AN ANALYTICAL STUDY OF COMPARISION BETWEEN STATE NUTRITIONAL INDEX (SNI) AND HDI FOR INDIAN STATES

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Abstract:

The overall health of an individual is significantly influenced by their nutritional status. Nutritional status of present children should be emphasised because the quality of future human resource depends on them. In this research exercise, State Nutritional Index (SNI) has been constructed for 27 states of India based on the percentage of stunted, wasted, severely wasted, underweight and overweight children under the age of five years. A comparison has been made between NFHS–4 (2015-16) and NFHS-5 (2019-21) data and between SNI ranks and Human Development Index (HDI) of 2020. Results show that four states namely Andhra Pradesh, Gujarat, Kerala and Manipur have remained stable in their ranks from NFHS-4 to NFHS - 5. Fourteen states have improved in their ranks and nine states showed deterioration in their ranks from NFHS - 4 to NFHS - 5. Apart from these, results also indicate that if some states have performed better in HDI, that doesn't mean that their nutritional status is also good. The highest relative difference between HDI and SNI ranks in terms of deterioration has been found for Karnataka. The highest relative difference between HDI and an SNI ranks in terms of improvement has been found for Manipur. Thus, in these circumstances, the government should first identify the areas and then take some affirmative actions to improve the nutritional status of children. The government and policy makers might use this SNI ranking to tackle the malnutrition problem and prioritise the areas.

JEL code: I14, I15, I1

Key words: SNI, HDI, Malnutrition, National Family Health Survey (NFHS)

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Introduction:

About 50 per cent of children under the age of five years die because of malnutrition. The United Nations Children's Fund (UNICEF), World Health Organisation (WHO), World Bank (WB), and global and regional child malnutrition estimates revealed that we have remained far from a world without malnutrition (UNDP et al., 2020). The overall health of an individual is significantly influenced by their nutritional state. The nutritional status of present children should be emphasised because the quality of future human resource depends on them (Som et al., 2007). Malnutrition, sickness, mortality, and child care are all covered under the umbrella of child health. Internationally, child growth is considered an essential indicator of nutrition and health.

Nutritional imbalance is measured by stunting, wasting, underweight, and overweight. The effect of such imbalance is either undernutrition or overweight (WHO, 2019). Stunting is also known as chronic malnutrition while studying the health of children. Stunting is the devasting result of poor nutrition in utero and early childhood. Stunted children may never grow to their fullest height and may never reach their full cognitive potential in terms of cognitive development (Vakilna & Nambiar, 2020). Wasting refers to a low weight for height. Acute undernutrition in children is characterised by wasting. Wasting is a result of inadequate dietary intake or a high prevalence of infectious illnesses, specially diarrhoea (WHO, 2019). Underweight refers to a low weight for age. The mortality risk increases in underweight children, while childhood obesity is associated with a higher probability of obesity in adulthood, which can lead to several disabilities and diseases such as diabetes and cardiovascular diseases (WHO, 2019). Nearly 35.5 per cent of children under the age of five are stunted in India (MHFW, 2020). Children under five years of age in India who are wasted, severely wasted, underweight, and overweight are 19.3 per cent, 7.7 per cent, 32.1 per cent, and 3.4 per cent respectively (NFHS-5, 2022).

In the study conducted by Rosenbloom et al., in 2008, a Global Nutritional Index (GNI) has been constructed by them. GNI is a composite index of three indicators: nutritional

deficit, nutritional excess and food security. Under this study, a comparison has been made between GNI value and Human Development Index (HDI) value. Apart from that, they devided all the countries into four categories: developed countries, transition countries, low mortality developing countries and high mortality developing countries. Results showed that India was ranked at 96th rank out of 192 countries for this study. Here, it was also observed that India has been placed in high mortality developing countries (Rosenbloom et al., 2008). Another important index related to nutritional status is a Global Hunger Index (GHI). GHI is a tool for measuring and tracking hunger at global, regional and national levels jointly released by concern Worldwide and Welthungerhilfe (Grebmer et al., 2023). GHI includes four indicators: undernourishment, child stunting, child wasting, and child mortality. In GHI, countries are divided into five severity scales namely low, moderate, serious, alarming and extremely alarming. In the GHI – 2023, India ranked at 111 out of 125 countries. GHI value of India is 28.7, which falls into the 'serious' category. Apart from that, India is ranked behind most of its neighbouring countries such as Pakistan, Sri Lanka, Nepal, and Bangladesh (Chandra, 2023). On the other side, India is the world fifth largest economy with 3.730 billion USD and 2.61 thousand USD GDP per capita (Batra, 2023). Despite the fact that, India is fifth largest economy in the world, its poor nutritional status raised serious questions on the economic growth story. Due to this contradictory outcomes, analysis of India as whole and states in particular for the various nutritional levels is becoming more urgent to address the issue. Therefore, in this research exercise, State Nutritional Index (SNI) has been constructed for 27 states of India based on the percentage of stunted, wasted, severely wasted, underweight, and overweight children under the age of 5 years using data available through National Family Health Survey (NFHS).

