



## Development and Standardization of Household Food and Nutritional Security Index

Dristika Jairu<sup>1\*</sup>, Amardeep Chauhan<sup>2</sup> and V. L. V. Kameswari<sup>3</sup>

<sup>1</sup>PhD Scholar, <sup>2</sup>Professor, <sup>3</sup>Professor and Head, Department of Agricultural Communication, GBPUA&T, Pantnagar-263145, Uttarakhand, India

\*Corresponding author email id: dristika21@gmail.com

### ARTICLE INFO

**Keywords:** Household food and nutritional security, Index development, Reliability, Validity

<http://doi.org/10.48165/IJEE.2023.59430>

**Conflict of Interest:** None

**Research ethics statement(s):**

Informed consent of the participants

### ABSTRACT

An assessment of Household Food and Nutritional Security (HFNS) is important to understand the nutritional state of a household. There are various techniques available for measuring it but they are all in scattered form, making the study tedious. Present research carried out during 2022-23 was aimed at constructing a composite HFNS index that would aid in amalgamating the different techniques to holistically study the HFNS. Initially, four dimensions and 48 indicators were identified and subjected to relevancy testing through judges' opinions which resulted in the selection of 32 indicators. A questionnaire with finalized indicators was administered to 60 households in the non-sampling area. The test-retest and split-half method was followed for testing the reliability of the tool and the reliability co-efficient was 0.84 and 0.87, respectively. Content validity and statistical validity were used to confirm the validity of the tool which was 0.96. The developed tool finally consisted of four dimensions and 32 indicators which are reliable and can produce consistent results while assessing the food and nutritional security of rural households.

### INTRODUCTION

Agriculture and nutrition share a common entry point: "food". Food and nutrition are the byproducts of agricultural activities, but the availability of food from agriculture does not ensure good nutrition. India has done significantly well in the agricultural forefront since independence, it is one of the leading producers of rice, wheat, milk etc., but despite all these accolades; India has ranked 107 out of 121 countries in the recent Global Hunger Index Report with stunting and wasting being one of the major concerns (Von Grebmer et al., 2022). The food security of the country has not directly correlated with the nutrition security of its citizens and the nation at large.

According to the Food and Agriculture Organization (1996), food security is achieved when it is ensured that all people, always, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life. The concept of food

security has undergone metamorphosis with the ever-changing scenario worldwide. Presently, the concept of nutrition has been deemed equivalent to food security due to the intertwined nature of these subjects hence emerging the concept of food and nutritional security. These concerns were previously studied in an overall regional, national, or even global food supply and shortfalls in supply compared to requirements. With due consideration to the bottom-up approach, a more intrinsic view of studying food and nutritional security at the community, local, household or individual level is more rational. While Family is the basic unit of society, the household-level study will be able to speak volumes about the state of food and nutritional security at the household level in particular and society in general. There are various standardized tools, and techniques developed over time to measure food and nutritional security at the household level like the Household Dietary Diversity Score (HDDS), Food frequency, anthropometric indices, Household Food Insecurity and Access Scale (HFIAS), Household Hunger Scale (HHS) etc. (Vhrumuku et al., 2014).

However, with all due understanding of the intricacies of each of them, the household food and nutritional security index was aimed to develop maintaining the essence of these techniques in addition to bringing the various new advances/areas under a composite index. A composite index is a collection of a large number of indicators or variables that are aggregated together to represent the overall performance of a phenomenon over time or space (Chand, 2019). Hence, the index on household food and nutritional security will serve the purpose of bringing the new as well as old indicators under an umbrella to study food and nutritional security, particularly from an agricultural lens.

### METHODOLOGY

The study design consisted of identification of the dimensions and indicators, validating and standardizing them using appropriate statistical methods. Initially, a systematic review of literature from various sources like research articles, journals and thesis repositories was used to identify the dimensions and indicators. The selected indicators were given to 120 judges for judgement using google forms. The degree of relevancy of each indicator had to be given on a three-point continuum. The comparative scores of 3, 2 and 1 were assigned for the “most relevant” (MR), “relevant” (R) and “not relevant” (NR) responses, respectively. Appropriateness of each indicator was defined with relevancy weightage (RW), relevancy per cent (RP) and mean relevancy score (MRS), using the following formulae as followed by Chaudhari et al., (2007); Kumar et al., (2016); Mukherjee et al., (2018); Chandhana et al., (2022) & Gupta et al., (2022).

