RESEARCH PAPER

MEASURING AND MAPPING THE STATE OF FOOD INSECURITY IN RAJASTHAN, INDIA

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Received: April 3th, 2020 / Accepted: February 16th, 2021 / Published: April 1st, 2021
https://DOI-10.24057/2071-9388-2020-67

ABSTRACT. Food insecurity is a global issue that persists at various scales and intensity. It is linked to irregularity or uncertainty of food, water and fuel and can develop under the influence of multiple factors. Food availability, accessibility, consumption and stability are the four broad dimensions of food security. This paper analyses the relationship between these four dimensions and food insecurity for 33 districts in Rajasthan, India, using the data collected from the published documents, periodicals and websites of the government or other authentic sources. To analyse the link between these four dimensions, several indicators were taken into consideration. The collected data was used to rank the districts based on their level of food insecurity. Thus, the results include categorization of the districts into four zones based on the values of the variables. The results are presented through maps, which show the spatial distribution of food insecurity. It can be concluded, that the districts of Banswara, Dungarpur, Udaipur, Bharatpur, Rajsamand, Dhaulpur and Jalore have a very high level of food insecurity.

KEY WORDS: Food Insecurity, Food Unavailability, Food inaccessibility, Inadequate consumption, instability of food

CITATION: Rajput Swati, Arora Kavita (2021). Measuring And Mapping The State Of Food Insecurity In Rajasthan, India. Geography, Environment, Sustainability, Vol.14, No 1, p. 33-40 https://DOI-10.24057/2071-9388-2020-67

Conflict of interests: The authors reported no potential conflict of interest.

INTRODUCTION

Food security is on the global agenda of all the nations, which focuses on achieving the target of zero hunger and providing all people with sufficient and nutritious food. Ensuring the necessary quantity and quality of food has become a big challenge especially in developing and underdeveloped countries. Food provides a human body with energy and helps to maintain the immune system, while its unavailability can cause malnourishment and hunger. In extreme cases, food insecurity can also lead to deaths due to famine and droughts. This paper analyses the concept and measurement of food insecurity as well as spatial variation of food insecurity in Rajasthan, India. Rajasthan, being mostly a semi-arid region, needs to be dealt with special priority and caution. The spatial variation of food insecurity includes differences in the severity of the problem and proportion of population effected (Ilaboya et.al 2012), which should result in the policies that are based on the geospatial variation of the phenomenon. The SDG 2 states, that ending hunger, achieving food security and improved nutrition and promotion of sustainable agriculture is one of the major goals for the world to attain, especially in the developing countries.

Concept of Food Insecurity: a wider perspective

The food security is not just about non-availability of food, it is also linked to its non-accessibility and unaffordability, which are also affected by the uncertainty factor. Therefore, for understanding the concept of food insecurity, the related concepts of food unavailability, inaccessibility, unaffordability and instability should also be considered. Regarding the first three important parameters, FAO's The State of Food security (2001) provides the following definition of food security:

«Food security [is] 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».

Nord, Andrew and Carlson (Nord et. al 2005) have defined food insecurity as disruption of food intake or eating patterns because of lack of money and other resources. The US Department of Agriculture (USDA) in 2019 defined food insecurity as a lack of consistent access to adequate food for an active, healthy life.

Based on these definitions, it can be observed that there are various aspects linked to food security:

1. Physical, Social and Economic Access
2. Sufficient, safe and nutritious food
3. Dietary needs and food preferences
4. Active and healthy life

The multidimensional and multifaceted concepts associated with food security make it very complicated and even more challenging to accomplish the goal of zero hunger. The concept of Food Security has four dimensions (Fig. 1):

Food availability focuses upon the supply side i.e., the food grown or imported and exported from a region. This means that it characterizes the available food stock and net trade of food commodities in a region.

Food accessibility covers more than just the availability or existence of food. It indicates both physical and economic opportunity of a consumer to obtain or

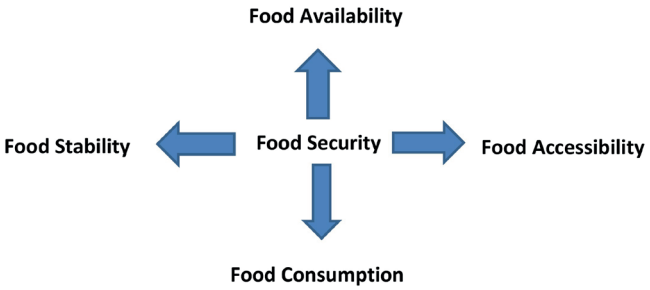

Fig. 1. Dimensions of Food Security

to buy food and characterizes the means by which it reaches people as the mere existence of commodities cannot ensure that the food produce will eventually be consumed or not.

Food utilization again extends the concepts of availability and accessibility. The human body will remain healthy only when it is able to consume a sufficient amount of nutrients. Therefore, the biological utilization of nutritious food is definitely a major dimension of food security.