Literature review:

(Rosenbloom et al., 2008) Researchers have developed a Global Nutritional Index (GNI) modelled on the Human Development Index (HDI), which is based on three indicators of nutritional status- deficit, excess, and food security. They divided countries into four categories, namely developed, transition, low-mortality developing countries, and high-mortality developing countries. The results of this study showed

that Japan has achieved first rank (0.989) and the United States (0.806) has obtained the last rank in developed countries. Estonia (0.943) ranked first rank in the case of transition countries and ranked 10th in overall ranking, while Tajikistan (0.629) obtained the last rank in transition countries. The Republic of Korea has secured first rank in the case of low-mortality developing countries and 12th rank in the overall ranking, while Nauru obtained the last rank in the low-mortality developing countries. Algeria (0.876) achieved first rank in high-mortality developing countries, and 47th rank in the overall ranking, while Sierra Leone obtained the last rank in the high-mortality developing countries.

(Kanjilal et al., 2010) This study indicated that across all major states, the lowest prevalence of stunting among children were found in Kerala, whereas more than half of the children below five years old were found stunted in Uttar Pradesh (57%), followed by Bihar (56%), Gujarat (52%), and Madhya Pradesh (50%).

(Naaz & Akram, 2017) The study explored the major achievements and shortcomings of progress made on key indicators related to the nutritional status of children and adults in the last decade by making a comparative analysis of the NFHS-3 and NFHS-4 factsheets. The results showed that in the case of stunted, Bihar was the worst-performing state, which means the highest percentage of stunted children were found in Bihar, followed by Uttar Pradesh and Jharkhand. On the other hand, Kerala was the best-performing state, which means the lowest prevalence of stunted children were found in Kerela, where only 19.7 per cent of children under five years were stunted. In terms of wasted, Manipur state was the best-performing state, while Jharkhand was the worst performing state. In the case of severely wasted children, results indicated that Jharkhand and Manipur were the worst and best-performing states, respectively. In the case of underweight, Jharkhand was the worst-performing state, while Mizoram was the best-performing state.

(Soheylizad et al., 2016) They have studied the correlation between malnutrition status of children under five years and Human Development Index (HDI) Worldwide. Data about the HDI and its components were obtained from the United Nations Development Programme (UNDP) for 188 countries and the data about the prevalence of wasting, stunting, and overweight children under 5 years were obtained from the World Health

Organisation (WHO). The bivariate correlation method was used to evaluate the correlation between the prevalence of malnutrition status and HDI. A significant negative correlation was found between the prevalence of stunting and wasting with HDI. A positive correlation was observed between overweight and HDI.

(Rajaram et al., 2003) The study assessed the nutritional status of children below five years by anthropometric measures (weight for age, height for age, and weight for height) in the Kerela and Goa states of India. NFHS-1 factsheet data were analysed in this study. The results showed that the relative prevalence of underweight and wasting were high in Kerala, but the prevalence of stunting was medium. In Goa, relative prevalence of wasting and underweight were very high and prevalence of stunting was high as compared to Kerala.

Objectives:

- To inquire and compare the nutritional status of children under five years across the States of India by using NFHS-4 and NFHS-5 data
- To prepare State Nutritional Index and compare its rank with Human Development Index rank

Methodology of the study:

To compare the nutritional status of children under five years across the states of India, a State Nutritional Index (SNI) is developed based on the five indicators of malnutrition: stunted, wasted, severely wasted, underweight, and overweight, which is quite similar to the Global Nutrition Index (Rosenbloom et al., 2008). Calculations are made for 27 states of India. Data for the SNI have been considered from the National Family Health Survey 4 (NFHS-4) (2015-16) and NFHS-5 (2019-21) for 27 states of India. NFHS is a comprehensive, multi-round survey of a representative sample of Indian households (MHFW, 2029-21). The SNI rank of NFHS-5 has been compared with the HDI rank of 2020. Because the NFHS-5 survey was completed in 2019-21, it is logical to compare it with the HDI rank of 2020. Which makes the comparison more reliable.

Tables 1 shows the actual values of stunted, wasted, severely wasted, underweight, and overweight data for NFHS-4 and NFHS-5 fact sheets. Figure -1 and Figure -2 show the

graphical presentation of prevalence of malnutrition indicators such as stunted, wasted, severely wasted, underweight and overweight in NFHS- 4 & NFHS-5 respectively. To construct the SNI, researchers have converted the actual value of each malnutrition indicator into the normalised value. The methodology for the calculation of the normalised value is demonstrated in Appendix. After getting the normalised value, for the construction of the SNI, we use Example 1. Stunted, wasted, severely wasted, underweight, and overweight are negative indicators of the nutritional index. Equal weightage has been given to all five variables because all the variables are equally important when we consider nutritional status. Table 2 shows the normalised value of each indicator of malnutrition. It also shows the value of an SNI for NFHS-4 & NFHS-5. The SNI value lies between 0 to 1. Getting 1 or closer to 1 indicates a better condition, while getting 0 or closer to 0 indicates a worse situation. Apart from that, Table 2 shows the rank of 27 states based on an SNI value.

Table – 3 shows the comparison between the SNI ranks of NFHS-4 and NFHS-5 data for these nutritional indicators. Additionally, Table – 3 and Figure – 3 show the change in the rank of SNI from NFHS-4 to NHHS-5. Table – 4 and Figure - 4 show the comparison and changes between SNI and HDI ranks for the year 2020. Figure – 3 and Figure – 4 are created using tableau desktop software. In the Figure 3 & 4, green and red colour indicate negative and positive increment in their rank respectively. Data on each indicator of SNI are taken from NFHS-5 (2019-21). While the HDI value of 2020 report has been considered for this comparison. Thus, the comparison becomes more reliable.

