Research Article

Indian Journal of Extension Education
Vol. 59, No. 4 (October–December), 2023, (97-102)

ISSN 0537-1996 (Print)
ISSN 2454-552X (Online)

Unveiling the Food and Income Insecurity among Farm Households of Lucknow, Uttar Pradesh

S. C. Ravi[1]*, Maneesh Mishra[1], Rohit Jaiswal[1], Arnab Roy[2], Shantanu Kumar Dubey[3] and T. Damodaran[1]

[1]ICAR-Central Institute for Subtropical Horticulture, Rehmankhera, Lucknow, Uttar Pradesh, India
[2]Sam Higginbottom University of Agriculture, Technology and Science, Prayagraj, Uttar Pradesh, India
[3]ICAR-Agricultural Technology Application Research Institute, Kanpur, Uttar Pradesh, India
*Corresponding author email id: ravisc3@gmail.com

ARTICLE INFO

Keywords: Food insecurity, Per capita income, Wealth index, Calorie intake, Decision tree, Farm households

http://doi.org/10.48165/IJEE.2023.59420

Conflict of Interest: None

Research ethics statement(s): Informed consent of the participants

ABSTRACT

The study was conducted during 2022-23 to assess the level of food insecurity and income status among farm households. Data from 474 farmers through personal interview method were collected. Agriculture was the primary occupation for most households followed by off-farm activities. Average per capita annual income (Rs. 1,00,073) was lower than the national average. The per capita annual income was Rs. 73,303, Rs. 93,256 and Rs. 1,44,456 for marginal, small, and medium farmers, respectively. About 47 per cent of the expenditure was made on consumption. A comparison of calorie intake to recommended calorie intake indicated that food insecurity was prevailing among 26 percent of the farmers. The major contribution to calorie intake was from cereals, the consumption of vegetables and fruits was low. A decision tree model using machine learning algorithms was used to identify the factors influencing food security. Per capita income, family size, consumption expenditure, social participation, and land holdings had significant importance in classifying the households as food secure and insecure. Diversifying farm activities and creating additional opportunities in rural areas, teaching households about balanced diets, promoting home gardening, and institutional policies to improve food security may be the strategic points.

INTRODUCTION

Food security is still difficult to achieve in many agriculturally dependent rural areas of Asian and African countries. Food insecurity is a worldwide problem that threatens every country, especially developing countries (Gebre, 2012; Zakari et al., 2014). Indian agriculture has made tremendous achievements, and now India is not only a self-sufficient country with regard to food grain production but also a leading exporter. Despite this achievement, India is now ranked 107th out of 121 nations on the Global Hunger Index for the year 2022, however there are some ambiguity in its methodology (PIB, 2022b). Food availability is important, but so is a family's financial stability so that they can afford to buy food (Dhamija et al., 2021). Although food production is sufficient, poverty remains a significant barrier to food security in many rural areas. The changes brought about by NFSM and RKVY-RAFTAAR, before and after launch revealed a significantly higher socio-economic impact on the beneficiary farmers (Vijayan et al., 2022; Vijayan et al., 2023). Uttar Pradesh is one of the most agriculturally important states in India. According to the National Family Health Survey (NFHS-4) conducted in 2015-16, around 35 per cent of households in rural Uttar Pradesh experienced food insecurity to varying degrees which is mainly attributed to the poverty level. However, in recent days the State has made progress and 3.4 crore people escaped from multidimensional poverty (TNN, 2023). Lucknow is one of the major mango fruit belts in Uttar Pradesh.

