the underlying factors affecting food security and highlights areas where interventions are needed. Despite its broad scope, the GFSI has faced criticism for its reliance on secondary data sources, which may not always be current or accurately reflect local realities. Furthermore, the index's focus on national-level data may overlook significant intra-country disparities and localized food insecurity issues (EIU, 2020). The IPC is another critical tool in the FAO's arsenal, providing a standardized approach to assess and compare the severity and scale of food insecurity across different regions. The IPC incorporates various indicators, including food consumption patterns, livelihood changes, and nutritional status, offering a multi-dimensional perspective on food security. While the IPC's comprehensive nature is one of its strengths, its complexity and resource-intensive implementation can pose challenges, particularly in resource-limited settings (IPC Global Partners, 2019). This review synthesizes data from numerous peer-reviewed studies, reports, and FAO publications, focusing on the period from 2000 to 2023. By analyzing the theoretical foundations, assessment methods, data gathering techniques, and real-world uses of these tools, the review seeks to fully understand their effectiveness and potential for improvement. The findings highlight the need for combining qualitative and quantitative data, improving the timeliness and accuracy of data collection, and incorporating more localized assessments to strengthen these tools. Additionally, leveraging new technologies such as remote sensing and mobile data collection can enhance the precision and efficiency of food security measurements. The study is organized into five sections: Introduction, Literature Review, Methodology, Findings and 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. (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.

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(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 areas (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 JL, 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 A, Gregory C, Singh A 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. (Carlo cafero.at al). 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 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 (Carlo Cafiero, Sara Viviani, Mark Nord 2018).

List 1 : Questionnaire

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?

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Discuss the implications of the findings for different regions, especially the most affected areas (e.g., Africa and Asia).

3.0 RESEARCH METHODOLOGY

There are various methods adopted by FAO for determining food security.

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

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The methodology section lacks depth about the inclusion/exclusion criteria for studies reviewed and how these criteria were applied.

There is no justification for the selection of the 2000-2023 period or for the focus on specific FAO tools.

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. (Ridwan Mukaila, et al). 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. (Ridwan Mukaila, et al).

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 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) 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. (Fiona H. McKay^{1,2} · Alice Sims Paige 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 J, Swindale A, Bilinsky P. 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 J. At 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 J, Swindale A, Bilinsky P. 2007).

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 %

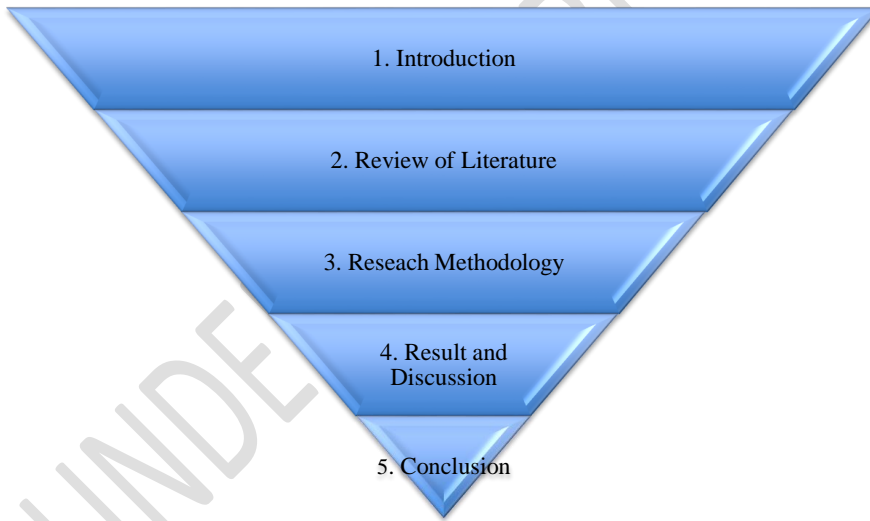


Figure 1. Framework of the study

4. **Result and Discussion**

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

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Calculations (e.g., prevalence rates in India) are included but need clearer contextual explanation and connection to the review's conclusions.

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)

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%.