Results of the study:

Tables – 2 & 3 show the comparison between the SNI rank of NFHS-4 and NFHS-5. If we consider NFHS-4, result shows that best nutritional status is found for Manipur with SNI score of 0.86, which indicates that lowest prevalence of malnutrition is found in the state. While Mizoram has obtained 2nd rank with 0.85 SNI score, Himachal Pradesh has secured 3rd rank with an SNI score of 0.77, Nagaland has obtained 4th rank with 0.74 SNI score, and Kerala has achieved 5th rank with 0.73 SNI score. Jharkhand is placed at the last nutritional rank with 0.2 SNI score, which indicates worst nutritional

level. In NFHS-4, Gujarat has obtained 22nd rank out of 27 states with an SNI score of 0.35, which means only five states are having worst nutritional situation than Gujarat. In the case of NFHS-5, results show that Manipur is having best nutritional status with an SNI score of 0.95, which means the lowest prevalence of malnutrition is found in Manipur. While Punjab has obtained 2nd rank with an SNI score of 0.88, Haryana has obtained 3rd rank with an SNI score of 0.81, Uttarakhand has obtained 4th rank with an SNI score of 0.77, and Kerala has secured 5th rank with an SNI score of 0.75. In NFHS-5, Gujarat is having worst nutritional status with 22nd rank out of 27 states with an SNI score of 0.24. If we consider an SNI Rank, Gujarat nutritional rank has remained stable at 22nd rank but an SNI value has deteriorated by 0.11 points from NFHS-4 to NFHS-5.

Table – 3 and Figure -3 show the changes in SNI rank from NFHS-4 (2015-16) to NFHS-5 (2019-21). The results show that four states namely Andhra Pradesh, Gujarat, Kerala, and Manipur have remained stable in their ranks in SNI. Fourteen states have improved their ranks from NFHS-4 to NFHS-5. While nine states, including Assam, Himachal Pradesh, Maharashtra, Mizoram, Nagaland, Odisha, Telangana, Tripura, and West Bengal have deteriorated their ranks from NFHS-4 to NFHS-5 in SNI ranking. Haryana is the state which has shown the highest improvement in its relative rank compared to other states. It has improved its SNI score by 0.35 points and has jumped to 3rd rank from 17th for the NFHS-4 and NFHS-5 data. The highest deterioration in relative rank is found in Nagaland and Telangana. Nagaland is having 4th rank in NFHS-4 and 15th rank in NFHS-5, while Telangana was having 7th rank in NFHS-4 which has deteriorated to 18th rank in NFHS-5. Both the states have deteriorated in their ranking by 11 numbers.

Apart from the comparison between NFHS-4 and NFHS-5 fact sheets data, researchers have also analysed the NFHS-5 fact sheet in detail. The results indicate that for 'Stunted Children' who are under five years of age, Sikkim is the best-performing state, while Meghalaya is the worst-performing state which means Sikkim is having lowest prevalence of stunted children and Meghalaya is having highest prevalence of stunted children. In terms of 'Wasted Children', Mizoram has achieved the first rank, while Maharashtra has obtained the last rank. Manipur and Maharashtra have obtained first

and the last ranked in terms of 'Severely Wasted Children' under 5 years respectively. Mizoram is having the lowest percentage of underweight children, while Bihar is having the highest percentage of underweight children for NFHS-5 (2019–21). Madhya Pradesh has performed the best in the overweight category, while Mizoram has performed worst in the overweight category in NFHS-5 (2019–21) which indicate that the lowest prevalence of overweight children is found in Madhya Pradesh whereas the highest prevalence of overweight children is found in Mizoram.

Table – 4 and Figure -4 show the comparison between the ranks of SNI and HDI. It also shows the changes in an SNI rank from NFHS-4 (2015-16) to NFHS-5 (2019-21). Results show that Andhra Pradesh, Assam, and Telangana states have achieved the same rank in both an SNI and HDI, whereas Manipur, Mizoram, Nagaland, and Tripura have achieved better places in an SNI as compared to their HDI rank. In HDI ranking, Kerala has achieved first rank but in the SNI it stands at 5th rank. Manipur has achieved first rank in an SNI, while it stands at 4th rank in HDI. Bihar has obtained the last rank in HDI whereas, Jharkhand has obtained the last rank in an SNI. The highest relative difference between HDI and an SNI ranks in terms of deterioration has been found in Karnataka. Karnataka has secured 5th rank in HDI while it stands at 22nd rank in an SNI. Which means Karnataka has been lagging with 17 numbers in its SNI rank. The highest relative difference between HDI and an SNI ranks in terms of improvement has been found in Manipur. Manipur has secured 4th rank in HDI while it stands at 1st rank in an SNI, which means Manipur has improved its rank by 3 number.

When we consider Gujarat, it is having 8th rank in HDI, but 22nd rank in an SNI for the data of NFHS-5 and HDI for 2020. If we compare the rank of Gujarat for HDI and SNI, we can find that Gujarat is lagging by 14 number from HDI to an SNI. Table -5 shows that when we use the categorization formula of HDI, we can say that Gujarat is placed in the medium category whereas, it has the lower category in an SNI. It indicates that the situation of Gujarat in nutritional status is worsening. The state needs to improve upon through affirmative actions and appropriate policy measures.