Received 29-08-2023; Accepted 26-09-2023

Mango cultivation is the major source of livelihood for the farmers, but its contribution to sustaining livelihood has diminished over the years (Mishra et al., 2019). Unemployment and under employment have made food insecurity worse. Without a reliable source of income, it can be difficult for people to buy enough food to sustain themselves and their families. Firsthand knowledge of farmers' current status of income, employment and food insecurity is vital to developing strategies to increase farmers' income and food security. Food and income insecurity can be studied at various levels, i.e., global, national, regional, and household levels, but the food insecurity at the national level does not necessarily explain the food insecurity among households (Rautela et al., 2020). Knowing the causes of food insecurity allows for the identification of at-risk households and the development of more effective strategies to reduce poverty. Despite growing attention to the issue of food security, little is known about the socioeconomic factors, and differential significance of various ecosystems' contribution and knowledge of users (Rejula et al., 2017) that lead to food insecurity on a household level in rural areas. In light of the scarcity of information on the level of food insecurity among local households, this investigation was undertaken to answer two research questions: what is the level of food insecurity and income status among the rural households of the area, and what are the factors contributing to food insecurity? This study defines key indicators to measure the progress made to reduce food insecurity.

METHODOLOGY

The baseline survey was conducted in three villages (Dhakhava, Bhanpur and Hasnapur) of Lucknow district. Purposive sampling was adopted in selection of the villages as the interventions are planned to reduce food and income insecurity. Random sampling was employed for the selection of respondents. Data were collected from 474 farm households through personal interview method. Wealth index was constructed using the variables concerning asset ownership (Smits & Steendijk, 2015; Aditya et al., 2019). In this study, principal component analysis was used for the construction of weights as used by Balaganesh et al., (2020) & Mishra et al., (2023). Based on the computed wealth index, the households were categorized as high, medium and low using quantile approach. Howe et al., (2009) reported that quantile approach for categorization was the most preferable approach. The quantity of each food item consumed by the household was converted into its calorie content by multiplying all respective food items (kg) by the corresponding food energy content, referring to Longvah et al., (2017). This was further converted into per capita calories by dividing the estimated total household calorie intake by the adjusted household size in adult equivalent (consumption unit). A household whose daily per capita calorie intake exceeded the recommended level (2400 kcal per capita per day) was regarded as food secure, whereas others were considered food insecure (Bellundagi et al., 2020). The decision tree classification methodology was employed for the development of prediction algorithms pertaining to a certain target variable (Song & Ying, 2015; McCordic et al., 2022). The proposed methodology involves the classification of the respondents into secure and insecure households that resemble branches, forming an inverted tree structure. This structure consists of a root node, internal nodes, and leaf nodes. The decision tree model was created using the "rpart" tool in the R programming language. The dataset was partitioned into separate sets for training and testing purposes. The model was constructed using a train dataset and subsequently predicted and evaluated for its accuracy in predicting using test dataset. Accuracy in a decision tree model is the ratio of correctly predicted instances to the dataset's total occurrences. For more comprehensive evaluation of the model's performance precision, recall, F1-score, and ROC-AUC were used (Chang et al., 2022).

RESULTS AND DISCUSSION

Occupational structure (Table 1) is indeed one of the underlying causes of food insecurity because incomes from different occupations have a positive effect on food security (Barrett, 2010). The per capita annual income and expenditure details of the households are represented in Table 2. It was noticed that agriculture was the major primary occupation for all three categories of farm households (> 95%). Agriculture income contributes around 43 and 61 per cent of total income respectively in case of small and medium farmers. Though agriculture was the major primary occupation for marginal farmers its contribution to total income was just 22 per cent and was less than income from off farm activities as well as daily wage income (27% each). The contribution of agriculture in the sustenance of livelihood of marginal and farmers was marginalized. This is because of low agriculture land and migration of farmers to nearby cities. It was noticeable that more than half of the marginal (63%) and small (52%) farm households were also working as farm laborers to meet their livelihoods. The off farm activities such as livestock rearing and nursery contributed to about 26 per cent of the total income in case of marginal and small farmers. Daily wage contributed to 27 and 16 per cent of total income in case of marginal and small farmers, respectively. The per capita annual income was Rs. 1,00,073 for all the farm households in totality was less than the national average. The National Statistical Office said the estimated annual