Food stability is yet another important dimension. The human body needs nutritive food on a regular basis, but due to sudden disasters like flood, famine, etc, the regular supply of food could be interrupted. Food instability can also occur due to various economic factors, which include price or income fluctuations. As a result, food security will not be achieved if at any given point in time the consumer is unable to have access or is unable to consume sufficient amount of food. Therefore, food insecurity can be defined as failure to ensure any of the four dimensions outlined above.

Food Insecurity = $f\ (FA+FA+FC+FS)^{-1}$

Types of Food Insecurity

Food and Agricultural Organization identifies three types of food insecurity:

1. Chronic Food Insecurity: Chronic food insecurity exists when an individual is constantly deprived of nutritious food. This can be due to poverty, lack of assets, insurance or loss of property etc. It is a situation that persists for a long period of time and can be improved by providing people with education, regular income and insurance rather than by short-term solutions.
2. Transitory Food Insecurity: Transitory food insecurity is a short-term or sudden situation of food deprivation. This can occur due to crop failure, prices or family income fluctuations, political unrest etc. This type of insecurity can be managed by short-term price corrections or policies.
3. Seasonal food insecurity: This is the third type of food insecurity which, can have an annual reflection but is seasonal in nature. It can be related to seasonal unemployment or non-availability of food. It is predictable and cyclic and can be managed by storing food or finding alternative employment opportunities.

Human health, food security and environmental sustainability are linked by complex and multidirectional patterns and present interrelated challenges in the current context. While the world currently produces enough food to feed everyone, over a billion people do not have access to adequate food. As of 2010, a total of 925 million people suffered from chronic hunger: 578 million in the Asia Pacific region, 239 million in Sub-Saharan Africa, 53 million in Latin America, 37 million in North and North East Africa, and just a little over 19 million in the developed countries (Shah 2013). About 870 million

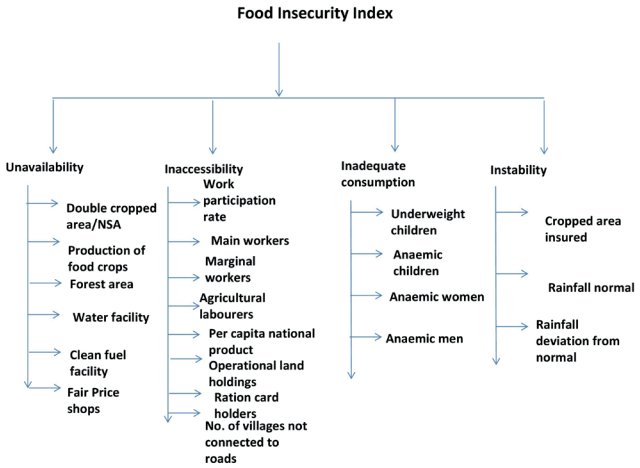

Fig. 2. Food Insecurity Index

people are estimated to have been undernourished (in terms of dietary energy supply) in the period 2010–2012. This represents 12.5 percent of the global population or one in eight people. The vast majority, 852 million, live in developing countries, where the share of people undernourishment is now estimated at 14.9 percent of the population (FAO 2012). The food insecurity, on the other hand, occurs when there is lack of availability of sufficient, safe and nutritious food.

Food insecurity is defined by the United States Department of Agriculture (USDA) as a situation of "limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways" (Bickel et.al 2013). This definition not only focuses upon the aspects of nutrition i.e., related to food consumption but also on the social acceptability of the food. This includes the availability of indigenous food produced and consumed in that region, especially in rural areas. In urban areas, new forms of food that become socially acceptable also need to be available on the market.

According to an estimate by United Nations, in India, 195 million people are undernourished, which accounts for nearly one quarter of the global population with undernourishment, and 4 out of 10 children are undernourished or stunting (https://in.one.un.org/un-priority-areas-in-india/nutrition-and-food-security/). Based on several studies it was highlighted that the states of Bihar, Jharkhand, Rajasthan, Chattisgarh, Madhya Pradesh, Uttaranchal and Odisha are marked by severe food insecurity. The small size of the agricultural landholdings, low area of agricultural land per capita and prevalence of traditional forms of agriculture affect the availability of sufficient food.

Study Area

Rajasthan is the largest state of India in terms of area and seventh largest state in terms of population. It is located in the north-western part of the country, at latitude 27.391277 and longitude 73.432617. Rajasthan has seven divisions and thirty-three districts. There are four major physiographic regions, namely (i) the western desert with barren hills, rocky plains and sandy plains; (ii) the Aravalli hills running south-west to north-east; (iii) the eastern plains with rich alluvial soils; and (iv) the south-eastern plateau. The state is drained mainly by three rivers: Mahi, Chambal and Banas.