$$\text{Relevancy Weightage of } i^{\text{th}} \text{ indicator} \\ (RW_i) = \frac{(\text{MR} \times 3) + (\text{R} \times 2) + (\text{NR} \times 1)}{\text{Maximum possible score}}$$

$$\text{Relevancy per cent of } i^{\text{th}} \text{ indicator} \\ (RP_i) = \frac{(\text{MR} \times 3) + (\text{R} \times 2) + (\text{NR} \times 1)}{\text{Maximum possible score}} \times 100$$

$$\text{Mean Relevancy Score of the } i^{\text{th}} \text{ indicator} \\ (MRS_i) = \frac{(\text{MR} \times 3) + (\text{R} \times 2) + (\text{NR} \times 1)}{\text{Number of judges responded}}$$

Thereafter, the relevant indicators were screened for testing reliability and validity in a non-sampled area with a total of 60 randomly selected respondents.

Reliability was measured with the test-retest (coefficient of stability) and split-half (coefficient of equivalence) method (Wuensch, 2012; Naik et al., 2019; Bardhan et al., 2023). The test-retest measures the correlation between scores on two administrations of the same form of test, separated by a fortnightly. In the split-half method, the responses for the odd and even-numbered items were obtained and the scores of both sets were used to calculate the coefficient of correlation.

Further, the reliability coefficient of the whole test was computed using the Spearman-Brown prophecy formula.

$$r_{xx} = \frac{2r_{hh}}{1+r_{hh}}$$

Where  $r_{hh}$  is the split-half reliability coefficient.

The validity of the scale was assured by assessing the content validity and statistical validity. Content validity is the representativeness or sampling adequacy of the content of a measuring instrument (Kerlinger, 2007). Content validation was carried out by subjecting the selected indicators to the judge's opinion.

Further, the data was subjected to statistical validity using the formulae.  $v = \sqrt{r_{xx}}$

Where  $r_{xx}$  is the whole test reliability value.

## RESULTS AND DISCUSSION

### Finalization of dimensions and indicators

With due consideration to the myriad literature, household food and nutritional security is defined as a situation when a household always has physical and economic access to nutritious food with proper utilization of the available food to meet their dietary requirements for a healthy life. The definition has four distinct dimensions that have been highlighted viz., availability, accessibility, utilization, and stability. These are key dimensions to study food and nutritional security (Jatav et al., 2022). Each of these dimensions is described as; a) availability is the extent to which food is within reach of the household members and the household in general, both in terms of sufficient quantity and quality; b) accessibility is the ease with which one can acquire nutritious foods within adequate reach of their household; c)utilization is the utility pattern and practices followed by the household for the consumption of nutritious foods; and d)stability is the volatility and affordability of the various food items in the particular household (Pieters et al., 2013). In addition to these dimensions, there were 48 indicators identified for the study which were processed by seeking response from the 120 judges out of which 60 judges responded. After duly recording their judgments, the relevancy analysis was undertaken.

### Relevancy test

Considering the calculated values, the relevancy weightage of the indicators ranged from 0.67 (minimum) to 0.96 (maximum), the relevancy percentage ranged from 67.2 (minimum) to 96.1 (maximum) percentage mean relevancy score ranged from 2.02 (minimum) to 2.88 (maximum). The indicators with their relevancy percentage, relevancy weightage and mean relevancy scores having a relevancy weightage of more than 0.81 relevancy percentage of more than 81.1, and a mean relevancy score of more than 2.43 was considered for the final selection of statements as shown in Table 1. Accordingly, 32 out of the 48 indicators could meet the set criteria of the study.

### Reliability and validity test

In the study, reliability was measured through test-retest and split-half methods. The correlation coefficient (r) of the test-retest method between two administrations with a time gap was found to be significantly higher (0.842) whereas the correlation value of the split-half method was also significantly high (0.873). Thus, the coefficient of stability and the coefficient of equivalence are considerably high as per the test-retest and split-half methods.

**Table 1.** Selected statements based on Relevancy Weightage (RW), Relevancy Percentage (RP) and Mean Relevancy Score (MRS)