Table 1. Occupational details of the households (%)

Particulars	Marginal		Small		Medium		Overall	
	Primary	Secondary	Primary	Secondary	Primary	Secondary	Primary	Secondary
Agriculture	95	5	99	1	99	1	97	3
Off farm activities	0.5	68	0	85	1	92	0.50	79
Agriculture labour	4	63	1	52	0	30	2	51
Daily wages	1	53	0	55	0	52	0.25	53
Job	0	6	0	6	1	7	0.25	6
Petty shop	0	8	0	6	0	7	0	7

Table 2. Per capita annual income and expenditure pattern of the households

Particulars	Marginal	Small	Medium	Overall	F value
Income (Rs.per capita per annum)					
Agriculture	15949(22)	39842(43)	88781(61)	44273(44)	160.43**
Off farm activities	19690(27)	24105(26)	27776(19)	23303(23)	10.66**
Agriculture labour	10656(15)	8828(9)	8153(6)	9415(9)	0.23^{NS}
Daily wage	20085(27)	14468(16)	12079(8)	16177(16)	13.41**
Salary	3465(5)	3402(4)	5585(4)	4088(4)	1.32^{NS}
Petty shop/Business	3459(5)	2611(3)	2081(1)	2818(3)	0.72^{NS}
Total income	73,303	93,256	1,44,456	1,00,073	145.21**
Expenditure (Rs. per capita per annum)					
Consumption expenditure	23990(50)	23219(46)	23152(44)	23532(47)	0.24^{NS}
Non consumption expenditure	24178(50)	27226(54)	30000(56)	26745(53)	6.30**
Total expenditure	48,168	50,445	53,152	50,277	1.16^{NS}

Note: 1. Figures in parenthesis indicate percent to total and 2. ** indicates significance at 1 and 5 percent, respectively.

per capita income (net national income) at current prices for 2022-23 stands at Rs. 1,72,000 per annum (PIB, 2023). As per the Situation Assessment Survey (SAS), average monthly income per agricultural household in Uttar Pradesh was Rs. 96,732 per annum (PIB, 2022a) for agricultural year July 2018- June 2019. However, there was a huge significance difference in annual per capita income across different categories. Per capita yearly income was Rs. 73,303 for marginal farmers, Rs. 93,256 for small farmers and Rs. 1,44,456 for medium farmers in the study area. The per capita income increased with the increased land holdings. According to the findings of Sharma et al., (2018), the average annual income of a rural household in Uttar Pradesh was Rs. 96,199.

The per capita annual expenditure of the farm households in the study area was Rs. 50,277. The per capita annual expenditure was more in case of medium farmers (Rs. 53,152) and low in case of marginal farmers (Rs. 48,168). The per capita income as well as expenditure among various categories of households was significantly different. Of the total expenditure, consumption expenditure was about 47 per cent for all categories of farm households which was on a higher side. This is worrying as farmers are spending more on consumption than on saving or investment, which affects the long term sustainable economic growth. The higher per cent of consumption expenditure besides obtaining the subsidized food grains from Public Distribution System can be attributed to the lower income of the farmers. There was no significant difference in the consumption expenditure across the different farm categories. The share of consumption expenditure to total income was high for marginal farmers.

Wealth of the households

It was evident from the analysis that overall 31 per cent of the households belonged to the low category, while 35 per cent belonged to the high category of the wealth (Figure 1). About 58 per cent of medium farmers belonged to high wealth category, as against 33 per cent and 19 per cent in the marginal and small farmer categories, respectively. The wealth of the households across different categories of farmers had significant association. The percent of households belonging to the high category of wealth increased with the size of land holdings. The results are in line with the findings of Swathi Lekshmi et al., (2008).

