



THE SYSTEMIC REVIEW OF FOOD SECURITY ASSESSMENT INDICATORS: UNDERSTANDING THE STRENGTHS AND WEAKNESSES OF THE INDICATORS

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ABSTRACT

This paper was conceived to review the concept of food security in terms of assessment by putting together some of the indicators that have been previously used to bridge the existing gap in the utilization of these indicators and ultimately serve as guidance for future studies on food security and for stakeholders particularly those involved in fighting hunger in the world. The findings based on the comprehensive reviews confirmed that the issue of food security in terms of assessment is still a complex and controversial one that no single indicator can capture completely all the known dimensions of food security. However, it was discovered that not much attention has been devoted to the importance of accurate capturing of food security considering its importance in determining the appropriate intervention needed to address food insecurity. It is on this note that the paper concluded by making strong case for adoption of self-report food security assessment based on perception of the concerned people going by its successes in few studies it has been used particularly in the area of food preferences among people which the traditional indicators have not achieved as outlined by FAO.

Keywords: Assessment, Concept, Food security, Indicators, Review

CONCEPT OF FOOD SECURITY

Food security concerns dated back to the early 70s when it was first defined in the 1974 World Food Summit as “availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices” (FAO, 1974). In 1983, FAO expanded its concept to include securing access by vulnerable people to available supplies thus it was then defined as “ensuring that all people at all times have both physical and economic access to the basic food that they need” (FAO, 1983). Subsequently in 1986, the highly influential World Bank report “Poverty and Hunger” expanded the scope of food security further by taking into consideration the dynamism of food insecurity in terms of chronic and transitory food insecurity again redefined food security as “access of all people at all times to enough food for an active and healthy life. By the mid-1990s, food security was recognized as a significant concern, the definition was reinvigorated to give more concern to the safety and the nutritional values of the food being consumed against the traditional focus on the availability of food in terms of quantity, consequently the concept of food security was redefined to include the nutritional values of the consumed food. The World Food Summit of 1996 went further to define food security by segregating it into different levels as individual, household, national, regional and global levels. By these categorization into these five levels, food security is perceived to have been achieved when “all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life” (FAO, 1996). Recently in 2001 shortly after the consummation of millennium development goals (MDGs) that gave recognition to food security as global concerns, food security was defined in the face of growing food insecurity in the world especially in developing countries as “a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (FAO, 2002).

In this context, the new dimensions of dietary diversity and preferences were put into consideration as parts of the conditions necessary to attain a state of food security in such a way that the contents of foods being consumed in terms of the nutrients were put into consideration as far as food security is concerned. It is worthy of note that this version of food security definition put into consideration the physical and economic access to safe, nutritious and sufficient food that meet the dietary and food preferences of the people to live active and healthy life. The National Food Security Programme (NSFP) of Nigeria on its own defined food security as the physical availability of food and ability of individuals to have access or afford same at reasonable costs (NSFP, 2001). On the other hand, United States Department for Agriculture (USDA), Bureau for Africa defined food security as a situation when all people at all times have access to sufficient food to meet their dietary needs for a productive and healthy life (USDA, 1997).

DIMENSIONS OF FOOD SECURITY

According to FAO (2008), food security can be examined under four dimensions namely;

- (i.) **Availability:** This means availability of sufficient food through own production or other means that are sustainable for example in the case of a country that lacks the resources such as arable land for food cultivation,
- (ii.) **Accessibility:** This means that the available is accessible by the households. In other words, the households or individual have both physical and economic access to the available food in right quality and quantity,
- (iii.) **Utilization:** This means ensuring good nutritional outcomes that can be termed nutrition security that is there is sufficient personal hygiene for absorption of the nutrients present in the food. Food utilization entails other factors such as personal hygiene and water sanitation,
- (iv.) **Sustainability:** This is the last dimension of food security that is attained when the above three dimensions can be sustained in a stable manner over a period of time.

The above four dimensions of food security are independent of each other that is, the achievement of one does not translate to achievement of others and food security will not be said to have been attained unless the four dimensions are met. In summary, food availability does not guarantee accessibility the same way accessibility does not guarantee utilization just as all these three do not guarantee sustainability (Arene et al., 2010).