S.No.	Indicators	RW	RP	MRS
Availability				
1.	Are cereal foods available in your household?	0.889	88.9	2.667
2.	Is there an availability of vegetables in your household?	0.878	87.8	2.633
3.	Is there an availability of seasonal fruits and dry fruits in your household?	0.850	85.0	2.550
4.	Do you have milk and milk products available in your household?	0.894	89.4	2.683
5.	Are non-vegetarian food items available in your household?	0.839	83.9	2.517
6.	Are you raising livestock in your household for consumption purposes?	0.811	81.1	2.433
7.	Do you have a kitchen garden?	0.822	82.2	2.487
Accessibility				
8.	What is the average monthly expenditure of your household on food items?	0.911	91.1	2.733
9.	Are the fruits available at your home accessible for all the household members?	0.872	87.2	2.617
10.	Do all the household members have access to the vegetables and cereals available in your household?	0.911	91.1	2.733
11.	Is the non-vegetarian food available at your household accessible to all the household members?	0.822	82.2	2.733
12.	How often do you buy food items from the neighbourhood stores?	0.828	82.8	2.483
13.	Are you purchasing your food items from the farmers' market?	0.844	84.4	2.533
14.	How often are you purchasing perishable food items?	0.833	83.3	2.500
Utilization				
15.	Is your household consuming a diverse diet comprising of different food groups like cereals, millet & pulses, fruits & vegetables, milk & animal products, fats & oils?	0.961	96.1	2.883
16.	Are you aware of the significance of each food group?	0.861	86.1	2.583
17.	Does your daily consumption include traditional diets like fermented foods, native tubers green leafy vegetables, etc.?	0.894	89.4	2.683
18.	Do you consume processed food items, and exotic food items daily in addition to the traditional diets?	0.811	81.1	2.433
19.	Are you washing the vegetables before cutting them?	0.833	83.3	2.500
20.	Do you peel vegetables thinly?	0.817	81.7	2.450
21.	Are you likely to cook food in a covered pan?	0.817	81.7	2.450
22.	How many meals do you and your household members consume in a day at your household?	0.889	88.9	2.667
23.	How frequently do you consume food items from different food groups?	0.850	85.0	2.550
24.	Are your food choices dependent on the nutritional value of the food item?	0.911	91.1	2.733
25.	Does the easy availability of the food item determine your food choices?	0.856	85.6	2.567
26.	Do you choose a particular food item just because it keeps you healthy?	0.894	89.4	2.683
27.	Have you brought any changes to your eating habits due to the changing market trends?	0.861	86.1	2.583
Stability				
28.	Have you observed variations in the prices of different food items?	0.911	91.1	2.733
29.	Are fruits and vegetables frequently affordable for your household consumption?	0.889	88.9	2.667
30.	How frequently affordable are the non-vegetarian food items for your household?	0.889	88.9	2.667
31.	Does the seasonal change disrupt your supply of food items?	0.878	87.8	2.633
32.	Do you think poor transport facilities are the reason for the poor supply of food?	0.850	85.0	2.550

Therefore, the index was found reliable. The reliability coefficient of the whole test as per the Spearman-Brown prophecy formula was calculated to be 0.932. This value re-emphasized the high reliability of the index.

The validity of the test was confirmed with the help of content validity as well as statistical validity. The indicators selected had a relevancy weightage of more than 0.81, a relevancy per cent of more than 81.00 per cent and a mean relevancy score of more than 2.43; hence, the content validity of the index was assured. The statistical validity was found to be 0.965 indicating high validity of the developed household food and nutritional security index (Table 2). The reliability and validity test has significantly increased the consistency and objectivity of the index, hence ascertaining the potential of the index. Subsequently, Naik et al., (2019) & Chandhana et al., (2022) followed a similar methodology to develop indices to assess the farmers' participation in effective canal irrigation management and sunflower farmers' perception of

public-private extension systems respectively. Likewise, Sharma & Singh (2017) studied the state-wise food security index using indicators related to food availability, food stability and food accessibility. Similarly, Adjimoti & Kwadzo (2018) also studied the household food security status in rural Benin with the help of the Food Security Index (FSI) by considering several indicators/dimensions like food availability, food accessibility, food affordability, food utilization and food stability.

**Table 2.** Reliability and validity of the tool

Particulars	Tests	Values
a) Reliability	Test-retest	0.842*
	Split-half test	0.873*
	Whole-test	0.932*
b) Validity	Statistical validity	0.965*

\*Significant at 5% level

In the present study, the final developed Household Food and Nutritional Security Index consists of four dimensions and 32 indicators, these will be measured in ratio scale and qualitative using both ordinal and nominal scales. The standardized indicators will be able to give a holistic view of the food and nutritional security of a household.

