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MEASURING FOOD SECURITY AMONG THE STATES OF NORTH EASTERN REGION OF INDIA

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ABSTRACT----------
Food security is essential for living a healthy and productive life. But a large number of people in India suffer from food insecurity owing to low agricultural productivity and incidence of poverty. In North Eastern Region of India, majority of the population depends on agriculture and allied activities for their livelihood. However, the agricultural productivity in the region is relatively low. Hence, there is a need to investigate the status of food security in the region. This paper makes an attempt to examine the status of food security among the States of NER India. The study is based on secondary data for the period 2010-11 to 2021-22. The results show that none of the State of the region belongs to high food security category. Sikkim with FSI value of 0.510 was found to be the most food secure State of NER, India in 2021-22 followed by Arunachal Pradesh. In recent times, Nagaland has become the least food secure State of NER due to sharp fall in food availability. The study calls for promoting area-specific agricultural development strategies, encourage adoption of modern technology, promote diversification of agriculture and livelihood activities to enhance income.
KEYWORDS: *Food Security, Availability, Accessibility, Food Security Index, North Eastern States----------*

INTRODUCTION

Food is essential for survival of living beings. Food security, which refers to ensuring access to adequate and nutritious food to all people at all time, is vital for living a healthy and productive life. It is also pre-requisite for achieving better status of human development. However, millions of people across the world suffer from inadequate access to food. In 2020, between 720 and 811 million people faced hunger and undernutrition in the world (FAO, 2021). Hence, food security has become an important issue in the development policy discourse in all developing countries.

The concept of food security was first defined by World food summit in 1997. It defines Food security as "all people, at all time have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preference for an active and healthy life style" (FAO, 1996). Mundhe (2019) argued for a healthy durable system of food focusing on environmental health, economic lifestyle, human health and social equity to ensure food security. Food and Agricultural Organization (FAO) identified the four pillars of food security: availability, accessibility, stability and utilization. Food utilisation depends upon quality of water, sanitation, health, the quality of food itself (Sharma, 2010)**.** Food stability is the ability to get food in all times.

India is a highly populated country. Despite its favourable economic growth, the country has been facing the problem of poverty, hunger and malnutrition. India was ranked 68th among 113 countries in the Global Food Security Index (The Economist, 2022). India has the largest number of undernourished people in the world (FAO, 2021). To address the issue of food security, the Government of India has large food security and poverty alleviation programs such as National Food Security Mission, Mid-day meal scheme at schools, Public Distribution System (PDS), Targeted Public Distribution System (TPDS).

North Eastern Region (NER) of India is the easternmost region representing both a geographical and political administrative division of the country. It comprises of eight states namely, Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Sikkim. With a total geographical area of 2,62,184 sq.km the region accounts for 8 percent of the country's total area. The region has a population of 4,57,72,188 accounting for 3.57 per cent of country's total population (Census 2011). It is characterized by cultural heterogeneity, ethnicity and richness

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in biodiversity. Majority of the population depends on agriculture, but the yield rate is relatively low. The food security and nutritional status of people is a matter of concern in the States of NER. There is a lack of knowledge about the latest status of food security among the States of NER. So, this paper makes an attempt fill the gap in knowledge. The study aims to measure the food security in the States of NER by constricting food security index.

REVIEW OF LITERATURE

Review of some of the previous studies on the issue of food security are presented as follows:
Misselhorn et al. (2012) discussed about some of the demand and supply side challenges facing global food security. They argued that globalisation and urbanisation changed the pattern of food habit and had some positive and threatening impact on global food security. Brahmananda et al.(2013) explored the various challenges to food security in India. The study pointed out that crop diversification, bio-fuel and medicinal plant cultivation, climate change, mismatch between water demand and availability are the important challenges to food security in India.

Borthakur et al. (2016) analysed the status of food availability in Assam during the post-independence period. They compared per capita availability of food grains with normative requirement. They found that the per capita availability of food had increased because of the use of modern technologies in agriculture, but it did not surpass the normative requirement. Mandal and Dhar (2019) analyzed the food insecurity in hills and plains of India. The study showed that food insecurity is less in the hill areas than in the plains. An increase in the years of schooling of female adult household members was found to reduce food insecurity.

Roy (2019) compared the food security status in hills and plains of India. food security was measured by constructing a composite Food Security Index (FSI) The study found that the hill region has performed better than the plains in terms of food security in 2001-04 as well as in 2011-14.

METHODOLOGY

The study is based on mainly secondary data. The data were collected from various sources like Census of India 2011, Statistical Handbook of Assam, Handbook of Statistics on Indian Economy (RBI, 2023), data published by journals and periodicals. The data on food availability and food accessibility taken from the Handbook of Statistics on Indian Economy.

