

Social Inequalities in Child Nutrition in Uttar Pradesh, India

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Abstract

Background: The various maternal and childhood well-being programs have been designed to address childhood malnutrition in India. The levels and the inequality in child nutrition are higher among economically poor and socially backward communities within the state.

Objective: To estimate and compare the inequality in child nutrition status across socio-demographic characteristics in the Uttar Pradesh state of India.

Methods: Data from the National Family Health Surveys (NFHS-4 & NFHS-3) was used for Uttar Pradesh – the most populous state of India. The nutrition status was assessed in terms of undernutrition (weight-for-age), stunted (height-for-age), wasted (weight-for-height) and anaemia level. Health inequalities indices, the absolute difference, Ratio, Population Attributed Risk, and Population Associated Fraction were calculated using WHO HEAT 2.0 software.

Results: The nutrition and anaemia levels vary according to background characteristics; however, the levels of undernutrition and anaemia among children were high in all groups. The wasting and anaemia levels were higher among younger children, whereas the proportion of underweight and stunted was higher in older children. The inequality indices showed a substantially higher burden of undernutrition among socially backward scheduled castes and tribes, and those residing in rural areas.

Conclusion: The study illustrated that despite the declining trend of childhood malnutrition in Uttar Pradesh, the socially backwards have a disproportionately higher burden of malnutrition. There is a need to reassess the ongoing nutritional programs concerning pervasive social inequality in child nutrition and anaemia level.

Key Words: Undernutrition, Stunting, Wasting, Anaemia, Uttar Pradesh, India

Introduction

Malnutrition among children has been a major public health problem globally, and especially in developing countries. It continues to exert a heavy toll and affect tens of millions of children¹ (UNICEF, 2019). Globally, the prevalence of child stunting and wasting in 2019 was 21.3 % (144 million) and 6.9 % (47 million) among under-

five children respectively². The 2019 edition of *The State of the World's Children* (SOWC) reported that despite progress in the last two decades, at least one-third of children are not getting the nutrition they need to grow well (stunted, wasted or overweight), and two-thirds are at risk of malnutrition and hidden hunger because of the poor quality of their diets¹. Asia is home to more than half of the total undernourished children in the world – it accounts for 54 % of all stunted children in the world³. Asia has shown progress in reducing the numbers of undernourished children. But in recent years, in South Asia, 58.7 million children under 5 years were stunted and 25.9 million were wasted in 2018, and contributed to 39.4 and 59.6 per cent of global stunted and wasted

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under five children⁴ In India, about 54% were not getting the nutrition they need to grow well (stunted, wasted or overweight) compared to 50 % in South Asia. India accounts for the highest proportion of stunting (38 %) and wasting (21 %) in the region⁴.

The prevalence of malnutrition among children in India has reduced, stunting to 38.4% from 48.0%, underweight 35.7% from 42.5% and wasting 22.9% from 34.2% during NFHS-3 (2005-06)⁵ and NFHS-4 (2015-16)⁶. However, India topped the list of the countries with the most number of stunted and wasted among under-five children. India is among 88 countries that are identified to miss global nutrition targets by 2025⁷. The evidence suggested that the country's progress is not on track to achieve the World Health Assembly (WHA) nutrition target for 2025 and the SDG Zero Hunger target by 2030^{1,2}. Malnutrition was the primary reason behind about 68 % of deaths of under-five children in India^{4,8,9}. However, the national patterns can cover up inequalities in nutrition indicators within the country and by socio-demographic characteristics. India has also been identified as one with the highest rates of domestic inequalities in malnutrition⁷ and child survival¹⁰. The malnutrition Disability-adjusted life years (DALY) rate was much higher in states with lower social development indicators and was recorded highest in the states of Uttar Pradesh^{8,10,12}. The stunting level in Uttar Pradesh is over 40% and their rate among individuals in the lowest income group is more than double those in the highest income group at 22.0% and 50.7%, respectively⁶. Also, stunting prevalence is 10.1% higher in rural areas compared to urban areas⁶. Elucidating social inequalities in nutritional indicators is pivotal for informed priority-setting, guiding the equitable distribution of resources and targeting interventions according to need. This paper examines social inequality in nutrition indicators by age and sex of child, religion and caste of the head of household and place of residence.