The climate varies from hot and dry in the west to humid in the eastern part of the state. In summer the temperature varies between 32° to 45°C whereas in winter it ranges from 4° to 28°C. Nearly 90 percent of the rainfall occurs in monsoon months, the average annual rainfall ranges between 200-400 mm getting as low as 150 mm in extremely dry zones. One other peculiar characteristics of the climate in Rajasthan is the frequent occurrence of droughts. Drought occurs almost once every three years (Bansil 2007) and sometimes the frequency is even higher. Scanty, low and irregular rainfall contributes to the proliferation of droughts. The scale of famine due to failure of monsoon and consequent water stress causes severe hardship to humans and livestock. The districts of Barmer, Jaisalmer, Jalore, Jodhpur and Sirohi experience it once every three years. Ajmer, Bikaner, Bundi, Dungarpur, Sriganganagar, Nagaur, Hanumangarh and Churu experience drought once every four years.

According to the Census of India: Administrative Atlas, 2001; Bhalla (2011) the state can be divided into four major physiographic divisions, namely, the Western Sandy plains, Aravalli and hilly regions, Eastern plain and Hadoti plateau. The 33 districts of Rajasthan belong to one of these regions. The Western Sandy desert can be further divided into the Sandy arid and semi-arid plains. The micro-regions of Marusthali and Dune free tracts are part of the Sandy plain. The semi-arid plain consists of 4 micro-regions: the Luni basin, Shekhawati region, Nagauri Upland and Ghaggar plain. The Aravalli and hilly range covers Alwar hill, the Central Aravalli range, Mewar rocky range and Abu block region. The Eastern plains comprise of the Chambal basin, Banas basin and Mahi plain. Hadoti plateau includes two micro-regions: the Vindhayan scrap land and Deccan Lava plateau.

The population in the state of Rajasthan is unevenly distributed and agriculture is still the most dominant economic activity. Therefore, the extension of alluvial plains and water availability remain as the underlying factors of population distribution. The urbanization in Rajasthan has always remained below the national average. According to the census of 2011, 76.62 percent of the state's population resides in rural areas. Agriculture and industry, particularly handloom and handicrafts, play a significant role in terms of employment and income in the state.

MATERIAL AND METHODOLOGY

To analyse food insecurity at the district level the Food Insecurity Index has been formulated depending upon the data availability for the year 2018–2019. The data has been acquired from Census of India publications, Statistical Abstract of Rajasthan 2018, Agricultural abstract of Rajasthan 2018. Data has also been acquired from some official government sites, such as www.pmfby.rajasthan.gov.in 2016–2017, food.raj.nic.in, rainfall-water.rajasthan.gov.in etc.

The study is based on robust data that was either taken as it is or was converted into a percentage or ratio. The acquired data was then processed and analysed according to the four dimensions of food insecurity, namely Food unavailability, Food inaccessibility, Food inadequate consumption and Food instability (Fig. 2). The various variables were then ranked according to the value they reflect. The following variables were taken to examine each dimension:

Food unavailability: Double cropped area/net sown area, production of food crops (both cereals and pulses), forest area to reporting area, households with