### CONCLUSION

The Household Food and Nutrition Security Index developed and validated in the present study provides a comprehensive outlook rendering a systematic and standardized approach to develop statistically sound measures along with conducting a proper content validation of the research tool for measuring the food and nutritional security of households. Furthermore, the empirical data, which will be collected from this household food and nutritional security index, will provide an understanding of the status of the food and nutrition in a household in addition to forming a foundation for studying the root cause of food and nutritional insecurity in various households and will assist in the formulation of strategies to combat the situation. The developed tool can be useful to researchers, policymakers and concerned organizations in taking necessary steps to improve household food and nutritional security that would in turn improve the food and nutritional security of the nation. Hence, the developed tool can be effectively utilized for future research in similar contexts and broader purviews.

### REFERENCES

- Adjimoti, G. O., & Kwadzo, G. T. (2018). Crop diversification and household food security status: evidence from rural Benin. *Agriculture and Food security*, 7(82), 1-12.
- Bardhan, T., Bhardwaj, N., Kashyap, S. K., Kameswari, V. L. V., Kuswaha, G. S., & Dey, A. (2023). Development of multi-dimensional scale to measure attitude of farmers towards conservation agricultural practices. *Indian Journal of Extension Education*, 59(1), 127-130.
- Chand, P. (2019). Construction of a composite index. In: Nikam, V., Jhajhira, A., & Pal, S. (eds.), *Quantitative methods in social sciences* (pp. 351-360). National Institute of Agricultural Economics and Policy Research, New Delhi.
- Chandhana, B., Kumar, G. D. S., & Sengar, R. S. (2022). Development of scale to measure sunflower farmers' perception on public and private extension systems. *Indian Journal of Extension Education*, 58(3), 197-200.
- Chaudhari, R. R., Hirevenkanagoudar, I. V., Hanchinal, S. N., Mokashi, A. N., Katharki, P. A., & Banakar, B. (2007). A scale for measurement of entrepreneurial behaviour of dairy farmers. *Karnataka Journal of Agricultural Science*, 20(4), 792-796.
- Food and Agriculture Organization. (1996). *World Food Summit-Declaration on World Food Security and World Food Summit Plan of Act*. <https://www.fao.org/3/w3613e/w3613e00.htm>
- Gupta, S. K., Nain, M. S., Singh, R., & Mishra, J. R. (2022). Development of scale to measure agripreneurs attitude towards entrepreneurial climate. *Indian Journal of Extension Education*, 58(2), 153-157.
- Jatav, S. S., Nayak, S., Singh, N. P., & Naik, K. (2022). Measuring and mapping food security status of Rajasthan, India: A district-level analysis. *Frontiers in Sustainable Food System*, 6(831396), 1-17.
- Kerlinger, F. N. (2007). *Foundation of Behavioural Research*. Rinehart and Winston. Inc. New York.
- Kumar, R., Slathia, P. S., Peshin, R., Gupta, S. K., & Nain, M. S. (2016). A test to measure the knowledge of farmers about rapeseed mustard cultivation. *Indian Journal of Extension Education*, 52(3&4), 157-159.
- Mukherjee, A., Singh, P., Satyapriya, Rakshit, S., & Burman, R. R. (2018). Development and standardization of scale to measure farmer's attitude towards Farmers' Producer Company. *Indian Journal of Extension Education*, 58(4), 84-90.
- Naik, A., Shivamurthy, M., & Chandre Gowda, M. J. (2019). Instrument to assess the farmers' participation in effective canal irrigation management. *Indian Journal of Extension Education*, 55(2), 13-19.
- Pieters, H., Guariso, A., & Vandeplass, A. (2013). *Conceptual framework for the analysis of the determinants of food and nutritional security*. Centre for Institutions and Economic Performance and Department of Economics, KU Leuven, Belgium.
- Sharma, P., & Singh, A. K. (2017). Association of state-wise food security index with climatic factors in India: evidence from state-wise panel data. *Journal of Global Agriculture and Ecology*, 6(3), 196-205.
- Vhurumuku, E. (2014, February 17-25). *Food security indicators [Workshop]*. Integrating nutrition and food security programming for emergency response Workshop, Nairobi, Kenya. <https://www.fao.org>
- Von Grebmer, K., Bernstein, J., Resnick, D., Wiemers, M., Reiner, L., Bachmeier, M., Hanano, A., Towey, O., Ní Chéilleachair, R., Foley, C. Gitter, S., Larocque, G., & Fritschel, H. (2022). *Global Hunger Index: Food Systems Transformation and Local Governance*. Welthungerhilfe, Bonn and Concern Worldwide, Dublin. <https://globalhungerindex.org>
- Wuensch, K. L. (2012). *A Brief Introduction to Reliability, Validity, and Scaling*. Retrieved August 30, 2023, from <https://core.ecu.edu/wuensch/MV/FA/Reliability-Validity-Scaling.docx>