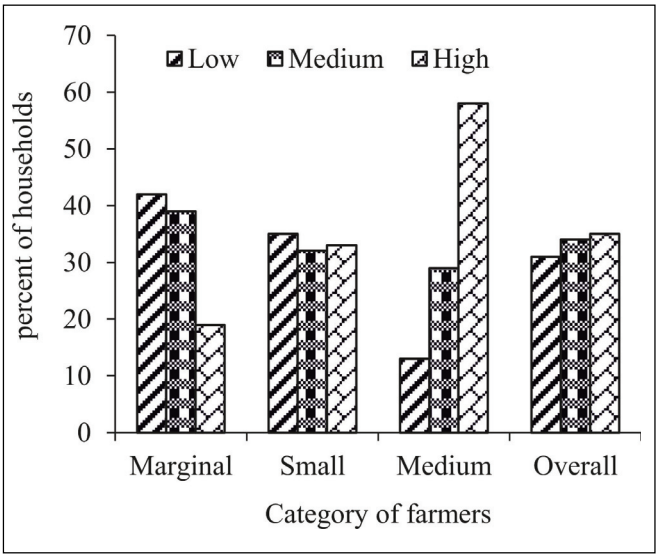

Figure 1. Wealth status of the households

Extent of food insecurity among the households

The information on how different socio-economic groups consume calories from various food categories are depicted in Table 3. Cereals provide the highest energy to households (1310.68 kcal/CU/day) followed by edible oil (385.90 kcal/CU/day), milk and milk products (222.22 kcal/CU/day), and pulses (125.53 kcal/CU/day). Food system in the area is cereal based (mainly rice and wheat) and cereals were the main source of calorie intake across all category of farm households. According to National Institute of Nutrition, a healthy diet needs to include nearly 500 grams of vegetables and fruits accounting for at least eight per cent of the daily calorie intake. However, the consumption of vegetables and fruits was 376.66 grams per day and contributed to just 4.57 per cent of total calorie intake. Mango is the major crop in this area and the area available for vegetable production is very less and hence, there is a need to provide interventions in the form of nutria garden with production of diversified vegetable and fruit crops. About 150 m^2 area of planned nutrition garden is appropriate to medium size family consisting 5 to 7 members (Singh et al., 2019). Meenakshi et al., (2019) found that providing grow bags

Table 3. Comparison of dietary intake and level of food insecurity among the households

Particulars	Marginal	Small	Medium	Overall	F value
Calorie consumed from different food items (kcal/CU/day)					
Cereals	1315.73(11.85)	1281.48(11.54)	1329.17(11.98)	1310.68(11.81)	4.41*
Pulses	146.28(1.36)	139.34(1.29)	153.01(1.42)	146.47(1.36)	4.06*
Edible oil	384.06(0.90)	386.79(0.91)	387.75(0.91)	385.90(0.91)	0.06^{NS}
Nuts & Dry fruits	25.26(0.14)	27.88(0.16)	29.74(0.17)	27.31(0.16)	2.27*
Milk & milk products	206.82(6.55)	218.54(6.88)	247.54(7.75)	222.22(7.00)	6.94**
Meat & animal products	36.78(0.83)	35.55(0.76)	29.37(0.66)	34.22(0.76)	2.31^{NS}
Sugar & Junk foods	153.99(1.16)	170.88(1.29)	166.82(1.30)	162.35(1.24)	5.10**
Vegetables	95.22(10.61)	91.23(10.77)	95.64(10.66)	94.28(10.67)	2.23^{NS}
Fruits	16.89(0.59)	16.44(0.60)	17.43(0.72)	16.94(0.63)	0.21^{NS}
Spices	23.03(0.47)	22.59(0.46)	21.94(0.46)	22.58(0.46)	0.51^{NS}
Others	6.58(0.17)	7.14(0.18)	7.65(0.19)	7.05(0.18)	6.39**
Total calorie intake	2410.64	2397.87	2486.06	2430.00	7.26**
Food insecurity (%)	29	27	21	26	-

Note: 1. **-Significant at one per cent and NS- Non significant; 2. Figures in parenthesis indicates quantity consumed in kg per month

and vegetable seeds improved nutritional status. Apart from this, the consumption of milk and milk products is also less than the recommended intake.