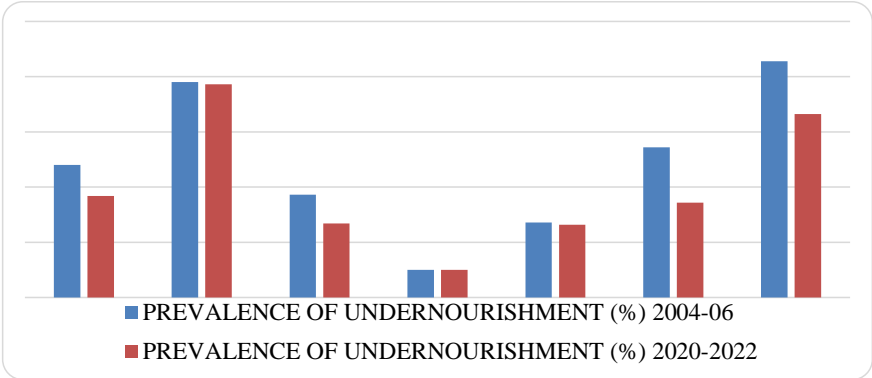
In Africa, undernourishment slightly declined from 19.9% to 19.3%, but severe food insecurity grew from 17.8% to 23.4%, and moderate to severe food insecurity surged from 46.6% to 58.9%. Latin America and the Caribbean saw a decrease in undernourishment from 9.3% to 6.7%, but severe food insecurity increased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

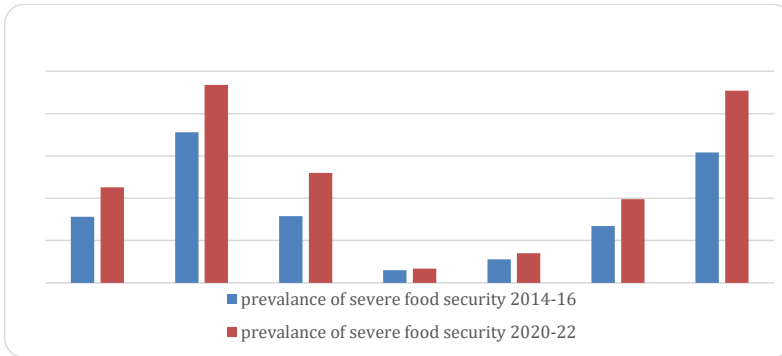
In India, undernourishment dropped from 21.4% to 16.6%, while severe food insecurity increased from 15.4% to 22.72% and moderate to severe food insecurity surged from 27.81% to 41.63%.

Figure 2 Prevalence of undernourishment



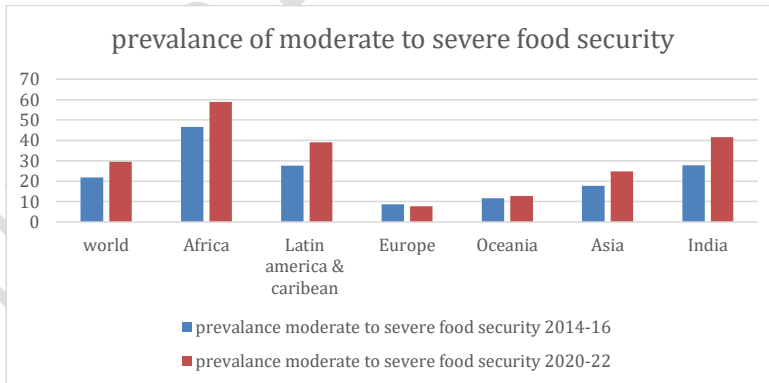
The Figure 2, titled "Prevalence of Undernourishment" compares the percentage of undernourished populations in various regions of the world during two different time periods. The blue bars indicate period (2014-16), and the red bars indicate a period (likely 2020-22). The graph shows a general trend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

Figure 3 Prevalence of severe food security



The Figure, 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.

Figure 4 prevalence of moderate to severe food security



The figure 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.

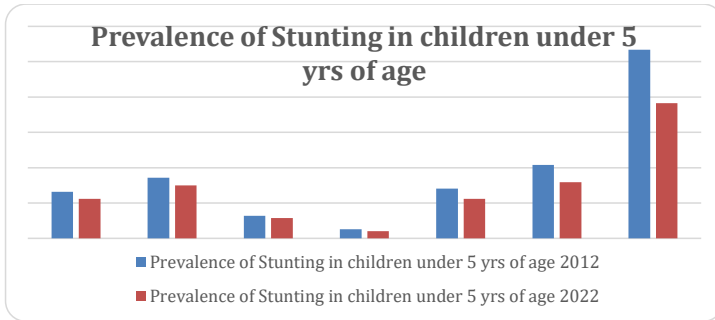
Table 2 - Forms of Malnutrition

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)

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%.