THE NEED FOR FOOD SECURITY ASSESSMENT PRIOR TO INTERVENTION

The need to have deep knowledge of a problem before contemplating solution is not different in the case of food security. Therefore to every problem there must be adequate knowledge of the fundamental causes, the extent of damage and alternative course of actions to solving the problem that is when the depth of the problem is ascertained it will be very easy to solve and this can be achieved when there is adequate facility and knowledge of assessing it. However, in the case of food security the stakeholders currently lack the required capacity on the household food security indicators that are needed for appropriate assessment partly due to lack of coordination, consensus on methodology across institutions through various survey efforts.

FAO estimates for global undernourishment is currently seen as the officially recognized indicator for monitoring the progress of one of the targets of the MDGs (Goal 1) of halving hunger and poverty in the world by 2015 though not totally met especially in the sub-Saharan Africa but a lot of progress have been made as regards this in various parts of the world. The annual release of this estimate by FAO always open gates of criticisms by stakeholders ranging from sources of the data employed in those estimates through the methodological approach to the propriety of the estimates. Food security being multidimensional in nature, the needed data on all its dimensions is rarely available or unreliable when it is available. There are glaring variations in the estimates of food security by institutions through different surveys. While some surveys focus on specific dimension of food security, others are more general that is the scope is often wide depending on the goals and objectives of such surveys.

For example, some surveys may focus on quantitative dimensions of food security while others focus on qualitative dimensions that are based on the perceptions and opinions of the focus group or community. The level at which food security is being examined is equally very important, some surveys focus on capturing food security at international level especially surveys by big institutions like FAO, WHO, World Bank, WFP among other development agencies while others may focus on regional, national, households or even individuals. Carletto (2013) contended that the uses to which various indicators of food security are being put vary as some are used in emergency projects while others are used for monitoring and evaluation purposes and some may be used for strategic planning depending on the needs of such surveys and the prevailing situation. It is also worthy of mentioning that there is independence among dimensions of food security namely; availability, accessibility, utilization, and stability. This is so because achieving one of the dimensions does not guarantee the achievement of others (Arene and Anyaeji, 2010). However, food security will not be deemed to have been attained unless four dimensions are fulfilled. As an illustration, availability is a necessary condition for food security but certainly not a sufficient condition for accessibility just as accessibility is not sufficient condition for utilization (Barrett, 2010). There is no single indicator that can completely capture four known dimensions of food security; therefore there is need for optimal combination of measures and indicators to fully reflect the complexity of food security analysis at any given context (Carletto et al., 2013). Food security measurement is a very important concept just as food security itself because to every challenge knowing the extent and the cause vis-à-vis duration are very crucial in stemming the tide.

Conversely, despite the importance of food security to human survival and maintenance of global peace there had not been progress as far as its measurement that is required to adequately design the needed intervention where there is insecurity in terms of food consumption. There have been concerns and arguments on the accurate measurement standards for food security by the stakeholders in the food sector as to which method exactly can be used to adequately capture the concept of food security in terms of its depth.

REVIEW OF SOME COMMONLY USED FOOD SECURITY INDICATORS

1. Household Consumption Survey (HCS)

This method involves taking weighed food intake surveys, diary recordings and recall interviews. The weighed food intake is subsequently compared with the recommended minimum daily energy requirements with the

households falling below this threshold categorized as food insecure while those above are grouped as food secure (Bello, 2009).

Strengths

- It is very suitable to capture the accessibility dimension of food security,

Weakness

- The major shortcoming of this method is that precise method of food measurement is intrusive meaning there is no acceptable standard for calorie content of the foods,
- The minimum calorie requirements cut off points are not similar as they vary from study to study.