Total calorie intake from consumption of all food items was higher in the medium farm farmers (2486.06 kcal/CU/day), followed by marginal farmers (2410.64 kcal/CU/day) and low in case of small farmers (2397.87 kcal/CU/day). The average calorie intake was 2430.00 kcal/CU/day in the study area. There was no significant difference across the groups in consumption of edible oil, meat and animal products, vegetables, fruits and spices but there was a significant difference in consumption of other food items across the groups. Majority of the farm households met the minimum calorie intake of 2400 kcal/capita/day as recommended by the ICMR for rural households. The food security analysis of the farm households revealed that, 74 per cent of the total farm households were food secure. About 21 per cent of medium farmers, 27 per cent of small farmers, and 29 per cent of marginal farm households were food insecure. Food security of the marginal farmers was poor. Gautam & Jha (2022) also reported that food security was low among marginal households. The study indicated that food security is still prevalent among 26 per cent of the farm households and this needs to be addressed. Apart from this, the lower level of income of the farmers in the region may affect the food security of the households in long run.

Decision tree classification model – factors influencing food security

A machine learning algorithm (decision tree classification model) was used to find out what factors affect the food security of farm households. According to Chodur et al., (2018), decision trees offer multiple advantages compared to standard regression approaches, particularly in terms of speed and the quality of outcomes. The dependent variable was a '0' or '1' variable, with '0' representing food insecurity and '1' representing food security. The structure of the decision tree suggests the class (either 0 or 1) based on the values of different conditions and attributes. The model employed a combination of continuous variables, including family size, land holdings, per capita income and expenditure, and education attainment, as well as categorical variables for age, gender, social participation, livestock possession, and wealth. The model was constructed using the training dataset, and subsequent predictions were made using the test dataset. The accuracy of the model was assessed, revealing an 80 per cent accuracy rate. The precision of the model's performance was 0.90, indicating the proportion of correctly predicted positive instances out of all instances predicted as positive. The recall of the model's performance was 0.84, indicating the proportion of correctly predicted positive instances out of all actual positive instances. The F1-score achieved a value of 0.87, while the area under the curve was 0.70 indicating moderate discriminating power of the model. All of the conducted tests suggest that the model was well-suited for the given data. Predicting outcomes under multiple scenarios is made possible by the decision tree model (Figure 2). Each leaf in the tree represents a different possible outcome, and the nodes themselves represent conditions. Following the tree's branches leads to a prediction of whether or not a person is food secure. Each branch of the tree is based on a different set of situations or traits. The findings revealed that the outcome is influenced by food spending, family size, and social participation in households with a per capita income of less than Rs. 66,414 per year.

The size of the family had a negative effect on food security, but food spending and social activity both had favorable effects. Growing numbers of people have a ripple effect on global food production, threatening food security. Increased family size with less active household members, increases dependency and consumer spending thus reduces the ability to provide enough food for a household (Sugandh & Tawheed, 2022). Social participation in FPOs and SHGs can positively impact food security by enhancing agricultural productivity, income, knowledge, and access to resources, while also promoting sustainable practices, risk management, and community support. The influence of social participation on the outcome of individuals with an income below Rs. 66,414, expenditure on food below Rs. 22,629, and a family size of 4.5 or greater is an additional factor to consider. Households who possess the aforementioned criteria and engage in social