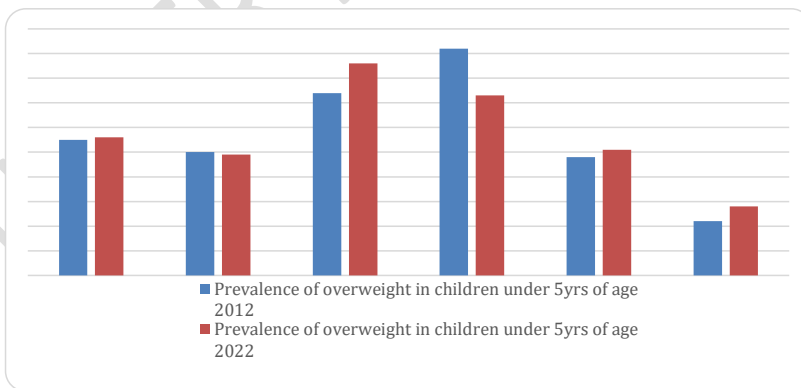
Figure 5 Prevalence of Stunting in children under 5 yrs. of age



The image you provided does not include any information regarding the prevalence of stunting in children under five years old. However, I can inform you that, based on the most recent National Family Health Survey (NFHS-5) conducted in India from 2019 to 2021, 35.5% of children under five years old were stunted. Stunting is a condition in which 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.

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Figure 6 Rate of stunting in children under five years old



The graph you provided displays the prevalence of overweight in children under five years old. Unfortunately, the years aren't labelled on the graph itself. Red bars

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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.

5. Conclusion

The systematic review of FAO's food security measurement tools underscores their critical role in addressing global hunger and malnutrition. The FIES, GFSI, and IPC each have their own strengths and weaknesses, indicating areas where they can be improved to increase their effectiveness and reliability. FIES, developed by the FAO in collaboration with the Voices of the Hungry project, has been praised for its straightforwardness, cost-efficiency, and ability to produce comparable data across various contexts. Its strength lies in its direct measurement approach, capturing individuals' experiences with food insecurity. This tool's simplicity facilitates widespread adoption, allowing for more extensive monitoring of food insecurity trends globally. However, FIES is largely dependent on self-reported data, which can be affected by cultural variations and the tendency for respondents to provide socially desirable answers. This reliance on subjective data may lead to inconsistencies and inaccuracies, particularly when comparing different cultural settings. The GFSI, produced by the Economist Intelligence Unit with support from FAO, offers 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, providing insights into the underlying factors affecting food security. However, its dependence on secondary data sources, which may not always be current or accurately reflect on-the-ground realities, poses a significant limitation. Furthermore, the GFSI's national-level focus may overlook intra-country disparities and localized food insecurity issues, limiting its ability to address specific regional challenges effectively. The IPC is a vital FAO tool that classifies the severity and magnitude of food insecurity in different regions. Its multi-dimensional nature, incorporating various indicators such as food consumption, livelihood changes, and nutritional status, provides a comprehensive view of food security situations. Despite its strengths, the IPC's complexity and resource-intensive implementation can be challenging, particularly in resource-limited settings. Consistent application of the IPC requires significant resources, expertise, and coordination, which may not always be feasible in all regions.

5.1 Recommendations for Improvement

The review identifies several areas for enhancing the effectiveness of FAO's food security measurement tools. Combining qualitative and quantitative data can provide a more nuanced understanding of food insecurity. Improving the timeliness and accuracy of data collection is crucial to ensure that interventions are based on current and reliable information. Additionally, incorporating more localized assessments can help address intra-country disparities and provide targeted solutions for specific regions. Integrating new technologies such as remote sensing and mobile data collection can further improve the precision and efficiency of food security measurements. These technologies can provide real-time data and reduce the reliance on self-reported information, mitigating some of the biases associated with current methods. By leveraging advancements in technology, FAO can enhance the robustness and accuracy of its food security assessments, ultimately leading to more effective interventions and policies to combat global hunger and malnutrition.

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Commented [B14]: Some references are incomplete or poorly cited. For instance, "Ballard, Kepple, & Cafiero, 2013" should include full bibliographic details.

The manuscript frequently mentions the FAO report (2023) but does not provide full details for cross-checking.

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