2. Dietary diversity and food frequency scored

This method involves setting minimum required diet or sufficient diet required for safe and healthy living in population group in such that households that fall below this threshold are regarded as food insecure and those above are regarded as food secure say 65 or 70 percent depending of the adopted cut off point. This method has proven to be suitable in capturing the accessibility dimension of food security in developing countries over time mostly in Africa where foods are composed mainly of starchy staples with little or no micronutrients. Ruel (2003) affirmed that most nutrition associated disorders are often not as a result of calorie deficient but low food quality in terms of diversity. Dietary diversity captures diet quality both at household and individual level (Ruel, 2012). This is an important indicator of food security in African countries where the quality of food is often compromised due to various factors such as poverty, low income, lack of education and diseases. It is measured by summation of various food groups consumed over time and the unit for its measurement is called household dietary diversity score (HDDS) which was developed in the 90s by Food and Nutrition Technical Assistance (FANTA) project by a team from Cornell University and revised in 2000. FANTA project used 12 food groups using 24-hour recall period (FANTA, 2003; Ogundari, 2013, Maxwell, 1996).

Strengths

- It captures food nutrients adequacy at individual level and food security at household level,
- It is a potent indicator for monitoring nutrient deficiency level among people,
- The survey is very easy to conduct because it involves simple questions,
- The established relationship between household dietary diversity and household per capita consumption is a plus to this method because food consumption is a good indicator of food security thereby suggesting that dietary diversity can also be a useful indicator,

The dietary diversity is strongly associated with per capita consumption and energy availability (FAO, 2016). A one percent increase in dietary diversity is accompanied by a one percent increase in per capita consumption (Ruel, 2002).

Weaknesses

- There is no fix method of grouping foods since it varies from study to study and from region to region,
- Variations in recall period is also a set-back that is capable of compromising food variability (Drewnowski et al., 1997 cited in Carletto et al., 2013),
- Selection of food items, grouping, portion size, intake frequency, cutoff points and recall period are mostly inaccurate and always give room for bias,
- Household consumption patterns have to be recorded and this may be time consuming and sometimes inaccurate to rely on,
- Recall period to get dietary diversity score benchmark may result in bias in estimates and may even be jerked up especially when external interventions are anticipated which may result to exaggeration in description of the shortfalls.

3. Coping strategies index (CSI)

This is another indicator of food security that enumerates various food consumption related strategies and measures adopted by people during food shortage and this is done through monitoring behavioural approaches of people over a period of time (Obayelu, 2010). The questions asked during this survey generally center on these four rules depending on location, culture and prevailing circumstances;

(a.) **Dietary change:** Eating less preferred but less expensive foods, this question seeks to know if at any time the quality or quantity of food consumption have been compromised due to shortage,

(b.) **Increasing short term food access:** This question seeks to know if the household has resorted to borrowing, receipt of food gifts, eating wild foods, consumption of seed stocks meant for next growing season,

(c.) **Decreasing number of people to feed:** This question seeks to know whether some members of the household have reportedly migrated temporarily to other places as a result of incidence of food insecurity (short term migration),

(d.) **Rationing strategies:** This seeks to ascertain if at some time there has been limiting of food portions especially among women in a matter prioritizing the children and men at the expense of housewives (limiting portion size, prioritizing children/men, skipping meals for a whole day). CSI is commonly used;

- During emergency situation especially in crisis zones to access the extent of food distress among households,
- For targeting purposes,
- To serve as an early warning indicator,
- To monitor the impacts of previous interventions and long term changes in food security status of households.

A weighted CSI is a better predictor of food insecurity vulnerability compared with dietary diversity index (Christiaensen et al. 2000). Maxwell et al. (1999) noted that CSI minimizes the risks of wrong classification of households during food security survey. Data on the frequency of each of the coping strategy is collected, values

assigned. Each strategy adopted by the population group is assigned severity score based on the perception of the people of the area under investigation. The frequency score and severity score are combined to derive CSI, the higher the frequency and number of coping strategies being employed the higher the CSI value and consequently the more the household is food insecure.