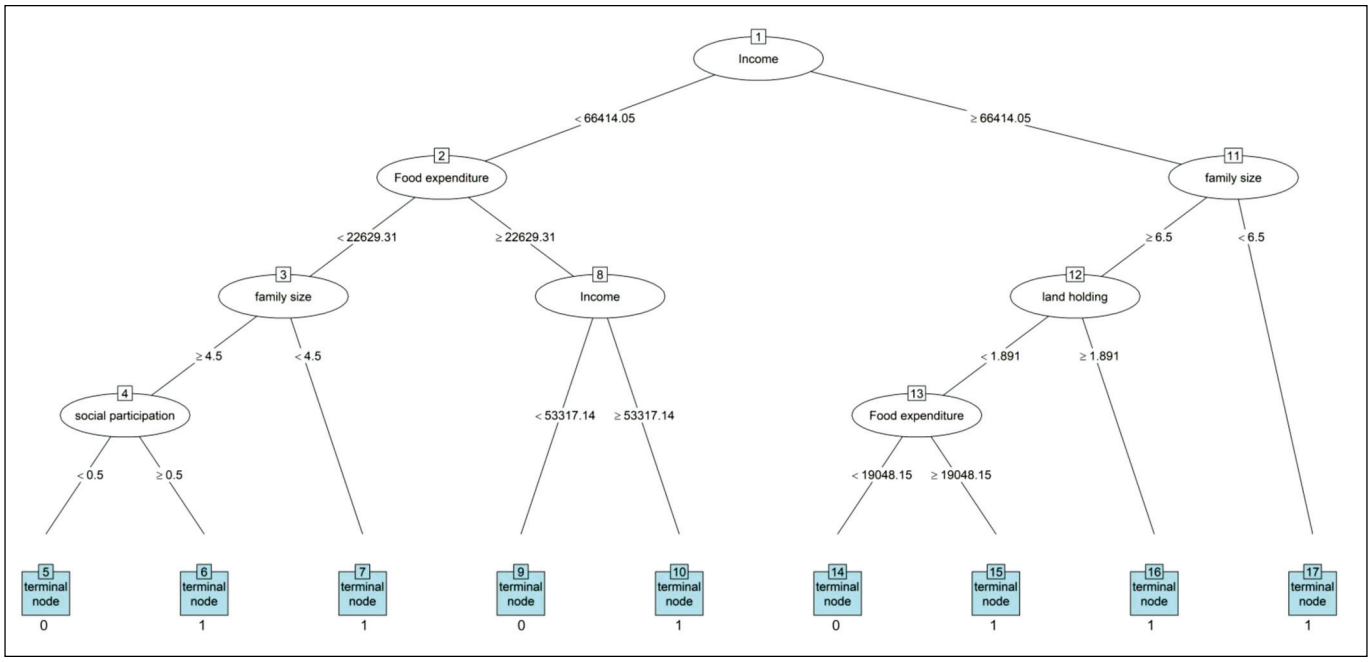

Figure 2. Decision tree model depicting the factors influencing food security of the farm households in the study area
Note: '0' indicates food insecurity and '1' indicates food security.

participation have positive prediction towards food security else food insecure. This observation highlights the significance of social participation among farmers with low income. However, households with a family size of fewer than 4.5 exhibited food security. Conversely, in the event that the amount spent on food exceeds Rs. 22,629, the final result is again contingent upon the individual's income. If the income is below Rs. 53,317, the forecast yielded a negative outcome.

For those with an income of Rs. 66,414 or more, family size and land ownership are significant factors. If family size is greater than or equal to 6.5 and land holding is less than 1.89 acres, the outcome is influenced by food expenditure. In such cases, those with food expenditures below Rs. 19048 were predicted to be food insecure. On the other hand, families with an income greater than Rs. 66,414 and a family size greater than 6.5, as well as a land holding greater than 1.89 acres, were predicted to be food secure. In essence, increased land holding provides opportunities for diversification and economies of scale, thereby enhancing both food and economic security. In recent years, land fragmentation caused by family separation has worsened food security. Families with a household income of at least Rs. 66,414 and a family size less than 6.5 were predicted as food secure.