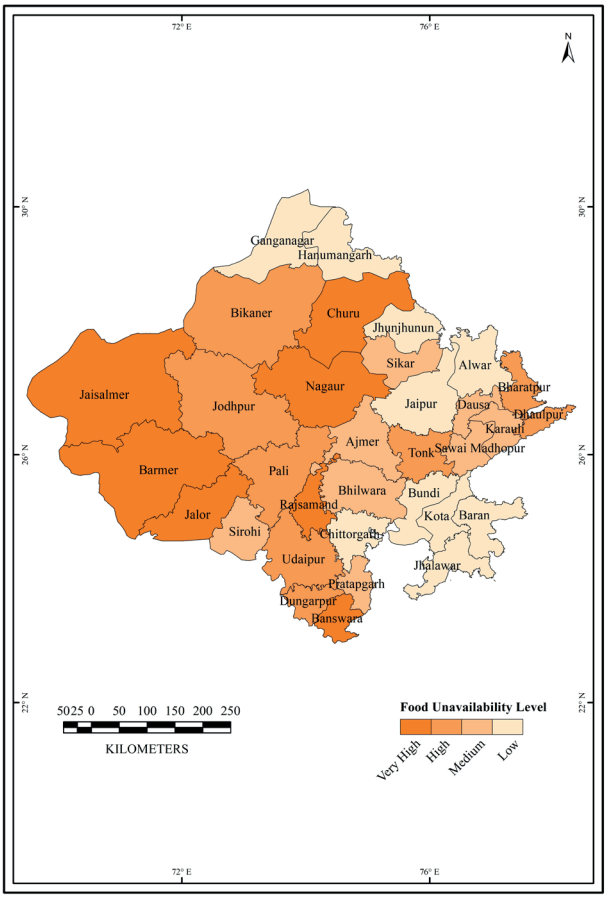

Fig. 3. Food Unavailability

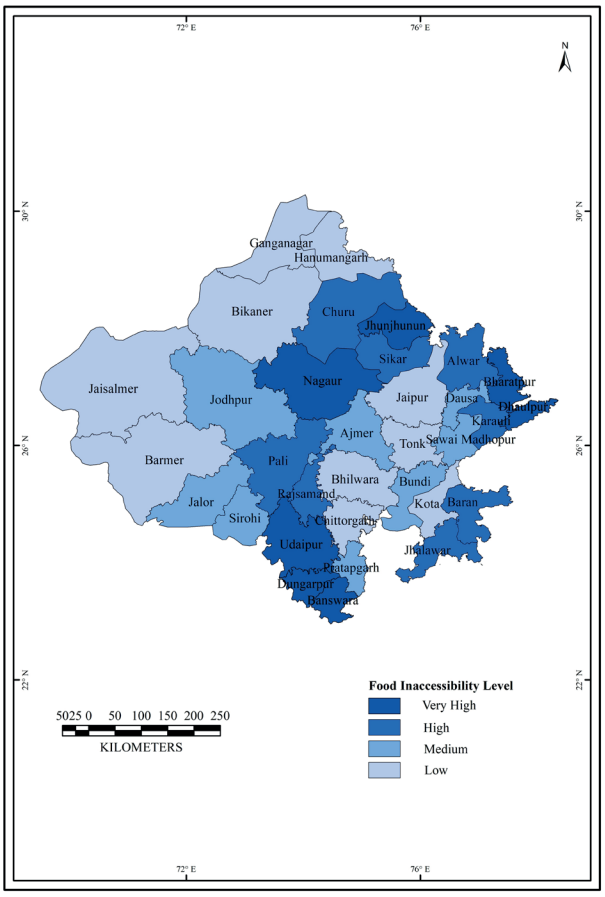

Fig. 4. Food Inaccessibility

improved water facilities, households using clean fuel and population per Fair Price Shop.

Food Inaccessibility: Food inaccessibility was examined based on work participation rate, main working population, marginal working population, number of agricultural labourers, per capita national product, the average size of operational holdings, number of ration card holders and number of villages not connected by roads.

Food inadequate consumption: Food consumption characteristics were also based on the available data i.e., underweight children below 5 years of age, anaemic children below 5 years, anaemic women between 15-49 years of age and anaemic men between 15-49 years of age.

Food instability: There was not much data available on this dimension, so the rainfall data was used as an important indicator as Rajasthan is mostly a semi-arid area and most of the rainfall happens in monsoon. The agriculture is mainly depended upon rainfall and the impacts of rainfall variability are threatening food production systems, leading to losses of livelihood and food insecurity (Murali and Afifi 2013). Crop insurance can be another important indicator as it can provide some security to farmers at the time of crop failure, allowing them to protect against poor harvests and adapt to a changing climate. So, two indicators i.e., total cropped area insured and rainfall normal and deviation from normal (2018) were used in the analysis.

Once the data was collected, the districts were then ranked based on the values of the parameters. Rank 1 was given to the district that was characterised by the highest food unavailability, inaccessibility, inadequate consumption and instability. The highest rank i.e., 33 was given to the district which had the lowest values of food insecurity parameters in each category. Later the ranks were added to find the final scores for each dimension and food insecurity as a whole. Maps are used to depict the geospatial pattern of the food insecurity and its various dimensions.

RESULT

Food insecurity is a multifaceted and multifunctional concept and its complex nature makes it challenging to analyse. The data, which was used to calculate and analyse food insecurity in Rajasthan at the district level, was acquired through numerous authentic published sources. The main limitation was thus associated with the limited availability of relevant and related data. Nevertheless, full care was taken to use the most relevant data.

Food unavailability

This dimension was evaluated by considering 6 factors. The availability of food can be easily characterized by its production and area under cultivation. It can be assumed that the type of food crops grown in the region are mostly the ones that are generally consumed by people and are a part of their staple diet. Besides, one also needs safe drinking water as it constitutes a major part of the human diet and is also needed to cook food. Clean fuel is another important input as its availability also ensures the availability of consumable food items. Forest area is also considered to be important as its resources contribute to the available food as well. In the areas where food crops are not grown in sufficient amounts or some items are not available, Fair Price Shops (FPS) also ensure the availability of food.

