

The Correlation Between Food Security and Health Status of Tribal Communities: A Case Study of Selected Tribal Villages in Nashik District

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ABSTRACT

The present investigation aims to the correlation between food security and the health status of tribal communities: a case study of selected tribal villages in Nashik district. It is based on primary data collected from 300 sample tribal households across 15 sample villages in the Nashik district. The present paper is a major analysis of the food security index (food availability, food accessibility, food stability, and food utilization), the health status index, and its correlation with the selected tribal villages in the study region. The study applies the Min-Max Normalisation Index technique to analyse the level of food security, and health status in tribal communities, and the Pearson correlation coefficient technique is applied to the correlation between food security and health status. The study observes regional imbalances in the levels of food security and health status among tribal communities in the selected villages. Generally, developed areas exhibit a high food security index, while less developed regions, particularly tribal areas, have the lowest levels of food security. Similar conditions are observed in the health status of these tribal villages. The correlation analysis reveals a strong positive relationship between the food security index and the health status index in these villages. This indicates a significant positive causal relationship between food security and health status, where higher food security directly leads to better health outcomes in the selected tribal villages.

(Keywords- Tribal community, food security, food availability, food accessibility, food stability, food utilization, health status,)

INTRODUCTION-

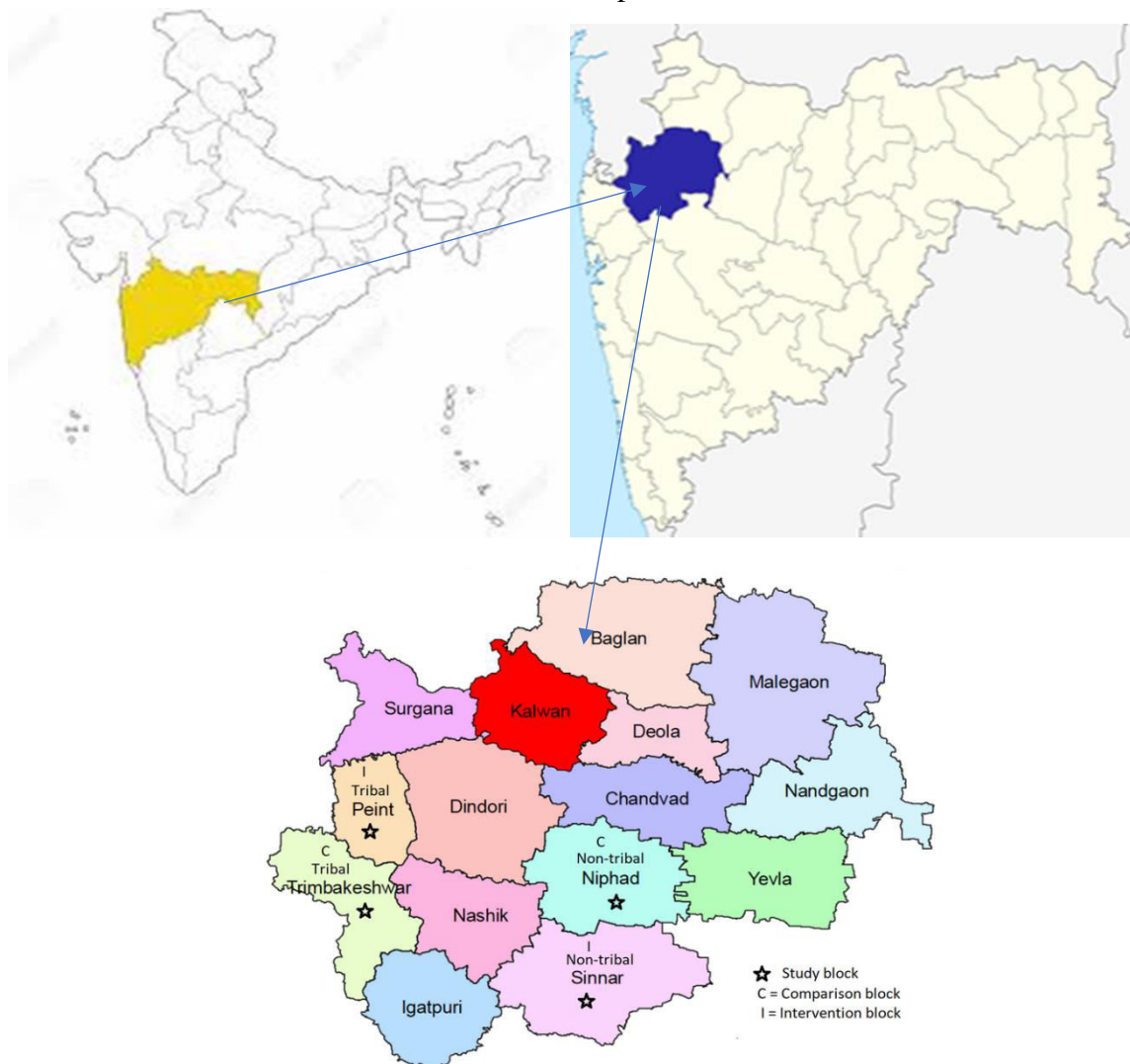
Scholars have published numerous research papers, articles, and reports regarding the relationship between food security and the health status of tribal communities. Murray et al. (1980) delved into the intricate relationship between diet and disease within tribal societies, emphasizing a profound ecological interdependence that has historically favoured human survival. Their research underscores the significance of dietary patterns in these societies, where natural food sources are intricately linked to health outcomes.¹ However, Murray et al. caution that this delicate equilibrium can be disrupted when tribal diets are altered to mirror the highly productive, technology-driven food systems of the Western world.² Chakma et al. (2009) investigated the nutritional status of the Baiga tribe, a primitive community in Madhya Pradesh, through a cross-sectional survey encompassing 455 individuals from 17 villages. The results depicted a distressing scenario of malnutrition, with 59.5% of individuals being underweight and 75.6% being stunted. The study attributed these findings to the Baiga tribe's diet, which was found to be deficient in essential nutrients such as protein, vitamins, and