Table -6 shows the bottom five states of India as per HDI and SNI rankings. Bottom five states are those states which have performed poorly in SNI and HDI. In the case of SNI rank Chhattisgarh has achieved the last rank, while Bihar has achieved the last rank

in HDI. Table – 7 shows the top five states of India as per HDI and SNI ranking for 2020. In the case of SNI, Manipur has performed best, while in the case of HDI Kerala has achieved first rank.

Conclusion:

In this study, a comparative analysis between NFHS-4 and NFHS-5 and between HDI (2020) and SNI ranking has been made. Some noteworthy achievements and failures have been examined in the malnutrition status of Indian children across all the states. The results show that one state is performing best in some indicator, but the performance in the other indicators need to be improve upon. States like Mizoram, it has performed best in the 'Wasted' and 'Underweight' categories but worst in the 'Overweight' category. Kerala is ranked first in HDI, but it is at 5th place in SNI. Apart from that, the results also show that Gujarat ranks 8th in HDI but 22nd in SNI. This means that if some states perform best in HDI, it doesn't mean that their nutritional status is also good. In economics, HDI is considered an indicator of economic development which also includes human development. Results indicate that HDI does not emphasised on nutritional status. So, when policymakers think about human development, they should also consider nutritional index like SNI with HDI simultaneously. In these circumstances, the government should first identify the areas and then take some affirmative actions and regulatory steps to improve upon this situation. The government and policymakers might use SNI to tackle the malnutrition problem and prioritise the area for policy action.

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Table -1 Actual values of stunted, wasted, severely wasted, underweight and overweight of 27 states of India in NFHS-4 (2015-16) & NFHS-5 (2019-21)

States	Stunted		Wasted		Severely wasted		Underweight		Overweight	
	NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5
Andhra Pradesh	31.4	31.2	17.2	16.1	4.5	6	31.9	29.6	1.2	2.7
Arunachal Pradesh	29.4	28	17.3	13.1	8	6.5	19.4	15.4	4.9	9.7
Assam	36.4	35.3	17	21.7	6.2	9.1	29.8	32.8	2.3	4.9
Bihar	48.3	42.9	20.8	22.9	7	8.8	43.9	41	1.2	2.4
Chhattisgarh	37.6	34.6	23.1	18.9	8.4	7.5	37.7	31.3	2.9	4
Gujrat	38.5	39	26.4	25.1	9.5	10.6	39.3	39.7	1.9	3.9
Haryana	34	27.5	21.2	11.5	9	4.4	29.4	21.5	3.1	3.3
Himachal Pradesh	26.3	30.8	13.7	17.4	3.9	6.9	21.2	25.5	1.9	5.7
Jharkhand	45.3	39.6	29	22.4	11.4	9.1	47.8	39.4	1.5	2.8
Karnataka	36.2	35.4	26.1	19.5	10.5	8.4	35.2	32.9	2.6	3.2
Kerala	19.7	23.4	15.7	15.8	6.5	5.8	16.1	19.7	3.4	4

Madhya Pradesh	42	35.7	25.8	19	9.2	6.5	42.8	33	1.7	2
Maharashtra	34.4	35.2	25.6	25.6	9.4	10.9	36	36.1	1.9	4.1
Manipur	28.9	23.4	6.8	9.9	2.2	3.4	13.8	13.3	3.1	3.4
Meghalaya	43.8	46.5	15.3	12.1	6.5	4.7	28.9	26.6	3.9	4
Mizoram	28.1	28.9	6.1	9.8	2.3	4.9	12	12.7	4.2	10
Nagaland	28.6	32.7	11.3	19.1	4.2	7.9	16.7	26.9	3.8	4.9
Odisha	34.1	31	20.4	18.1	6.4	6.1	34.4	29.7	2.6	3.5
Punjab	25.7	24.5	15.6	10.6	5.6	3.7	21.6	16.9	2.3	4.1
Rajasthan	39.1	31.8	23	16.8	8.6	7.6	36.7	27.6	2.1	3.3
Sikkim	29.6	22.3	14.2	13.7	5.9	6.6	14.2	13.1	8.6	9.6
Tamil Nadu	27.1	25	19.7	14.6	7.9	5.5	23.8	22	5	4.3
Telangana	28	33.1	18.1	21.7	4.8	8.5	28.4	31.8	0.7	3.4
Tripura	24.3	32.3	16.8	18.2	6.3	7.3	24.1	25.6	3	8.2
Uttar Pradesh	46.3	39.7	17.9	17.3	6	7.3	39.5	32.1	1.5	3.1
Uttarakhand	33.5	27	19.5	13.2	9	4.7	26.6	21	3.5	4.1
West Bengal	32.5	33.8	20.3	20.3	6.5	7.1	31.6	32.2	2.1	4.3

Source- (Ministry of Health and Family Welfare, 2015-16) & (Ministry of Health and Family Welfare, 2019-21)

Table -2 State Nutritional Index value & ranking of 27 states of India based on the State Nutrition Index in NFHS-4 (2015-16) & NFHS-5 (2019-21)