Considering all six factors, it was found that the districts of Barmer, Jalore, Churu, Rajsamand, Banswara, Jaisalmer and Nagaur lie in the very high food unavailability zone. Barmer has the lowest double-cropped area and therefore the lowest production of food crops. Most of such areas lie in either southern part of the state or in Mewar region. The districts of Bharatpur, Jodhpur, Tonk, Bikaner, Dhaulpur, Udaipur, Dungarpur and Pali lie in the high food unavailability zone. Bhilwara, Pratapgarh, Sawai Madhopur, Karoli, Sirohi, Ajmer, Sikar and Dausa lie in the moderate food unavailability zone. Alwar, Hanumangarh, Jhunjhunu, Ganganagar, Chittorgarh, Jhalawar, Jaipur, Kota, Bundi and Baran have high food availability. In Baran, the double-cropped area per net sown area is more than 89 percent and Ganganagar has the highest food grain production of all districts. Karoli has nearly 34 percent of its area under forest. Alwar and Kota have high share i.e., more than 96 percent, of households with safe drinking water facilities followed by Hanumangarh, Dausa and Jaipur respectively. Jaislmer, Naugaur, Bansawar have less than 70 percent and districts like Barmer and Bharatpur have around 75 percent of households with safe drinking water facilities. In Kota (66 percent) and Jaipur, more than 54 percent of households have safe clean fuel available for cooking. Bansawar (12.6%), Pratapgarh (13.6%), Karoli (14%) are marked by the lowest share of households with clean fuel available. Analysing the number of people per Fair Price Shop (FPS) it can be seen that Ganganagar has 20,300 people per FPS while Bikaner has around 5030, Churu has 4678 and Jaipur has 3421. The lower is the number of people per FPS, the better is food availability in the district. For example, Baran has 1830 people per FPS, Jaislmer has 1994, Chittorgarh has 2175 (Fig. 3).

Food Inaccessibility

The dimension of food accessibility was measured using eight indicators, namely work participation rate, the proportion of main workers, marginal workers and agricultural labourers, per capita national product, the average size of operational holdings, the number of villages connected by roads and the number of ration card holders. It was attempted to analyse the accessibility from both physical and monetary perspective to highlight the ease of access and affordability of food. Connectivity by roads ensures the physical accessibility of food. Similarly, ration card holders also have access to food items at an affordable cost. The jobs of people also reflect their ability to afford food.

The districts of Bharatpur, Dungarpur, Udaipur, Dhaulpur, Banswara, Nagaur and Jhunjhunu have very high food inaccessibility. The districts of Sikar, Pali, Karoli, Alwar, Baran, Churu, Rajsamand and Jhalawar are characterized by high food inaccessibility. Jodhpur, Ajmer, Sawai Madhopur, Bundi, Dausa, Jalore, Sirohi and Pratapgarh have moderate food accessibility, while Jaisalmer, Kota, Jaipur, Barmer, Tonk, Bikaner, Ganganagar, Bhilwara, Chittorgarh and Hanumangarh have low food inaccessibility. The work participation rate is the highest in Pratapgarh, Chittorgarh, Bansawar. The share of main workers is the highest in Jaipur, Chittorgah and Ajmer i.e., above 80 percent. The share of marginal workers is the highest in Dungarpur district with 66 percent and in Banswara and Udaipur it is around 41 percent. Marginal workers and agricultural labourers are the people with lower guaranteed income. The ratio of agricultural

labourers is the highest in Baran (33 percent), Jhalawar (30 percent) and Dungapur (29 percent). The lowest share of agricultural labourers is observed in Jaipur, Jhunjhunu and Sikar, where it does not exceed 9 percent. Per capita national product (at current prices) is high in Jaipur, Alwar, Ganganagar, Kota, while in some districts it is very low i.e., Rs. 50,767 in Dungarpur, Rs. 51,650 in Dhaulpur, Rs., 53,660 in Sawai Madhopur etc (Fig. 4).

Inadequate Consumption of Food

Food insecurity is ultimately related to food consumption and health. If people are not healthy or suffer from deficiency diseases then it is commonly interpreted that they have inadequate consumption of food. To analyse food consumption several indicators were taken into consideration, namely the proportion of underweight children below 5 years of age, anaemic children (0-5 years), anaemic men, and anaemic women. The selection of indicators was based upon the data available.

The districts of Banswara, Udaipur, Dungarpur, Bundi, Pratapgarh, Baran and Sirohi lie in the very high zone of inadequate food consumption. In Kota, Chittorgarh, Jhalawar, Jalore, Rajsamand, Bhilwara, Tonk and Pali inadequate consumption of food is characterized as high. Barmer, Ajmer, Jodhpur, Dhaulpur, Bharatpur, Alwar, Karoli and Bikaner have moderate consumption of food, while Sawai Madhopur, Jaisalmer, Nagaur, Churu, Ganganagar, Jaipur, Jhunjhunu, Dausa, Hanumangarh and Sikar have a low rate of inadequate food consumption. The share of underweight children is high in Pratpgarh, Dungarpur, Udaipur and Banswara where more than 50 percent of children are underweight. Percentage of anaemic children is high in Banswara, Bundi, Udaipur and Jhalawar where it exceeds 75 percent. The highest share of anaemic women is observed in districts of Banswara, Dungarpur, Udaipur and Baran, where it is more than 66 percent of women, while in districts of Banswara and Sirohi it is more than 40 percent. In Kota and Udaipur around 30 percent of men are anaemic (Fig. 5).