minerals. Additionally, limited food availability and awareness about balanced nutrition were identified as contributing factors to the prevalent malnutrition among the Baiga tribe.³ Galal (2009) stated that the interaction between food supply and other important factors making up the system can shed light on individual and population health. A critical analysis of the health system must also include consideration of disparity in food security since it represents one of the most dramatic indicators of economic and health inequality.⁴ Bhattacharjee et al. (2011) authored a chapter in the book "Indigenous People's Food Systems" titled "The Bhil Food System: Links to Food Security, Nutrition, and Health." The chapter discusses the hurdles encountered by the Bhil community in sustaining their food system, highlighting the adverse effects of environmental degradation, displacement, and erosion of traditional knowledge of the Bhil food system. The authors advocate for policies and initiatives aimed at conserving and promoting traditional food systems to ensure food security and nutritional well-being among indigenous populations.⁴ Nitin Tagade (2012) has conducted research on food insecurity in the tribal region of Maharashtra. He concluded that a household's socioeconomic status directly impacts food security and nutrition.⁵ Bhagat et al. (2018) studied the food security and health status of tribal and non-tribal people in Maharashtra. A study of 1300 households in the Melghat division of the Amravati district found that the food security and health status of the tribal people was less than that of the non-tribal people.⁶

STUDY AREA-

The Nashik district is located within the upper Godavari basin and the partly Tapi river basin, spanning from 19°35' to 20°52' North latitudes and 73°16' to 75°56' East longitudes. It comprises a distinct geographical unit covering an area of 15,530 square kilometers. According to the 2011 census, the population of Nashik district was 6,107,187, with tribal people accounting for 1,564,369 (25.62%). However, the distribution of tribal populations across the district is uneven. In Surgana tehsil, 96.51% of the population is tribal, followed by Peth (96.44%), Trimbak (80.20%), Kalvan (68.95%), Dindori (55.57%), and Igatpuri (40.47%). The district, situated in the *Khandesh* and North Maharashtra regions, comprises 1,929 villages and 18 towns. Nashik District shares its borders with Jalgaon and Aurangabad Districts to the east, Dhule District to the north, Thane District to the southwest, Ahmadnagar District to the south, and Dang District to the northwest.