Sr. No	States	Stunted		Wasted		Severely wasted		Underweight		Overweight		SNI		Rank	
		NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5
1	Andhra Pradesh	0.59	0.63	0.51	0.6	0.75	0.65	0.44	0.4	0.94	0.91	0.65	0.64	9	9
2	Arunachal Pradesh	0.66	0.76	0.51	0.79	0.37	0.57	0.79	0.9	0.47	0.04	0.56	0.62	11	10
3	Assam	0.42	0.46	0.52	0.25	0.56	0.24	0.50	0.29	0.80	0.64	0.56	0.37	11	19
4	Bihar	0	0.15	0.36	0.17	0.48	0.28	0.10	0	0.94	0.95	0.38	0.31	21	20
5	Chhattisgarh	0.37	0.49	0.26	0.42	0.33	0.04	0.28	0.04	0.72	0.76	0.39	0.49	20	16
6	Gujarat	0.34	0.31	0.11	0.03	0.21	0.04	0.24	0.04	0.85	0.76	0.35	0.24	22	22
7	Haryana	0.5	0.78	0.34	0.89	0.26	0.87	0.51	0.69	0.69	0.84	0.46	0.81	17	3
8	Himachal Pradesh	0.77	0.65	0.67	0.52	0.81	0.53	0.74	0.55	0.85	0.54	0.77	0.56	3	13
9	Jharkhand	0.10	0.28	0	0.2	0	0.24	0	0.06	0.90	0.9	0.2	0.37	24	19
10	Karnataka	0.42	0.46	0.13	0.39	0.09	0.33	0.35	0.29	0.76	0.75	0.35	0.46	22	17
11	Kerala	1	0.95	0.58	0.62	0.53	0.68	0.88	0.75	0.66	0.75	0.73	0.75	5	5
12	Madhya Pradesh	0.22	0.45	0.14	0.42	0.24	0.59	0.14	0.28	0.87	1	0.32	0.55	23	14
13	Maharashtra	0.49	0.47	0.15	0	0.22	0	0.33	0.17	0.85	0.74	0.4	0.27	19	21
14	Manipur	0.68	0.95	0.97	0.99	1	1	0.95	0.99	0.69	0.82	0.86	0.95	1	1
15	Meghalaya	0.16	0	0.59	0.85	0.53	0.83	0.53	0.51	0.59	0.75	0.48	0.59	16	11
16	Mizoram	0.71	0.73	1	1	0.99	0.8	1	1	0.56	0	0.85	0.70	2	7
17	Nagaland	0.69	0.57	0.77	0.41	0.78	0.4	0.87	0.5	0.74	0.64	0.74	0.50	4	15
18	Odisha	0.49	0.64	0.37	0.47	0.54	0.64	0.37	0.4	0.76	0.81	0.51	0.59	14	11
19	Punjab	0.79	0.91	0.58	0.95	0.63	0.96	0.73	0.85	0.79	0.74	0.71	0.88	6	2
20	Rajasthan	0.32	0.61	0.26	0.56	0.30	0.44	0.31	0.47	0.82	0.84	0.4	0.58	19	12
21	Sikkim	0.65	1	0.65	0.75	0.59	0.57	0.94	0.98	0	0.05	0.57	0.67	10	8

Sr. No	States	Stunted		Wasted		Severely wasted		Underweight		Overweight		SNI		Rank	
		NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5
22	Tamil Nadu	0.74	0.89	0.41	0.7	0.38	0.72	0.67	0.67	0.45	0.71	0.53	0.74	13	6
23	Telangana	0.70	0.55	0.47	0.25	0.72	0.32	0.54	0.32	1	0.82	0.69	0.45	7	18
24	Tripura	0.84	0.59	0.53	0.47	0.55	0.48	0.66	0.54	0.70	0.22	0.66	0.46	8	17
25	Uttar Pradesh	0.06	0.28	0.48	0.52	0.59	0.48	0.23	0.31	0.89	0.86	0.45	0.49	18	16
26	Uttarakhand	0.52	0.8	0.41	0.78	0.26	0.83	0.59	0.71	0.64	0.74	0.49	0.77	15	4
27	West Bengal	0.55	0.52	0.38	0.33	0.53	0.51	0.45	0.31	0.82	0.71	0.55	0.49	12	16

Source- Author’s own calculation

Table -3 Comparison of State Nutritional Index rank for NFHS-4 (2015-16) and NFHS-5 (2019-21)

SR. NO	States	NFHS-4 Rank	NFHS-5 Rank	Change
1	Andhra Pradesh	9	9	-
2	Arunachal Pradesh	11	10	+1
3	Assam	11	19	-8
4	Bihar	21	20	+1
5	Chhattisgarh	20	16	+4
6	Gujrat	22	22	-
7	Haryana	17	3	+14
8	Himachal Pradesh	3	13	-10
9	Jharkhand	24	19	+5
10	Karnataka	22	17	+5
11	Kerala	5	5	-
12	Madhya Pradesh	23	14	+9
13	Maharashtra	19	21	-2
14	Manipur	1	1	-
15	Meghalaya	16	11	+5
16	Mizoram	2	7	-5
17	Nagaland	4	15	-11
18	Odisha	14	11	-3
19	Punjab	6	2	+4
20	Rajasthan	19	12	+7
21	Sikkim	10	8	+2
22	Tamil Nadu	13	6	+7
23	Telangana	7	18	-11
24	Tripura	8	17	-9
25	Uttar Pradesh	18	16	+2
26	Uttarakhand	15	4	+11
27	West Bengal	12	16	-4