CONCLUSION

Most farm family subsisted on farming. Per capita income was poor, especially for marginal and small landholders. Mango cultivation was the dominant agricultural pursuit in the region, although its income-contributing capacity was jeopardized by various challenges necessitating the development of additional income-generating avenues within rural settings. Approximately 47 per cent of household spending went to consuming. The sample respondents' average per capita calorie intake was 2430 kilocalories, almost meeting the recommended daily amount of 2400 kcal/ capita/day. However, 26 per cent of respondents were food insecure. There is a need for educating households about balanced dietary habits to meet basic nutritional requirements. It is prudent for the area to encourage kitchen gardening that features a wide variety of fruit and vegetable crops. The study's findings highlighted that factors such as per capita income & expenditure, landholding size, family size and social participation were key influencers of food security.

REFERENCES

Aditya, K. S., Jha, G. K., Sonkar, V. K., Saroj, S., Singh, K. M., & Singh, R. K. P. (2019). Determinants of access to and intensity of formal credit: evidence from a survey of rural households in eastern India. *Agricultural Economics Research Review, 32*(conf), 93-102.

Balaganesh, G., Malhotra, R., Sendhil, R., Sirohi, S., Maiti, S., Ponnusamy, K., & Sharma, A. K. (2020). Development of composite vulnerability index and district level mapping of climate change induced drought in Tamil Nadu, India. *Ecological Indicators, 113*, 106197.

Barrett, C. B. (2010). Measuring Food Insecurity, *Science, 327*, 825–828.

Bellundagi, V., Umesh, K. B., & Ashwini, B. C. (2020). Is food insecurity exists among the households in rural-urban interface of Bangalore? An economic analysis. *Journal of Food Agriculture and Environment, 18*(3&4), 27-35.

Chang, V., Ganatra, M. A., Hall, K., Golightly, L., & Xu, Q. A. (2022). An assessment of machine learning models and algorithms for early prediction and diagnosis of diabetes using health indicators. *Healthcare Analytics, 2*, 100118.

Chodur, G. M., Zhao, X., Biehl, E., Mitrani-Reiser, J., & Neff, R. (2018). Assessing food system vulnerabilities: a fault tree modeling approach. *BMC Public Health, 18*(1), 1-11.

Dhamija, G., Ojha, M., & Roychowdhury, P. (2022). Hunger and health: Reexamining the impact of household food insecurity on child malnutrition in India. *The Journal of Development Studies, 58*(6), 1181-1210.

Gautam, P. K., & Jha, S. K. (2022). Food and nutrition security under different farm households in Bundelkhand. *Indian Journal of Extension Education*, *58*(4), 15-18.

Gebre, G. G. (2012). Determinants of food insecurity among households in Addis Ababa city, Ethiopia. *Interdisciplinary Description of Complex Systems: INDECS*, *10*(2), 159-173.

Howe, L. D., Hargreaves, J. R., Gabrysch, S., & Huttly, S. R. (2009). Is the wealth index a proxy for consumption expenditure? A systematic review. *Journal of Epidemiology & Community Health*, *63*(11), 871-877.

Longvah, T., Anantan, I., Bhaskarachary, K., Venkaiah, K., & Longvah, T. (2017). *Indian food composition tables* (pp 2-58). Hyderabad: National Institute of Nutrition, Indian Council of Medical Research.

McCordic, C., Frayne, B., Sunu, N., & Williamson, C. (2022). The household food security implications of disrupted access to basic services in five cities in the global South. *Land, 11*(5), 654.

Meenakshi, A. K. G., Krishnan, A. I., Gayathri, K. V., & Sithara, B. V. (2019). Improving food and nutritional security of rural women: action study. *Indian Journal of Extension Education, 55*(2), 97-100

Mishra, M., Gurjar, P. S., Verma, A. K., & Rajan, S. (2019). Socio-economic and resource profile of three villages in Malihabad, Uttar Pradesh. *Green Farming, 10*(3), 387-390.

Mishra, M., Ravi, S. C., Verma, A. K., Gupta, A. K., Dubey, S. K., & Jaiswal, R. (2023). Assessing composite livelihood security and its determinants among rural households. *Indian Journal of Extension Education*, *59*(2), 41-45.