Location Map- Nashik District

**OBJECTIVES**

1. To study the food security status of the tribal community in selected tribal villages in the Nashik district.
2. To study the health status of the tribal community in selected tribal villages in the Nashik district.
3. To study the correlation between food security index and health status.

MATERIAL AND RESEARCH METHODOLOGY

This study is based on primary data. The tribal villages were selected using a random sampling method. A list of tribal villages was prepared based on villages with more than 50% tribal population selected for each tehsil of the district from the secondary data of the 2011 population census of Nashik district. For research, one tribal village in each tehsil was selected. Out of the total tribal households in each respective sample village, an average of 20 sample households were selected for the interview. This research collected primary data from 300 sample households spread across 15 villages in the Nashik district's 15 tehsils. It processed and edited the collected data for analysis using various statistical methods

presented in tables. To calculate the level of food security and health status in the tribal community in the study region, use the Min-Max Normalisation Index method. This method involves applying the NITI Aayog for Health Index in India. The formula is used:

$$\text{Variable Index for positive indicator} = \frac{Xi - \text{Min } X}{\text{Max } X - \text{Min } X}$$

$$\text{Variable Index for negative indicator} = \frac{\text{Max } X - Xi}{\text{Max } X - \text{Min } X}$$

Where

X_i = value of the variable Min

X = Minimum value of X in the scaling Max

X = Maximum value of X in the scaling

Different indicators included in the food security Index and health status index components have been scaled and normalized to take a value on a scale ranging from 0 to 1. The scaled least achievement corresponds to zero whereas the best achievement corresponds to 1.

The level of food security and health status was grouped under four heads:

Category	Composite health status score
High food security, and health status region	More than 0.60
Moderate food security, and health status region	0.41 to 0.59
Low food security, and health status region	Below 0.40

For calculating the Pearson correlation coefficient use the following formula to calculate the Correlation between the level of the food security index and the health status index

$$r = \frac{\sum xy}{\sqrt{\sum x^2 \cdot \sum y^2}}$$

Result and discussion –

Levels of food security –

Food security can be defined as "access by all members at all times to enough food for an active, healthy life, including, at a minimum: the ready availability of nutritionally adequate and safe foods, and the assured ability to acquire personally acceptable foods."⁸ based on the Min-Max score method for selected villages of the tribal community in Nashik district, levels of food security were ascertained and grouped into three levels: high, moderate, and low. Lower-level values of the composite index indicated a lower rate of food security, and higher values of the ranking composite index indicated a higher rate of food security.

Table 1- Indicators of food security

Group	Indicators	
Food availability	X1	Per capita land availability (in hectares)
	X2	Per capita per day domestic Food grain Availability (gram)
	X3	Percentage of households with enough food every day
Food accessibility	X4	Percentage of households with an average monthly income of more than 5000 rupees
	X5	Percentage of the working population
	X6	Percentage of Agricultural Laborers to Total Worker
Food stability	X7	Percentage Irrigated area total agriculture area
	X8	Percentage Of household ration card availability
	X9	Percentage of Households with at least two times of food frequency
Food utilization	X10	Infant mortality rate
	X11	Juvenile Sex Ratio

(Source: Compiled by the Researcher)

I) High Food Security Region-

Food security is high, with a min-max range above 0.60. The sampled tribal households in selected villages in the Nashik district categorize four villages as having high food security: Banganganagar (0.70), Babhulane (0.65), Ganeshnagar (0.64), and Kashyapnagar (0.60). All indicators of food security fall into the high or moderate category. These villages are in the Niphad, Baglan, Nandgoan, and Nashik tehsils. Agriculture, industrial development, and education facilities play a crucial role in ensuring high food security in these villages.