Source- Author's own calculation

Table – 4 Comparison between Human Development Index rank and State Nutritional Index rank

Sr.no	Name of the States	HDI Value	SNI value	HDI rank	SNI rank	Change
1	Andhra Pradesh	0.63	0.64	9	9	0
2	Arunachal Pradesh	0.66	0.62	6	11	-5
3	Assam	0.60	0.37	11	11	0
4	Bihar	0.57	0.31	13	21	-8
5	Chhattisgarh	0.60	0.49	11	20	-9
6	Gujarat	0.64	0.24	8	22	-14
7	Haryana	0.69	0.81	3	17	-14
8	Himachal Pradesh	0.70	0.56	2	3	-1
9	Jharkhand	0.59	0.37	12	24	-12
10	Karnataka	0.67	0.46	5	22	-17
11	Kerala	0.75	0.75	1	5	-4
12	Madhya Pradesh	0.59	0.55	12	23	-11
13	Maharashtra	0.69	0.27	3	19	-16
14	Manipur	0.68	0.95	4	1	3
15	Meghalaya	0.64	0.59	8	16	-8
16	Mizoram	0.68	0.70	4	2	2
17	Nagaland	0.67	0.50	5	4	1
18	Odisha	0.60	0.59	11	14	-3
19	Punjab	0.69	0.88	3	6	-3
20	Rajasthan	0.64	0.58	8	19	-11
21	Sikkim	0.70	0.67	2	10	-8
22	Tamil Nadu	0.69	0.74	3	13	-10
23	Telangana	0.65	0.45	7	7	0
24	Tripura	0.63	0.46	9	8	1
25	Uttar Pradesh	0.59	0.49	12	18	-6
26	Uttarakhand	0.67	0.77	5	15	-10
27	West Bengal	0.62	0.49	10	12	-2

Sources- Authors own calculations

https://en.wikipedia.org/wiki/List_of_Indian_states_and_union_territories_by_Human_Development_Index

Table – 5 Categorization of Indian states based on State Nutritional Index value and Human Development Index value using criteria of Human Development Index for 2020

Classification	HDI	SNI
Very High Category (> 0.800)	NIL	Haryana, Manipur, Punjab
High Category (0.700 to 0.799)	Himachal Pradesh, Kerala, Sikkim	Kerala, Mizoram, Tamil Nadu, Uttarakhand
Medium Category (0.550 to 0.699)	Note- All the states except three states (Himachal Pradesh, Kerala, Sikkim) are fall into the medium category	Andhra Pradesh, Arunachal Pradesh, Himachal Pradesh, Madhya Pradesh, Meghalaya, Odisha, Rajasthan, Sikkim
Low Category (<0.550)	NIL	Assam, Bihar, Chhattisgarh, Gujarat, Jharkhand, Karnataka, Maharashtra, Nagaland, Telangana, Tripura, West Bengal

Source – Authors own calculations based on HDI classification

Table -6 The Bottom Five states of India according to HDI and SNI rank

Sr. No	State Nutritional Index	Human Development Index
1	Jharkhand	Bihar
2	Madhya Pradesh	Uttar Pradesh, Madhya Pradesh, Jharkhand
3	Gujarat, Karnataka	Assam, Chhattisgarhi, Odisha
4	Bihar	West Bengal
5	Chhattisgarh	Andhra Pradesh, Tripura