Due non-availability of latest data on indicators of food absorption, the food absorption index could not be included. so only the two indices i.e. food availability and food accessibility indices have been taken into account for calculation of food security index (FSI). Food security has been measured by constructing a composite FSI as developed and applied by Roy and Deb (2017).

The method of constructing Food Security Index involves the following steps:
Step 1: Construction of Dimensional Index for Food Security:
Dimensional Index= $(X_{ij}-X_{min})/ (X_{max}-X_{min})$;$0 \leq$Dimensional Index$\leq 1$
Where X_{ij}=actual value of the j^{th}dimensional indicator for the i^{th} state.
X_{min}=Minimum value of the j^{th} dimensional indicator for the i^{th}state.
X_{max}=Maximum value of the j^{th} dimensional indicator for the i^{th} state.

In calculating food availability index, the maximum value was taken as 90 percentile of per capita net food availability of Punjab, the State with the highest per capita net food availability. The minimum value was taken as the per capita net food availability of Kerala, the State with the lowest per capita net food availability. The 90 percentile of the highest value is taken to minimise the problem of extreme value (Sarma, 2015).

Per capita net availability of food grains was estimated by adjusting the total food grains production for seed, feed and wastages. The Techno Economic Research Institute estimated that on an average 10.31 per cent of total food grains production is used as seed, feed and wastage (Ansari and Singh, 2006). Hence, per capita net availability of food grains was calculated by deducting 10.31 per cent food grains production from the total food grains production. Net availability of food grains was then divided by the 2011 Census population of respective States to obtain per capita net availability of food grains.

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While calculating food accessibility index, maximum value was taken as 90 percentile of per capita income of Goa, the State with the highest per capita income. The minimum value was taken as the per capita income of Bihar, the State with the lowest per capita income.

Step 2: Finally, the Food Security Index(FSI) has been constructed by taking the simple average of dimensional indices. FSI is calculated as follows:

FSI = (Availability Index + Accessibility Index)/2;0≤FSI≤1

Table 1: Categorisation of the level of Food Security using FSI

FSI	Level of food security
0≤FSI≤0.20	Very low
0.21≤FSI≤0.40	Low
0.41≤FSI≤0.60	Moderate
0.61≤FSI≤0.80	High
0.81≤FSI≤1	Very high

Source: Roy and Deb (2017)

RESULTS

The availability and accessibility of food have assessed on the basis of per capita food grains production and per capita income. The per capita production of food grain which indicates food availability is given in table 2.

Table 2: Per Capita Net Availability of Food grains in North Eastern States of India (in kg per annum)

States	2010-11	2017-18	2021-22
Meghalaya	196.48	297.43	291.84
Arunachal Pradesh	216.47	232.95	251.83
Manipur	195.31	232.81	215.91
Tripura	174.05	208.97	212.78
Sikkim	162.79	138.59	134.75
Assam	140.32	159.01	134.60
Nagaland	257.35	250.10	114.75
Mizoram	20.24	22.45	23.57

Source: Calculated by authors using data from Handbook of Statistics on Indian Economy, RBI

Table 3: States with Highest and Lowest Per Capita Net Availability of Food grains (in kg per annum)

States	2010-11	2017-18	2021-22
Punjab	902.15	1026.00	914.65
Kerala	14.16	14.07	13.14
All India	181.20	211.23	233.91

Source: Calculated by authors using data from Handbook of Statistics on Indian Economy, RBI

The table 2 shows the per capita net availability of food grains in the States of NER of India. It was found that in 2010-11 per capita net availability of food grains was the highest in Nagaland (257.35 kg per annum) followed by Arunachal Pradesh (216.47 kg per annum. In the same year, Mizoram had the lowest per capita net availability of food grains (20.24 kg per annum). But in 2021-22, Meghalaya emerged to have the highest per capita net availability of food grains (291.84 kg per annum). Mizoram continued to have the lowest per capita net availability of food grains in 2021-22 (23.57 kg per annum).

The table 3 shows that in all the years under consideration, Punjab had the highest per capita net availability of food grains and Kerala had the lowest per capita net availability of food grains. In 2021-22, per capita net availability of food grains in Punjab was 914.65 kg per annum, which was much higher than the national average of 233.91 kg per annum.

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The accessibility to food is captured by per capita income as it is an indicator of purchasing power. The per capita Net State Domestic Product (NSDP) at constant prices in States of NER is presented in table 4.