Table: 2 Level of Food Security Indicators- Selected tribal village

village	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11
Palvihir	0.09	544.45	81.20	56.52	68.85	84.44	44.25	95.00	89.25	16.5	958
Jogmodi	0.10	297.35	83.50	61.01	65.21	86.00	38.25	93.98	85.25	18.59	1026
Divyachapada	0.11	248.15	92.89	64.01	64.25	88.75	42.65	92.50	88.25	26.5	975
Mohobari	0.10	733.12	94.24	65.22	61.38	89.25	60.25	91.50	96.50	5.3	905
Mandane	0.12	214.63	89.57	69.25	65.59	84.06	45.8	98.15	90.25	7.09	916
Somaj	0.09	275.63	95.74	68.53	60.25	85.25	55.25	96.00	97.50	6.4	965
Babhulane	0.13	976.36	93.25	72.46	62.25	84.05	68.15	98.50	98.50	4.5	890
Hanmantpada	0.11	212.25	92.86	60.00	63.56	88.25	52.52	100.00	87.70	3.59	865
Jambutke	0.14	535.1	89.50	72.15	61.25	91.05	48.5	95.50	90.50	3.58	825
Banganagar	0.19	625.78	100.00	67.00	58.84	94.68	60.5	100.00	95.00	4.5	805
Ganeshnagar	0.16	963.12	88.11	79.00	51.04	88.25	62.64	96.75	96.75	0	925
Chandrapur	0.14	495	91.28	69.25	53.25	92.05	65.5	93.00	94.30	0	775
Gopalwadi	0.11	996.15	89.67	76.33	52.00	86.38	70.52	90.00	88.50	0	895
Garbad	0.15	645.14	88.64	68.25	61.35	84.62	58.25	92.25	92.50	2.5	955

Kashyapnagar	0.11	568.25	91.25	84.25	64.65	86.58	74.25	93.25	96.75	0	819
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(Source: Compiled by the Researcher)

Table: 3 Min-Max scores of food security- selected tribal village

Village	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	CS	FOOD SECURITY INDEX
Palvihir	0.00	0.42	0.00	0.00	1.00	0.04	0.17	0.50	0.30	0.38	0.73	3.54	0.32
Jogmodi	0.10	0.11	0.12	0.16	0.80	0.18	0.00	0.40	0.00	0.30	1.00	3.17	0.29
Divyachapada	0.20	0.05	0.62	0.27	0.74	0.44	0.12	0.25	0.23	0.00	0.80	3.72	0.34
Mohobari	0.10	0.66	0.69	0.31	0.58	0.49	0.61	0.15	0.85	0.80	0.52	5.77	0.52
Mandane	0.30	0.00	0.45	0.46	0.82	0.00	0.21	0.82	0.38	0.73	0.56	4.72	0.43
Somaj	0.00	0.08	0.77	0.43	0.52	0.11	0.47	0.60	0.92	0.76	0.76	5.43	0.49
Babhulane	0.40	0.97	0.64	0.57	0.63	0.00	0.83	0.85	1.00	0.83	0.46	7.19	0.65
Hanmantpada	0.20	0.00	0.62	0.13	0.70	0.40	0.40	1.00	0.18	0.86	0.36	4.85	0.44
Jambutke	0.50	0.41	0.44	0.56	0.57	0.66	0.28	0.55	0.40	0.86	0.20	5.44	0.49
Banganganagar	1.00	0.53	1.00	0.38	0.44	1.00	0.62	1.00	0.74	0.83	0.12	7.65	0.70
Ganeshnagar	0.70	0.96	0.37	0.81	0.00	0.40	0.68	0.68	0.87	1.00	0.60	7.05	0.64
Chandrapur	0.50	0.36	0.54	0.46	0.12	0.75	0.76	0.30	0.68	1.00	0.00	5.47	0.50
Gopalwadi	0.20	1.00	0.45	0.71	0.05	0.22	0.90	0.00	0.25	1.00	0.48	5.26	0.48
Garbad	0.60	0.55	0.40	0.42	0.58	0.05	0.56	0.23	0.55	0.91	0.72	5.55	0.50
Kashyapnagar	0.20	0.45	0.53	1.00	0.76	0.24	1.00	0.33	0.87	1.00	0.18	6.56	0.60