Strengths

- It is cost effective and easy to undertake compared with other indicators,
- It identifies the level of vulnerability and trade-offs made in acquisition of foods,
- It is easy to construct using household information with focus group (community) perception,
- It is well suited to assess the short run impact of food shock (transitory food insecurity),
- In addition to measuring food insecurity, CSI can also be a potent tool in monitoring the impacts of various previous food interventions (Senefelds and Polsky, 2005)

Weakness

- It is capable of raising false alarms by creating false responses especially when food aid is expected in emergency situations,
 - It is a relative measure of food insecurity without ability to provide an indication of food gaps,
 - It lacks adequate information to distinguish between pre-crisis (chronic poverty) and food insecurity.
- However, construction of a pre-crisis index using adequate recall techniques may help to overcome these deficiencies to a large extent (FAO, 2016).

Table 1: Hierarchy of coping strategies for a typical rural population

Stages	Responses /actions by households
Stage I (low damaging responses)	- changing in cropping patterns, - reduction in food consumption, - collection of wild foods for consumption, - loans, - Migration.
Stage II (High damaging responses)	- sales of live stocks, - sales of agricultural tools, - consumption of seeds meant for next farming season, - sale/mortgaging of lands, - seeking of credits from money lenders, - Further reductions to the already reduced current food consumption.
Stage III (Destitution)	- begging , prostitution and scavenging, - distress migration, - giving children (especially females) out as housemaids in urban centers or at worse giving them out in early marriage.

Adapted from Corbett J 1998: modified by the authors)

4. Household Economy Rapid Appraisal (HEA)

This provides direct estimates of food gap by establishing the household food balance which matches resources, income and all other food sources converted into kilocalorie or cash equivalent against the minimum requirements in form of food intake and other essential needs converted into kilocalorie or cash equivalent. This method disaggregates households into different wealth groups. Assessment through this approach is undertaken at three different levels;

- (i) A comprehensive HEA,
- (ii) A simplified HEA,
- (iii) A rapid HEA.

Strengths

- It allows insights into the crisis induced changes in food security compared with baseline information that is pre-crisis period,
- It has the capacity to estimate a food deficit taking into account both the impact of shocks on food availability, prices, food and non-food incomes, savings and households coping potentials,
- It helps in identifying potentially damaging coping strategies,
- It allows identification of chronic food insecurity.

Weaknesses

- The information gathering allows for bias because it is through key informant and focus group which may compromise representativeness,
- It requires very high skills and technical know-how to undertake this survey,
- It requires good judgment and technical know-how to quantify qualitative information e.g. coping strategies,

4. Food Poverty or Purchasing power approach

Data from household income and expenditure survey are needed to measure the food poverty. There are three scenarios here;

(i) If the data included food consumption data: In this scenario, food quantities are converted into calorie and other nutrient equivalents using nutrient conversion table deriving estimates for apparent calorie consumption per person per day using household composition data. Subsequently, apparent consumption and reference level (e.g. 2400kcal/person/day) are compared to determine the food poverty.

(ii) If only the food expenditure data were collected: In this scenario, quantitative consumption data were not collected as in the previous case. Consequently, rough estimates of food consumption may be obtained by taking the recorded food expenditures expressing them in cereals equivalent (using market price of cereals) and then convert to calorie equivalent.

(iii) If the consumption of foods other than cereals is significant: In this scenario, the households are found to be consuming other groups of foods other than cereals therefore adjustments must be made for higher costs of these foods (e.g., fish, vegetables, fruits and pulses compared with cereals) if desired results in terms of food consumption is to be expected. However, calorie equivalent of these other foods can be calculated directly if data on both expenditure and prices are available for them so that their quantities in calorie can be estimated otherwise an assumption can be made in such a way that non-cereal foods cost 20 percent more than cereals and cereal-calorie equivalent of these other foods are adjusted downwards in such a way that only 80 percent of the cereal equivalent conversion are taken for the estimation. With figures for calorie intake, shortfalls may be estimated by comparing the calorie converted of the food consumption with the nutritional reference level say 2400kcal/person/day or alternatively the calorie consumption estimates may be used directly to classify the households into various degree of severity of food insecurity (Babatunde et al. 2007a; Babatunde et al. 2007b; Muche et al. 2014; Okwoche and Benjamin, 2012).