National Institute of Nutrition- https://www.nin.res.in/directordesk.html#:~:text=A%20healthy%20diet%20needs%20to,day%E2%80%9D%20(NIN)%20recommendation

PIB. (2022a). *Income of Farmers,* Ministry of Agriculture & Farmers Welfare, GoI. [Press release]. PIB Delhi. Retrieved from https://pib.gov.in/PressReleasePage.aspx?PRID=1884228

PIB. (2022b). *Global Hunger Report 2022- The index is an erroneous measure of hunger and suffers from serious methodological issues,* Ministry of Women and Child Development, GoI. [Press release]. PIB Delhi. Retrieved from https://pib.gov.in/PressReleasePage.aspx?PRID=1868103

PIB. (2023). *Per Capita Income in Rural and Urban Areas,* Ministry of Statistics & Programme Implementation, GoI. [Press release]. PIB Delhi. Retrieved from https://pib.gov.in/PressRelease Iframe Page.aspx?PRID=1913325#:~:text=All%20India%20annual%20per%20capita,illustrating%20achievement%20in%20this%20 regard.

Rautela, G., Ali, M. K., Prabhakaran, D., Narayan, K. V., Tandon, N., Mohan, V., & Jaacks, L. M. (2020). Prevalence and correlates of household food insecurity in Delhi and Chennai, India. *Food Security*, *12*, 391-404.

Rejula, K., Singh, R., & Nain, M. S. (2017). Rice farming for food security and ecological sustainability: An analysis of farmers' awareness in Kerala. *Indian Journal of Extension Education, 53*(4), 101-106.

Sharma, M. K., Rao, K. S., Sisodia, B. V. S., Verma, S., & Singh, A. (2018). Rural household income patterns in Uttar Pradesh: primary data. *Journal of Pharmacognosy and Phytochemistry*, *7*(2S), 254-261.

Singh, A., Singh, A. K., Singh, S. K., Singh, S., Sahay, R., Tiwari, D. K., & Maurya, R. C. (2019). Food and nutritional security through nutrition gardening in Unnao District. *Indian Journal of Extension Education*, *55*(3), 60-64.

Smits, J., & Steendijk, R. (2015). The international wealth index (IWI). *Social Indicators Research*, *122*, 65-85.

Song, Y. Y., & Ying, L. U. (2015). Decision tree methods: applications for classification and prediction. *Shanghai Archives of Psychiatry*, *27*(2), 130.

Sugandh, A., & Tawheed, N. (2022). Determinants affecting household food security in India: a critical review. *International Journal of Economic Policy in Emerging Economies*, *15*(2/3/4), 317-330.

Swathi Lekshmi, P. S., Venugopalan, R., & Padmini, K. (2008). Livelihood analysis using wealth ranking tool of PRA. *Indian Research Journal of Extension Education, 8*(2&3), 75-77.

TNN. (2023, July 18). 3.4 crore escaped poverty in Uttar Pradesh in 5 years, most in India: NITI Ayog. *The Times of India.*

Vijayan, B., Nain, M. S., Singh, R., & Kumbhare, N. V. (2023). Socio-economic transformation through national food security mission in Uttar Pradesh and Karnataka. *Current Science, 124*(8), 976-980. http://doi.org/10.18520/cs/v124/i8/976-980

Vijayan, B., Nain, M. S., Singh, R., Kumbhare, N. V., & Ravi, K. N. (2022). Socio-economic transformation through RKVY-RAFTAAR in Uttar Pradesh and Karnataka. *Indian Journal of Extension Education, 58*(3), 108-112. http://doi.org/10.48165/IJEE.2022.58323

Zakari, S., Ying, L., & Song, B. (2014). Factors influencing household food security in West Africa: The case of Southern Niger. *Sustainability*, *6*(3), 1191-1202.