(Source: Compiled by the Researcher)

II) Moderate Food Security Region-

The moderate level of food security ranges from 0.41 to 0.59 (min-max score). The sample tribal households in the sample villages of Nashik district categorize eight villages, namely Mohobari (0.52), Garbad (0.50), Chandrapur (0.50), Jambutke (0.49), Somaj (0.49), Gopalwadi (0.48), Hanmantpada (0.44), and Mandane (0.43), under the moderate food security region. A detailed assessment of eleven food security indicators in Mohobari village classifies five as high and two as moderate. Garbad village has three indicators as high and six as moderate. Chandrapur village has four indicators as high and two as moderate. Jambutke village has two indicators as high and seven as moderate. Hanmantpada village has four indicators as high and two as moderate, and Mandane village has three indicators as high and three as moderate. In most of the villages, per capita land availability and per capita per day domestic food grain availability are observed at low levels. Other indicators are observed at sufficient levels. These villages are mostly concentrated in the northern and eastern parts of the study region.

III) Low Food Security Region-

The low level of food security ranges below 0.35 on min-max scores. The sampled tribal households in selected villages in the Nashik district categorize three villages, namely Jogmodi (0.29), Palvihi (0.32), and Divyachapada (0.34), under the low food security region. These villages are located in the tehsils of Triembak, Surgana, and Peint. A detailed assessment of eleven food security indicators in Jogmodi village classifies eight as the lowest level; Palvihi Tehsil classifies seven as the lowest level; and Divyachapada Tehsil classifies seven as the lowest level. In these villages, only the juvenile sex ratio and the working population demonstrate high levels. In contrast, other indicators are observed at moderate or lowest levels.

Level of the Health Status–

We determined and grouped the levels of health status into three categories: high, moderate, and low, based on the Min-Max score method for selected villages of the tribal community in Nashik district. Lower-level values of the composite index indicated a lower rate of health status, and higher values of the ranking composite index indicated a higher rate of health status.

Table 4- Indicators of health status

X1	Percentage of households using public or household toilets
X2	Percentage of households having Safe Drinking water facilities
X3	Percentage of households having the Processing of drinking water
X4	Percentage of households having no Solid Waste Management facility
X5	Percentage of households having no Wastewater Management Facility
X6	Status of health insurance
X7	Percentage of infants who are fully immunized against EPI diseases
X8	Percentage of households using government health care facilities
X9	Percentage of households using Family planning
X10	The percentage of Severely Under-Weight children in the age group of 0-5 years
X11	Percentage of respondents smoking
X12	Percentage of respondents consuming alcohol

I) High Health Status Region-

The level of health status is high, with a min-max range above 0.60. The sampled tribal households in selected tribal villages in the Nashik district categorize three villages as having high health status: Banganganagar (0.76), Chandrapur (0.67), and Kashyapnagar (0.66). According to a detailed assessment of twelve health status indicators in Banganganagar village, eight are classified as high. A similar pattern exists in Chandrapur village, where nine indicators are in the high category; in Kashyapnagar village, seven health status indicators fall into the high category. These villages receive high and moderate ranks in many indicators.

II) Moderate Health Status Region-

The moderate level of health status ranges from 0.41 to 0.59 (min-max score). The sample tribal households in selected tribal villages in the Nashik district categorize nine villages under the moderate health status region: Babhulane (0.58), Gopalwadi (0.58), Jambutke (0.57), Mandane (0.56), Garbad (0.52), Ganeshnagar (0.51), Mohobari (0.50), Hanmantpada (0.44), and Somaj (0.43). A detailed assessment of twelve health status indicators in Babhulane village classifies five as high and four as moderate; in Gopalwadi village, seven as high and one as moderate; in Jambutke village, five as high and three as moderate; in Mandane village, six as high and four as moderate; in Garbad village, four as high and three as moderate; in Ganeshnagar village, six as high and two as moderate; in Mohobari village, five as high and four as moderate; in Hanmantpada village, four as high and two as moderate; and in Somaj village, three as high and three as moderate. These villages are located in the northern, eastern, and southeastern parts of the study region. While all indicators are observed at a sufficient level, the low availability of health insurance, the high rate of smokers, and the consumption of alcohol negatively influence the health status of these villages.