Table 4: Per Capita NSDP (at constant prices) in North Eastern States of India (in Rupees)

States	2010-11	2017-18	2021-22
Sikkim	66136	232483	246526
Mizoram	40072	117272	129785
Arunachal Pradesh	34548	94001	111776
Tripura	36718	75020	85210
Nagaland	43992	66813	70020
Assam	21146	57835	65726
Meghalaya	31418	58493	63295
Manipur	20711	51211	49602

Source: Handbook of Statistics on Indian Economy, RBI

The table 4 shows that among the States of NER, per capita NSDP was the highest in Sikkim in all the years under consideration. Whereas Manipur had the lowest per capita NSDP in all the years. This implies that food accessibility is relatively poor in Manipur. The per capita NSDP of Manipur was nearly half of the national average (Table 5). In 2021-22, the three States namely, Sikkim, Mizoram and Arunachal Pradesh had per capita income above the national average. The per capita income of Sikkim was 2.66 times more than the per capita income of India.

Table 5: States with Highest and Lowest Per Capita NSDP (at constant prices)

States	2010-11	2017-18	2021-22
Goa	110306	**308296**	**310201**
Bihar	12090	26719	28679
All India	**36202**	**87586**	**92583**

Source: Handbook of Statistics on Indian Economy, RBI

The table 5 shows that among the States of India, Goa had the highest per capita income and Bihar had the lowest per capita income in all the years under consideration. In 2021-22, the per capita income of Goa was 3.10 lakh, which was 3.24 times the per capita income of India.

Food security status has been measured by taking two dimensional indices namely food availability index and food accessibility index. The food availability index and food accessibility index are presented in tables 6 and 7.

Table 6: Food Availability Index of North Eastern States of India

States	2010-11	2017-18	2021-22
Meghalaya	0.229	0.312	0.344
Arunachal Pradesh	0.254	0.241	0.295
Manipur	0.227	0.241	0.250
Tripura	0.200	0.214	0.246
Sikkim	0.186	0.137	0.150
Assam	0.158	0.159	0.150
Nagaland	0.305	0.260	0.125
Mizoram	0.008	0.009	0.013

Source: Authors' calculation.

The table 6 shows the food availability index of NER States. In 2010-11, Nagaland had the highest food availability index (0.305) followed by Arunachal Pradesh (0.254). In the same year, Mizoram had the lowest food availability index which is attributed to its low food grains production. The food availability index of Meghalaya improved over the years to 0.312 in 2017-18 and further improved to 0.344 in 2021-22. As a result, Meghalaya climbed to first rank in terms of food availability index. Nagaland slipped to second lowest position in 2021-22 due to significant fall in its food grains production. Food accessibility index of the States of NER are presented in table 7.

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Table 7: Food Accessibility Index of North Eastern States of India

States	2010-11	2017-18	2021-22
Sikkim	0.620	0.821	0.870
Mizoram	0.321	0.361	0.404
Arunachal Pradesh	0.258	0.268	0.332
Tripura	0.282	0.193	0.226
Nagaland	0.366	0.160	0.165
Assam	0.104	0.124	0.148
Meghalaya	0.222	0.127	0.138
Manipur	0.099	0.098	0.084

Source: Authors' calculation.

The table 7 shows that Sikkim had the highest food accessibility index followed by Mizoram and Arunachal Pradesh. While Manipur had the lowest value of food accessibility index. In 2010-11, food accessibility index of Sikkim was 0.620 which improved to 0.821 in 2017-18 and further improved to 0.870 in 2021-22. This mainly on account of significant rise in its per capita NSDP (Table 4). During the period under consideration, the food accessibility index of Sikkim, Mizoram, Arunachal Pradesh has improved significantly. In case of Assam, it improved marginally. But it has deteriorated for Tripura, Nagaland, Meghalaya and Manipur.

The food security index of eight States of NER is presented in table 8.

Table 8: Food Security Index (FSI) of North Eastern States of India

States	2010-11	2017-18	2021-22
Sikkim	0.403	0.479	0.510
Arunachal Pradesh	0.256	0.255	0.313
Meghalaya	0.225	0.219	0.241
Tripura	0.241	0.203	0.236
Mizoram	0.164	0.185	0.208
Manipur	0.163	0.169	0.167
Assam	0.131	0.142	0.149
Nagaland	0.335	0.210	0.145

Source: Authors' calculation

The table 8 shows that Sikkim is the most food secure State among the NER States as indicated by the value of food security index in all years under review. Arunachal Pradesh is ranked second among the States of NER in terms of FSI value in 2021-22. The FSI of Sikkim improved significantly over the years from 0.403 in 2010-11 to 0.479 in 2017-18 (Figure 1). The FSI of Sikkim further improved to 0.510. The improvement can be attributed to sharp rise in its per capita NSDP.