Weaknesses

- Lack of knowledge of the types of foods on which expenditures were made. For example, purchased foods may bring few calories but might be expensive even more than those with relatively higher calories,
- The food expenditure may be close to cost of minimum food basket but food consumption may be deficient in terms of energy consumption.

Based on food poverty level, households are categorized into four food insecurity severity level as in Table 2 subsequently.

Table 2: Food insecurity severity classification based on food poverty level

Food poverty level	Calorie consumption/person/day
Food secure	Consistently above the reference level for calorie consumption
Marginally food insecure	Marginally below the reference level
Moderately food insecure	Moderately below the reference level
Severely food insecure	Consistently below the reference level for calorie consumption

Devereux, 2006: modified by the authors

5. Undernourishment

This is the commonly used method by the FAO and the officially recognized indicator for quantifying food security by comparing food availability and requirements at the national level based on set reference threshold of minimum energy requirements. It is measured by estimating per capita dietary energy derived from aggregate food supply and food requirements. The proportion of the population lying below the minimum per capita requirements are the undernourished (Naiken, 2003; Carletto et al. 2013).

Strengths

- It allows for frequent comparison of the energy deficiencies across countries over time (Smith, 2006 cited in Carletto et al. 2013)

Weakness

- It relies solely on poor and unreliable data most often in calculating food/calorie availability (food balance sheets),
- The data sometimes are outdated and as such could not be trusted to give sound judgment across countries considering the dynamic nature of food insecurity.

6. Household food consumption survey

Going by the general consensus that it is somehow impossible to get a survey that can give global undernourishment figures as it is currently being computed by FAO then it becomes more likely that food consumption data from household surveys may be used in its stead to derive the food security status of the households against the FAO cumbersome estimates. This method also involves conversion of foods consumption to calorie and compared with the minimum requirements or cut off points that vary across countries.

Strengths

- It considers the household food consumption patterns and expenditure which are mostly traceable,
- Collection of food quantity alongside expenditure makes it suitable for food security monitoring and analysis.

Weaknesses

- Data on food distribution among members in the households are sometimes cumbersome to collect. This makes the survey to rely on assumption of equitable distribution of food among members which may be wrong.

7. Food Consumption Score (FCS)

This is similar to dietary diversity and is often referred to dietary diversity by some authors or WFP's food consumption score. It is estimated using the frequency with which households consume eight food groups (staples, pulses, vegetables, fruits, meat/fish/egg, milk, sugar and oil) using a 7-day recall period from the date of survey. The consumption frequencies are summed up to yield food group score of 7-0 and multiplied by the weight of the food group depending on the nutritional density of such food groups and this creates what is known as food consumption score. This method is considered more superior to the simple dietary diversity food group count because of inclusion of the frequency of consumption of food groups (Wiesmann et al. 2009; Obayelu, 2010).

Strengths

- It is easy to calculate as compared with other methods,
- The food group consumption frequencies give it an edge over the dietary diversity ordinary food group counts.

Weaknesses

- There is no universally accepted cut-off point for grouping households into either food secure or food insecure,
- This method lacks the requisite ability to demarcate processed and unprocessed foods which is very important in measuring food security status,
- Using 8 food groups is also controversial because the accuracy of food group varies from region to region. Smith and Wiesmann (2007) noted that dietary diversity in sub-Saharan Africa is much lower compared with South Asia therefore there is need to adjust the FCS to reflect the peculiarity of each region as far as dietary diversity is concerned while measuring food security with FCS.

8. Household food insecurity access scale (HFIAS)

This is measured by monitoring the reactions that are linked with the experience of food insecurity in an area over a particular period by summarizing and quantification through surveys. This method was carved out of the popular USDA approach for estimating national prevalence of food insecurity and its measures through the following;

- households access to food,
- The degree of anxiety involved in acquisition of food.

This method uses standard questions in grouping households into either food secure or insecure (Coates et al. 2007). Data on severity and frequency of experience of food insecurity, food shortage over a period of 30-day are collected. HFIAS has proven over time as a potent method of capturing households' food security status.