III) Low Health Status Region-

The low level of health status ranges below 0.35 (min-max scores). The sampled tribal households in selected tribal villages in the Nashik district categorize three villages, namely Divyachapada (0.32), Jogmodi (0.26), and Palvihir (0.25), under the low health status region. These villages are mostly located in tribal concentration tehsils like Surgana, Peint, and Triembak. A detailed assessment of twelve health status indicators classifies seven as the lowest level in Divyachapada village, nine as the lowest level in Jogmodi village, and eight as the lowest level in Palvihir village. All indicators are observed at a very poor level in these villages in the study region.

Table: 5 Level of health status Indicators- selected tribal villages

Village	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12
Palvihir	52.15	32.15	14.85	58.75	92.17	5.75	85.45	48.15	68.74	4.75	59.65	37.15
Jogmodi	32.62	38.25	25.75	63.45	81.14	11.75	80.48	55.65	81.35	3.15	60.42	47.11
Divyachapada	45.14	34.10	36.14	56.52	82.15	11.25	74.15	48.14	85.14	5.15	55.48	36.06
Mohobari	53.28	50.65	42.82	53.73	78.15	13.95	80.36	65.16	81.90	1.65	62.92	35.42
Mandane	47.15	56.14	56.76	70.57	72.10	21.84	85.02	70.57	81.29	2.15	55.40	34.85
Somaj	35.16	46.86	27.89	56.25	75.68	8.85	78.10	85.58	74.32	2.63	52.50	39.00
Babhulane	64.05	56.05	56.05	62.25	66.86	9.44	91.13	74.68	72.68	2.13	58.18	39.63
Hanmantpada	52.51	34.61	35.71	58.14	61.29	0.00	74.92	68.15	78.57	0.00	46.07	46.07
Jambutke	53.45	46.75	58.25	69.00	67.15	10.15	82.50	62.12	78.00	0.00	47.88	31.35
Banganganagar	61.75	70.85	70.75	58.25	58.15	21.25	85.16	68.75	100.00	0.00	60.00	38.89
Ganeshnagar	41.50	58.75	59.00	56.25	64.75	0.00	88.80	64.50	84.25	0.00	65.15	42.50
Chandrapur	65.75	48.05	19.25	52.75	65.00	15.00	82.15	75.70	87.25	0.00	48.30	33.40

Gopalwadi	58.45	63.33	62.00	48.65	48.15	0.00	74.14	68.15	68.25	0.00	59.15	34.50
Garbad	43.15	51.30	42.00	63.15	75.33	5.45	85.12	62.00	84.25	0.00	51.33	34.15
Kashyapnagar	56.10	54.12	56.94	58.94	71.95	8.82	88.29	72.15	88.75	0.00	57.46	28.95

(Source: Compiled by the Researcher)