Food Instability

Due to lack of relevant data, three main indicators were taken into consideration to analyse food instability, namely the insured cropped area to net sown area, normal rainfall and deviation from normal rainfall for the year 2018. Insurance of crop gives economic assurance to the farmer in case of crop failure. In the short term, crop insurance can help to reduce hunger and in long term, it can increase resilience (https://oneacrefund.org/blog/crop-insurance-can-improve-food-security-africa/). In Rajasthan, which is a semi-arid region with a low number of irrigation facilities, most of the agriculture and, therefore, crop production is depended upon rainfall. Exceedance of the normal rainfall assures economic prosperity in terms of crop production.

The districts of Barmer, Jaisalmer, Banswara, Karoli, Tonk, Jodhpur and Bundi are marked by very high food instability. Dhaulpur, Jalore, Ganganagar, Alwar, Dausa, Udaipur, Bharatpur and Hanumangarh have high food instability. Dungarpur, Pali, Sirohi, Churu, Ajmer, Baran, Nagaur and Bikaner are characterized by moderate food instability. Food stability can be found in districts of Pratapgarh, Bhilwara, Jhunjhunu, Sikar, Jaipur, Sawai Madhopur, Rajsamand, Jhalawar, Kota and Chittorgarh (Fig. 6).

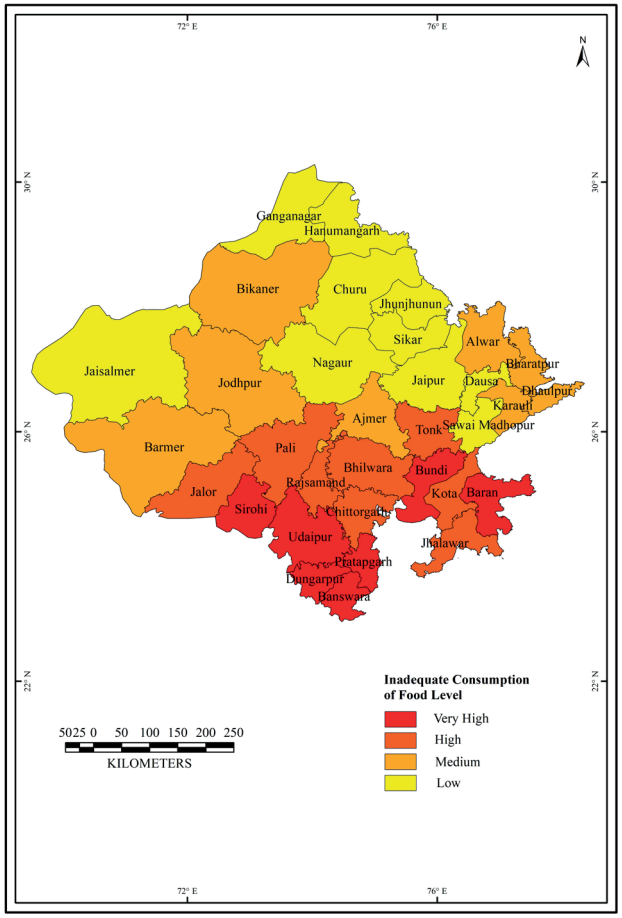

Fig. 5. Inadequate Consumption of Food

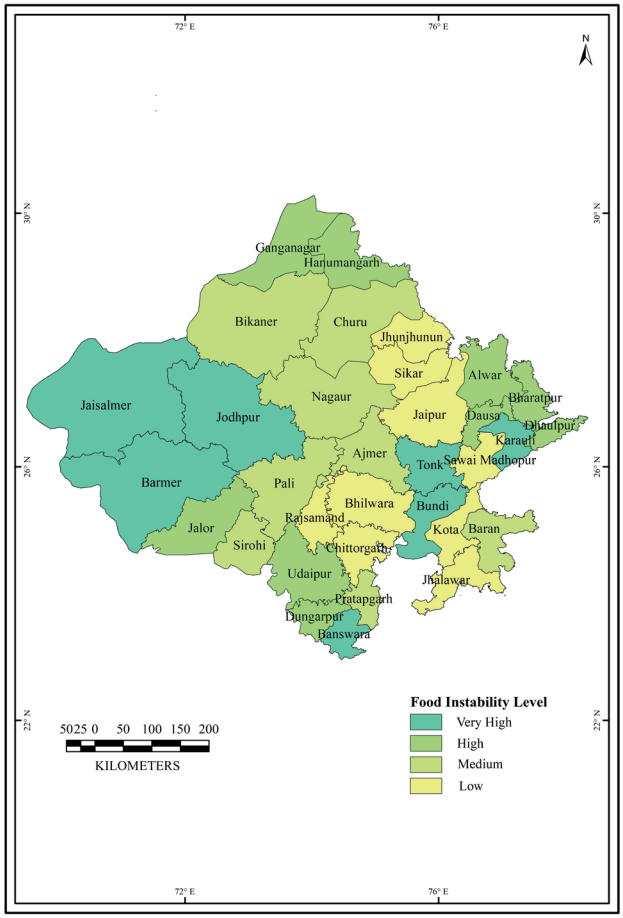

Fig. 6. Food Instability

Dhaulpur has only 12 percent, Bharatpur has 57 percent, Banswara has 80 percent and Dungarpur has 84 percent of its total cropped area insured relative to the net sown area. This parameter reaches as high as 1450 percent in Sirohi, 1140 percent in Chittorgarh, 1120 percent in Kota and around 1100 percent in Pali. Rainfall in Rajasthan varies between 201 mm in Sirohi and 868 mm in Sikar. Pali, Banswara and Jalore also received more than 800 mm of rainfall in June 2018. In Barmer, Jhunjhunu, Bikaner and Ganganagar normal rainfall is less than 300 mm. Jalore, Sirohi and Barmer experienced a deviation of more than -40 mm compared to normal rainfall in 2018. In Sikar, Pratagarh and Sawai Madhopur rainfall in the same year was 30 mm higher than normal.