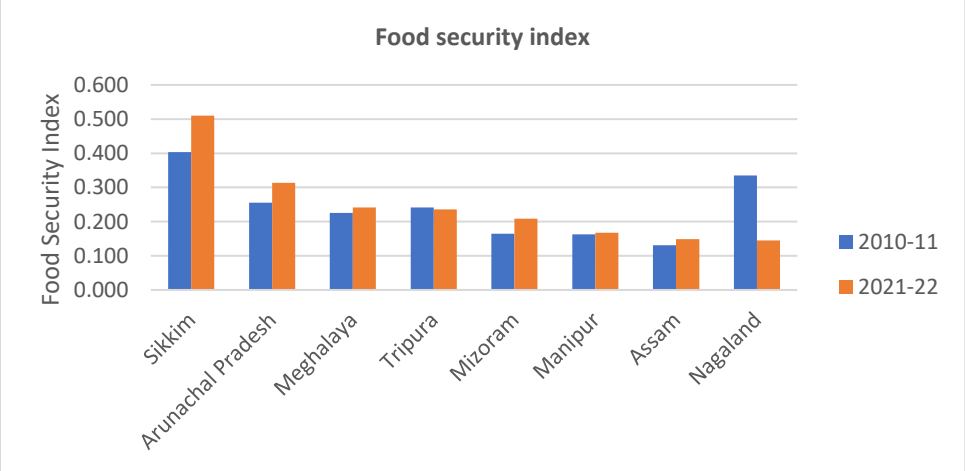


Figure 1: Food Security Index of States of NER, India.

Volume: 13 | Issue: 11 | November 2025 | Journal DOI: 10.36713/epra0813| Impact Factor SJIF(2025): 8.733| ISSN: 2321 – 7847

The FSI value of Arunachal Pradesh improved from 0.256 in 2010-11 to 0.313 in 2021-22. It was due to improvement in availability index as well as accessibility index. In 2010-11, Nagaland was ranked second in terms of FSI value (0.335). But its FSI fell to 0.145 in 2021-22, owing to substantial decline in its food availability index. As a result, Nagaland slipped to bottom position in terms of FSI value in 2021-22 followed by Assam (Figure 1).

The analysis indicated that none of the States of the region belonged to high food security category. In 2021-22, Sikkim belonged to moderate food security category. In the same year, four States namely, Arunachal Pradesh, Meghalaya, Tripura and Mizoram belonged to low food security category and Manipur, Assam and Nagaland belonged to very low category.

DISCUSSION

The study analysed the status of food security in eight States of NER, India based on secondary data. It measured the food security index based on two dimensional indices namely, food availability index and accessibility index. The other dimensions of food security could not be included due to lack data. The analysis revealed that in 2010-11 among the eight States of NER, India, Nagaland had the highest per capita net availability of food grains followed by Arunachal Pradesh. Mizoram recorded the lowest per capita net availability of food grains. In 2017-18, Meghalaya emerged as the State with highest per capita net availability of food grains. In 2021-22, Meghalaya continued to stand first amongst the NER States in terms of per capita net availability of food grains. It was followed by Arunachal Pradesh. Mizoram stood at the bottom in per capita net availability of food grains. Nagaland went down to second lowest in per capita net availability of food grains in 2021-22 on account of substantial fall in its food grains production. In 2021-22, two States of NER namely, Meghalaya and Arunachal Pradesh has per capita net availability of food grains above the national average of 233.91 kg per annum.

In 2010-11, the food availability index was the highest in Nagaland and it was the lowest in Mizoram. During 2010-11 to 2021-22, the food availability index of Meghalaya and Arunachal Pradesh improved significantly. As a result, in 2021-22, Meghalaya emerged to stand first among the NER States in terms of food availability index followed by Arunachal Pradesh. Mizoram continued to record the lowest value of food availability index. During the period 2010-11 and 2021-22, the food availability index of Sikkim, Assam, Nagaland and Mizoram has deteriorated, which calls for remedial measures.

Per capita income was taken as the indicator of food accessibility. Among the eight States of NER, India, Sikkim recorded the highest and Manipur recorded the lowest per capita NSDP in all the years under the review. In 2021-22, the per capita income of Sikkim was more than double the per capita income of India. The food accessibility index value was the highest for Sikkim followed by Mizoram and Arunachal Pradesh. It was the lowest for Manipur followed by Meghalaya. The food accessibility index of Sikkim increased from 0.620 in 2010-11 to 0.870 in 2021-22. It also improved for Mizoram, Arunachal Pradesh and Tripura. But it declined sharply for Nagaland, Meghalaya and Manipur due to slow growth in their per capita income.