Table: 6 Min-Max scores of health status indicator- selected tribal villages

Tahsil	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	CS	Health status index
Palvihir	0.59	0.00	0.00	0.54	0.00	0.26	0.67	0.00	0.02	0.08	0.29	0.55	2.99	0.25
Jogmodi	0.00	0.16	0.19	0.32	0.25	0.54	0.37	0.20	0.41	0.39	0.25	0.00	3.09	0.26
Divyachapada	0.38	0.05	0.38	0.64	0.23	0.52	0.00	0.00	0.53	0.00	0.51	0.61	3.84	0.32
Mohobari	0.62	0.48	0.50	0.77	0.32	0.64	0.37	0.45	0.43	0.68	0.12	0.64	6.02	0.50
Mandane	0.44	0.62	0.75	0.00	0.46	1.00	0.64	0.60	0.41	0.58	0.51	0.68	6.68	0.56
Somaj	0.08	0.38	0.23	0.65	0.37	0.41	0.23	1.00	0.19	0.49	0.66	0.45	5.15	0.43
Babhulane	0.95	0.62	0.74	0.38	0.57	0.43	1.00	0.71	0.14	0.59	0.37	0.41	6.90	0.58
Hanmantpada	0.60	0.06	0.37	0.57	0.70	0.00	0.05	0.53	0.33	1.00	1.00	0.06	5.27	0.44
Jambutke	0.63	0.38	0.78	0.07	0.57	0.46	0.49	0.37	0.31	1.00	0.91	0.87	6.83	0.57
Banganganagar	0.88	1.00	1.00	0.56	0.77	0.97	0.65	0.55	1.00	1.00	0.27	0.45	9.11	0.76
Ganeshnagar	0.27	0.69	0.79	0.65	0.62	0.00	0.86	0.44	0.50	1.00	0.00	0.25	6.08	0.51
Chandrapur	1.00	0.41	0.08	0.81	0.62	0.69	0.47	0.74	0.60	1.00	0.88	0.75	8.05	0.67
Gopalwadi	0.78	0.81	0.84	1.00	1.00	0.00	0.00	0.53	0.00	1.00	0.31	0.69	6.97	0.58
Garbad	0.32	0.49	0.49	0.34	0.38	0.25	0.65	0.37	0.50	1.00	0.72	0.71	6.23	0.52
Kashyapnagar	0.71	0.57	0.75	0.53	0.46	0.40	0.83	0.64	0.65	1.00	0.40	1.00	7.95	0.66

(Source: Compiled by the Researcher)

Correlation between the level of food security index and health status index

- **Null Hypothesis (H0):** "There is no significant correlation between the level of the food security index and the health status index."
- **Alternative Hypothesis (H3):** "There is a significant positive causal relationship between the food security index and health status, where higher food security directly causes better health status."

The correlation analysis reveals a strong positive relationship ($r = 0.81$) between the food security index and the health status index in selected tribal villages in the study region. Thus, it can be expressed that There is a significant positive causal relationship between the food security index and health status, where higher food security directly causes better health outcomes in selected tribal villages in the study region. P- value (0.0000232) obtained from the correlation analysis indicates that it is below the 0.01 hance significance at the 1 percent level.

Table- 7 Correlation between the level of a food security index and health status index

Variables	N	Correlation (r)	P-value
Food security index	15	0.81**	0.0000232
Health Status Index	15		

** Correlation is significant at the 0.01 level (2-tailed).

It testifies to the **Null Hypothesis (H₀)** There is no significant correlation between the level of the food security index and the health status index of the study region rejected and **Hypothesis (H₃)** There is a significant positive causal relationship between the food security index and health status, where higher food security directly causes better health status has accepted. Thus, we can say that 99 percent confidence that enhanced the level of food security index directly influences the level of health status of tribal communities selected tribal villages of the study region.

CONCLUSION-

The present study found regional imbalances in the level of food security and health status among tribal communities in selected villages within the study region. Generally, developed areas exhibit a high food security index, while less developed regions, particularly tribal areas, have observed the lowest level of food security. Tehsils with high tribal populations, such as Surgana, Peint, and Triembak, have low food security, while agriculturally and industrially developed tehsils have high food security. Social, economic, and agricultural developments directly influence food security in selected tribal tehsils in the Nashik district. Per capita land availability and per capita per day domestic food grain availability are observed at low levels for all villages in the study region. Similar conditions are observed in the health status of these tribal villages. The health status of tribal communities improves from low-developed to highly developed areas. Processing of drinking water, Solid Waste Management facility, and Wastewater Management Facility are the very lowest levels available in all villages. Social, agricultural, industrial, infrastructure, and education development in selected villages are affected by the levels of food security and health status of tribal communities in the study region. Correlation analysis reveals a strong positive relationship between the food security index and the health status index in these villages. This indicates a significant positive causal relationship between food security and health status, where higher food security directly leads to better health outcomes in the selected tribal villages.

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