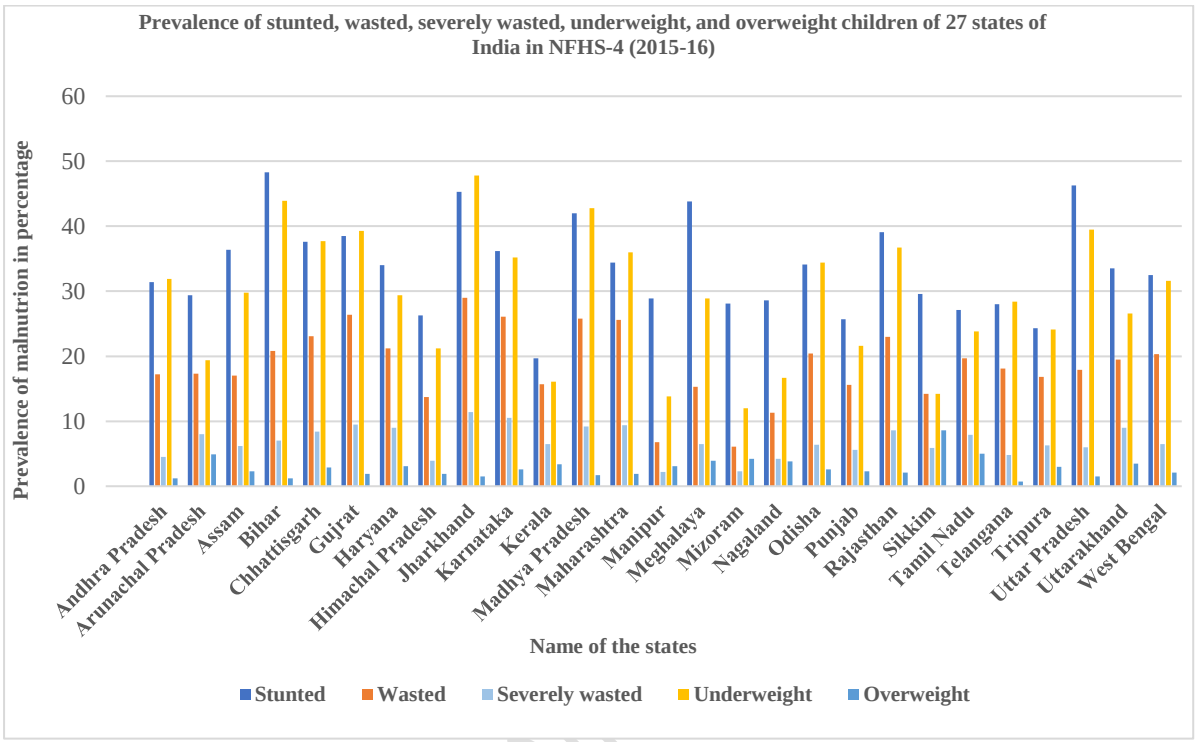
Source – Authors own calculation

Table – 7 The Top Five states of India according to HDI and SNI rank

Sr. No	State Nutritional Index	Human Development Index
1	Manipur	Kerala
2	Mizoram	Himachal Pradesh, Sikkim
3	Himachal Pradesh	Haryana, Maharashtra, Tamin Nadu, Punjab
4	Nagaland	Manipur, Mizoram
5	Kerala	Karnataka, Nagaland, Uttarakhand

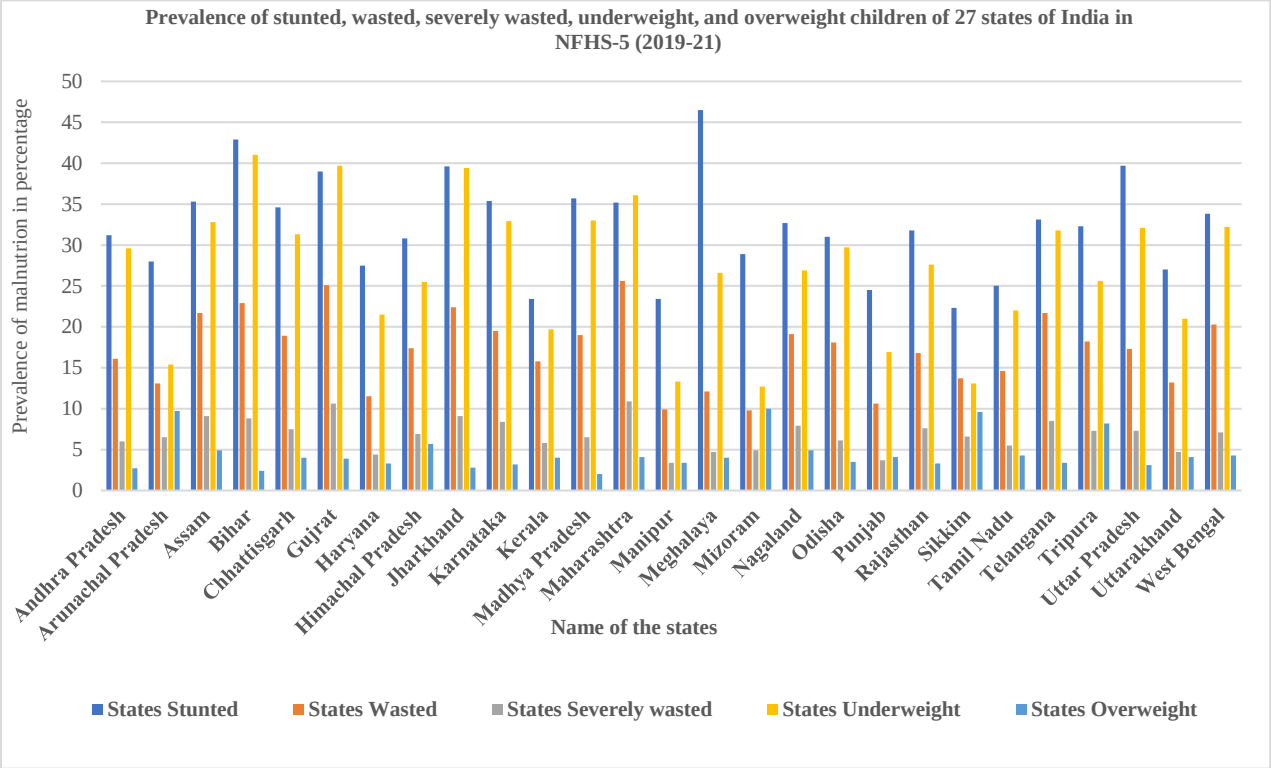
Source – Authors own calculation

Figure-1 Prevalence of stunted, wasted, severely wasted, underweight, and overweight children of 27 states of India in NFHS-4 (2015-16)