9. Self-report food security assessment

This method is a newly introduced qualitative method of food security measurement in households. It is captured by asking direct questions from the head of the food unit (household) whether they are food secure, marginally food insecure, moderately food insecure or severely food insecure and their food security situation is captured as such without subjecting it to standard food security indicators. This is a good method of food security measurement considering the fact that from the FAO definition of food security as having attained when the food being consumed meet dietary needs and food preferences, this method is best suited to indicate whether the preference dimension is met or not but not the traditional indicators can capture the preference dimensions of food security. This method also to a large extent will address the sufficiency aspect of food security especially in terms of self-contentment.

However, this method is subject to bias on the part of the households but adequate measures would be taken to ensure they report the true situation which is the actual reflection of their food security status especially by not preempting expectation of food assistance which may result to bias (Hossain et al. 2016, Magana-Lemus et al. 2016).

10. Other relevant surveys used in measuring food security

Apart from the listed indicators above, there are many other surveys that are also being used to capture food security status among households though some of them unlike the previously discussed indicators were not specifically designed to measure food security but the information collected therein have been proven to be suitable in some cases to capture the food security situation among households. Shetty (2015) affirmed that in about 17 years ago food security had well over 450 indicators and over 200 definitions confirming the position of this paper that food security is a very wide scope. While food adequacy questions like other qualitative and subjective indicators tried to capture food security by asking simple questions ranging from "yes or no" to "true or false".

Food adequacy questions (FAQ) like other subjective indicators may become problematic because there may be false alarms through exaggeration by household heads particularly when food aids are being anticipated thus result to giving misleading answers to the questions asked. Non-food factors affecting food security are all those factors that may affect food security status of households such as health and care inputs, feeding practices and access to some hygienic practices such as water and sanitation which are all necessary conditions for the utilization dimension of food security among individuals in the households. Also, there have been many surveys in the past that had been adopted in determining the food security situation at various levels (regional, national, households and individuals).

It is worthy of mentioning that some of these survey instruments were not originally developed to capture food and nutrition security as mentioned but were however used in measuring food and nutrition security owing to the fact that some details contained in such instruments were actually suitable for capturing food security. Some of these surveys collected data on food consumption trends in households, information on undernourishment a key food security indicator as well as estimates of indicators such as food consumption, dietary energy, micronutrient intakes and expenditure shares on foods. This paper will not go into details of how the instruments were used but it will outline few of such surveys as variously used in one time or the other to capture food and nutrition security. The surveys include the following among others as listed below;

- (i.) Household budget surveys (HBS) or simply referred to as income and expenditure surveys (IES),
- (ii.) Living Standards Measurement Study (LSMS) or Multipurpose Integrated Household Survey (IHS),
- (iii.) Demographic and Health Surveys (DHS),
- (iv.) Multiple Indicators Cluster Surveys (MICS),
- (v.) Comprehensive Food Security and Vulnerability Analysis Surveys (CFSVA),
- (vi.) Welfare Monitoring Surveys (WMS),
- (vii.) Core Welfare Indicators Questionnaire (CWIQ),
- (viii.) 24-Hour Nutrition Surveys (24HNS).

CONCLUSION

This review has been able to examine various indicators that have been successfully used to assess food security in the past with the respective dimension of food security that such indicator captured. The paper also concludes that no single indicator can appropriately capture the four dimensions of food security but combinations of these indicators can serve the purpose better. It was further observed that all the indicators that have been popularly used have some weaknesses and strengths depending on the objectives of measuring food security and the prevailing circumstances under which the investigation is being carried out.

The issue of adequate and accurate measurement of food security is not being given the deserved attention and this is making intervention very difficult especially among population groups that are faced with food insecurity threats. It is therefore recommended that there should be synergy between the institutions involved in food security especially the big ones in order to up with an indicator that will lead to central and acceptable means of capturing food security in a population group. It is on this note that this paper is making a strong case for the adoption of self-reported food security going by its objectivity especially in revealing the food preference of people as defined by the FAO in explaining what the food security means.

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