Food Insecurity Level

Combining all the four dimensions and the outcomes of their analysis, the final characteristic of the food insecurity level was obtained. The following four food insecurity zones were identified in Rajasthan:

Very High Food insecurity

The districts of Banswara, Dungarpur, Udaipur, Bharatpur, Rajsamand, Dhaulpur and Jalore have a very high level of food insecurity. It can be noticed that Banswara is 5th in terms of food unavailability, has 5th rank in food inaccessibility, 7th rank in inadequate food consumption and 3rd in food instability. Dungarpur has a very high level of food inaccessibility and inadequate food consumption, while it is also ranked 14th in food unavailability and 16th in food instability.

High Food Insecurity

Pali, Barmer, Pratapgarh, Nagaur, Sirohi, Jodhpur, Tonk and Churu are high in food insecurity. Barmer ranks first in food unavailability and second in food instability. Barmer stands at 27th place in terms of food inaccessibility and 16th in terms of inadequate consumption of food.

Moderate Food Insecurity

The districts of Jhalawar, Karoli, Bundi, Baran, Ajmer, Jaisalmer, Bhilwara and Sawai Madhopur lie in the moderate zone of food insecurity. Bundi and Baran are ranked high in inadequate food consumption while food unavailability there is low to moderate. Jaisalmer is marked by high food unavailability and food instability but other two indicators i.e., food inaccessibility and inadequate consumption of food, are both low.

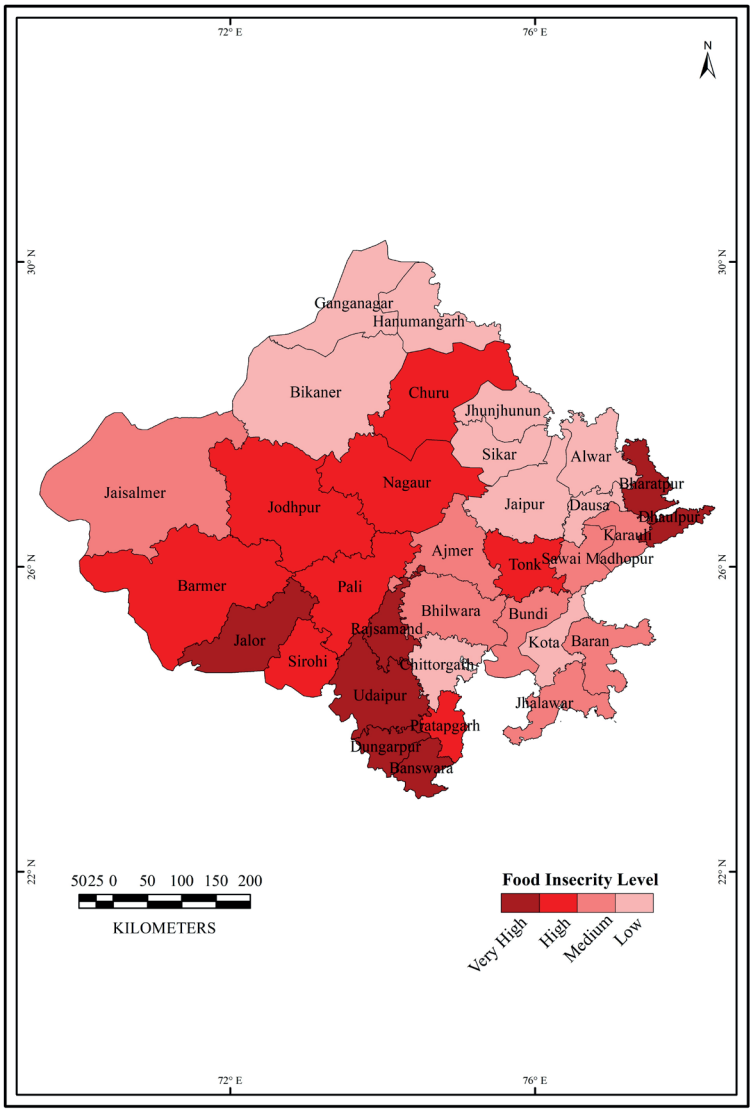

Fig. 7. Food Insecurity Level

Table 1. Ranking of the Districts on the basis of Four Dimensions of Food Insecurity