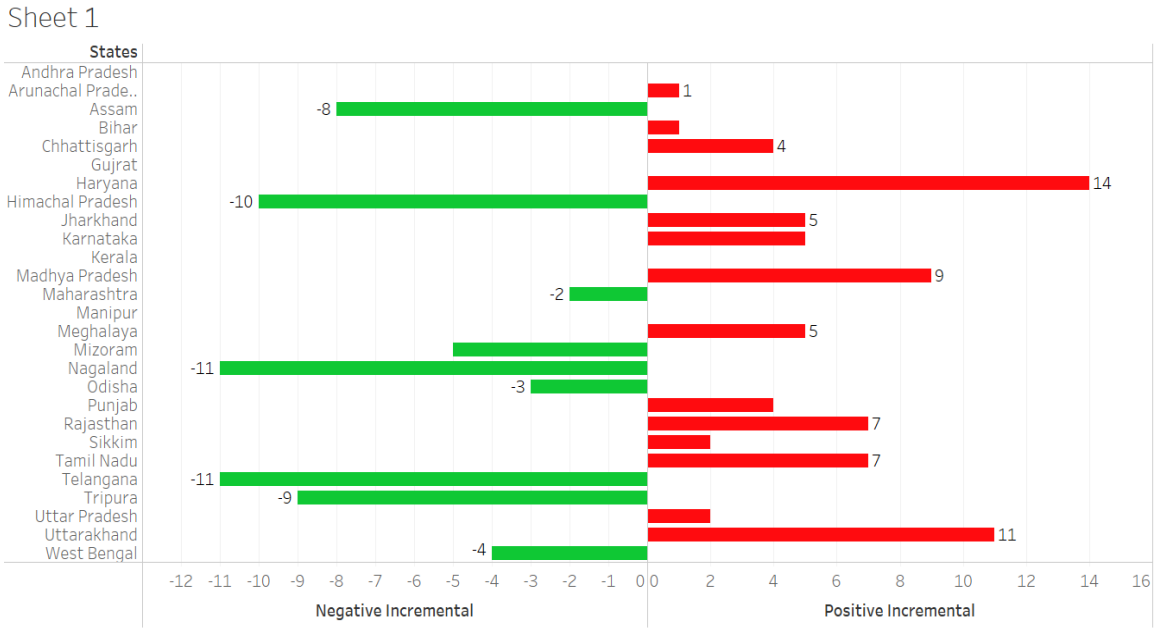
Source – Computed data from NFHS-4 and NFHS-5

Figure -2 Prevalence of stunted, wasted, severely wasted, underweight, and overweight children of 27 states of India in NFHS-5 (2019-21)



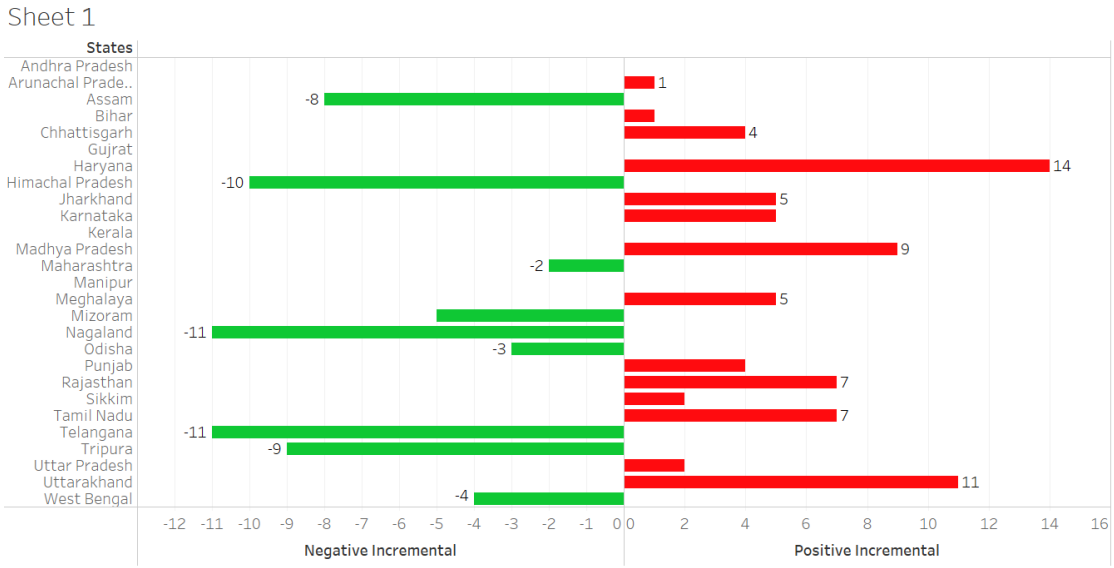
Source – Computed data from NFHS- 4 & NFHS-5

Figure – 3 Differences in SNI rank between NFHS-4 and NFHS-5 for 27 Indian states



Source – Author's own calculations

Figure -4 Differences observed between HDI rank and SNI rank in the year 2020 in 27 Indian states



Source – Author's own calculations

❖ **Appendix**

For negative indicator = $(Max_i - X_i) / (Max_i - Min_i)$ ……. (1)

When,

Max_i = Maximum value of i indicator

X_i = Actual value of i indicator

Min_i = Minimum value of i indicator

❖ **Example (1) (Andhra Pradesh)**

=Sum (stunted, wasted, severely wasted, underweight, overweight) *1/5…… (2)

= Sum (0.63+0.60+0.65+0.40+0.91) *1/5

= (3.19) *1/5

= 0.64