Despite having low food availability index, Sikkim ranked first in terms of the value of food security index in all years under review. In 2010-11, Nagaland ranked second in terms of food security index and Mizoram was ranked the last among the NER States. Arunachal Pradesh improved its position and was ranked second in 2017-18 as well as 2021-22. The FSI value of Sikkim improved over the years from 0.403 in 2010-11 to 0.510 in 2021-22. The improvement in FSI value of Sikkim was mainly contributed by increase in food accessibility index. Sikkim's per capita NSDP rose sharply from Rs. 66,136 in 2010-11 to Rs. 2,46,526 in 2021-22. However, its FSI value is still half of the benchmark value 1. This can be attributed to fall in its food grains production from 110.3 thousand tonnes in 2010-11 to 91.3 thousand tonnes in 2021-22 (RBI, 2023). The FSI value of Arunachal Pradesh also improved from 0.256 in 2010-11 to 0.313 in 2021-22. The improvement in FSI value of Arunachal Pradesh was on account of increase in both food availability and food accessibility indices. The FSI value of Meghalaya improved from 0.225 to 0.241 in 2021-22. The FSI value of Mizoram improved significantly from 0.164 to 0.208 owing to spectacular rise in its per capita income. During the same period, the FSI value of Manipur and Assam improved only marginally and that of Tripura fell marginally from 0.241 to 0.237.

The study finds that hill States like Sikkim, Arunachal and Mizoram have performed better in food security as compared to plain States like Assam and Tripura. This findings is similar to those of Roy (2019) and Mandal and Dhar (2019.

Volume: 13 | Issue: 11 | November 2025 | Journal DOI: 10.36713/epra0813| Impact Factor SJIF(2025): 8.733| ISSN: 2321 – 7847

During the period 2010-11 and 2021-22, the FSI value of Nagaland fell drastically from 0.335 in 2010-11 to 0.145 in 2021-22. It was on account of sharp fall in food availability as well as food accessibility. Its food availability index fell from 0.305 in 2010-11 to 0.125 in 2021-22, mainly due to sharp decline in its food grains production from 552.3 thousand tonnes in 2017-18 to 253.4 thousand tonnes in 2021-22 (RBI, 2023). Its food accessibility index also fell from 0.366 in 2010-11 to 0.165 in 2021-22, due to relatively slow growth in its per capita NSDP. During 2010-11 and 2021-22, its per capita NSDP grew only 1.59 times as compared to 3.73 times for Sikkim, 3.24 times for Arunachal Pradesh and 3.23 times for Mizoram.

The findings of the study reveal that the status of food security in the States of NER, India is not up to the marks. These States need to take necessary steps to improve the scenario of food security. The study calls for application of new agricultural technology, promote diversification of agriculture as well as promote livelihood diversification and industrial development.

The limitation of the study is that it constructed FSI based on only two dimensional indices. There is scope to conduct future study on food security and construct FSI by taking all the dimensional indices, if the data become available.

CONCLUSION

The status of food security in the States of North Eastern Region of India is found to be poor. The food security index was calculated by taking two important dimensional indices; food availability and accessibility. Food availability index was based on per capita net availability of food grains and food accessibility index was based on per capita NSDP. FSI was calculated as the arithmetic average of the two indices. The findings show that per capita net availability food grains was the highest in Meghalaya and the lowest in Mizoram. The food availability index was the highest in Meghalaya followed by Arunachal Pradesh and it was the lowest in Mizoram. Among the NER States, Sikkim had the highest and Manipur had the lowest per capita NSDP. Accordingly, food accessibility index of Sikkim was the highest followed by Mizoram. It was the lowest for Manipur, Meghalaya and Assam. The value of FSI indicates that Sikkim is the most food secure State among the States of NER, India. It is followed by Arunachal Pradesh. In recent times, Nagaland has become the least food secure State, followed by Assam and Manipur. None of the State of the region belonged to high food security category. Most States belonged to either low and very low food security category. This implies that necessary steps need to be taken to improve agricultural production and productivity and control population growth to enhance net availability of food grains. Further, efforts should be made to promote diversification of agriculture and industrial development to generate employment opportunities in order to raise per capita income.

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Volume: 13 | Issue: 11 | November 2025 | Journal DOI: 10.36713/epra0813| Impact Factor SJIF(2025): 8.733| ISSN: 2321 – 7847

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