Districts	Ranks			
Food insecure zone	Food unavailability	Food Inaccessibly	Inadequate Consumption	Food instability
Banswara	5	5	7	3
Dungarpur	14	2	3	16
Udaipur	13	3	2	13
Bharatpur	8	1	20	14
Rajsamand	4	14	45	30
Dhaulpur	12	4	19	8
Jalore	2	21	11	9
Pali	15	9	15	17
Barmer	1	27	16	2
Pratapgarh	17	23	5	24
Nagaur	7	6	26	23
Sirohi	20	22	7	18
Jodhpur	9	16	18	6
Tonk	10	28	14	5
Churu	3	13	27	19
Jhalawar	29	15	10	31
Karoli	19	10	22	4
Bundi	32	19	4	7
Baran	33	12	6	21
Ajmer	21	17	17	20
Jaisalmer	6	24	25	2
Bhilwara	16	31	13	25
Sawai Madhopur	18	18	24	29
Kota	31	25	8	32
Alwar	24	11	21	11
Jhunjhunu	26	7	30	26
Bikaner	11	29	23	23
Sikar	22	8	33	27
Chittorgarh	28	32	9	33
Dausa	23	20	31	12
GangaNagar	27	30	28	10
Hanumangarh	25	33	32	15
Jaipur	30	27	30	28

Low Food Insecurity

Kota, Alwar, Jhunjhunu, Bikaner, Sikar, Chittorgarh, Dausa, Ganganagar, Hanumangarh and Jaipur are characterized by low food insecurity. This means that these districts are the most secure in Rajasthan in terms of food. Alwar and Sikar are high in terms of food inaccessibility but they have a lot of area under food grain and production is also high. These districts also have more than 96 percent of households with safe drinking water. Sikar has around 48 percent of households with clean fuel for cooking. Alwar district has a high share of insured crop area. The deviation of rainfall from normal is also positive. Therefore, most of the indicators are conducive to food security (Fig. 7).

DISCUSSION

This paper analyses the food insecurity situation in 33 districts of Rajasthan. The analysis is based on several indicators, which were assessed under four broad dimensions, namely food unavailability, food inaccessibility, inadequate consumption of food and food instability. It is to be noted that food includes sufficient and safe food, as well as water and fuel to cook it. Various indicators that characterize food insecurity under the four main dimensions are presented in the paper. Considering the results (Table 1) it can be clearly seen that each indicator has its own relevance. The variation of each indicator reflects its significant role in evaluating food insecurity as Rajasthan is extremely diverse in terms of its physiographic and demographic factors. The state

has food secure districts like Jaipur, Hanumangarh, Ganganagar, Alwar, Sikar and Bikaner. In general, in these districts, all the parameters are positive to food security. In districts of Banswara, Dungarpur, Udaipur, Bharatpur, Rajsamand, Dhaulpur, Jalore food insecurity is very high. The policies formulated by the government regarding food insecurity need to focus on the different dimensions and their status. This is especially the case for districts like Barmer, which has low double-cropped to the net sown area so its food production is also low. It is also marked by low forested area, safe drinking water and fuel for cooking are not properly available, there is a high number of underweight children and anaemic people, rainfall deficit is high and insured cropped area is also very low. The Banswara district has very high food unavailability, food inaccessibility, food instability and inadequate consumption of food. The district ranks fifth, fifth, third and seventh respectively in all four dimensions. Similarly, Dungarpur is very high in food inaccessibility and inadequate consumption of food. Therefore, policies should focus more on improving both these indicators in this district. Main workers and marginal workers there are very low in number and people are mainly engaged in agricultural labour, which does not ensure the security of income. In Dungarpur, the average size of land holdings is very low along with the net domestic product. The parts of Dungarpur, Rajasmand, Banswara, Bharatpur and Udaipur have a tribal population and because of their poverty and backwardness, they are affected the most by the food insecurity.

Food insecurity cannot be just characterized by scarcity of food grains. Due to semi-arid conditions, many districts of Rajasthan are not able to produce a lot of food. Because of that, there is a need for better PDS (Public Distribution System) to adhere to the calorie and nutrition requirements of the localities. The situation in districts with very high food insecurity level can be worse in case of rainfall deficiency or drought year, so it is important to ensure the cropped area and explain the farmers the importance of crop insurance. Nutrition security is another important concern and Public Distribution System should not only focus on food grain distribution but also on distribution of protein and iron-rich food items at subsidised and affordable rates. Distribution of clean fuel, safe drinking water and milk should also be a part of a food security mission. Sustainable Development Goal of zero hunger can be achieved by understanding the holistic nature of food security. Thus, it is important to measure food security by considering its various parameters, which can provide a real picture as well as the scope of improvement to make it a realistic goal to achieve.

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