Material and Methods

Study site and population: The analysis was restricted only to under-five children to identify the inequality in the nutrition status in Uttar Pradesh state in the view of existing relatively very high malnutrition.

Data: The data for the present analysis is taken from published reports of NFHS-4 (2015-16)⁶ and NFHS-

3 (2005-06)⁵. The National Family Health Surveys provide information on population, health, and nutrition for India and each state and union territory.

Outcome variable:

Anthropometric measurement – Three anthropometric indices viz. underweight (weight-for-age), stunted (height-for-age), and wasted (weight-for-height) were used to classify the malnourished among under-five children. In the NFHS survey Z-scores for weight-for-age (WAZ), height-for-age (HAZ), and weight-for-height (WHZ) were calculated using 2006 WHO standards or reference¹³. Children whose weight-for-age is below -2 SD from the reference population median were classified as underweight; Stunting was calculated based on height-for-age. Z-score (HAZ) below -2 SD from the median of the WHO reference population. The wasting was calculated using weight-for-height and children below -2 SD from the reference median^{6,13}.

Anaemia - Anaemia was classified into four categories - mild, moderate, severe or not anaemic with respective cut-off values of anaemia were 10.0–10.9 g/dl (mild), 9.0–9.9 g/dl (moderate), < 9.0 g/dl (severe) and ≥ 11 g/dl (not anaemic). Further, for the analysis, it was grouped dichotomously as < 11 g/dl (anaemic) and ≥ 11 g/dl (not anaemic).

Statistical Analysis: The analysis was performed using SPSS.20 statistical software and MS Excel. Further, health inequality indices were computed using WHO HEAT software 2.0^{14,15}. Four inequality indices, the absolute difference (D), Ratio (R), Population Attributable Risk (PAR), and Population Attribution Fraction (PAF) were computed with a 95% confidence interval. i). **Absolute Difference (D)** - The absolute difference is a simple, unweighted measure of inequality that shows the absolute inequality between highest and lowest subgroups values, $D = Y_{high} - Y_{low}$ ii). **Ratio (R)** – The ratio is a simple, unweighted relative measure of inequality that shows the relative inequality between highest and lowest subgroups values, $D = Y_{high} - Y_{low}$. ii). **Population Attributable Risk (PAR)** – PAR is a complex, weighted measure of inequality. This explains the potential of improvement in a health indicator if all subgroups reached the same level of health as a reference subgroup. PAR is calculated as the difference between

the estimate for the reference subgroup Y_{ref} and the average μ , $= Y_{ref} - \mu$. iv). **Population Attributable Fraction (PAF)** – The PAF is a complex, weighted relative measure of inequality. It shows the relative potential of improvement in a nutrition indicator that could be achieved if all subgroups reached the same level of health as a reference subgroup. The PAF is calculated by dividing the population attributable risk (PAR) by the average value μ and multiplying the fraction by 100, . $PAF = PAR / \mu * 100$.

The higher value of D and R indicates higher absolute inequality, and the zero value of absolute difference and one of the ratio indicates the existence of no inequality. Similarly, the larger values of PAR and PAF indicate a larger degree of inequality. The zero value of PAR and one of PAF indicates that all subgroups have reached the same level of health as the reference subgroup.

Results

Malnutrition among children

In the NFHS-4 survey, 40% and 12% of children under five years of age were underweight and severely underweight respectively. Forty-six per cent and 21% of children under five years of age were stunted and severely stunted respectively. Eighteen per cent were wasted or too thin for their height, and six per cent of children were severely wasted. The children’s nutritional status in Uttar Pradesh had improved since NFHS-3 by some measures, but not by all measures.

Stunting decreased from 57% to 46% in the 10 years between NFHS-3 and NFHS-4, and the percentage of underweight children decreased marginally from 42% to 40%. However, in the same period, wasting increased from 15% to 18%. Thus, despite recording gains in stunting and underweight during the last decade, child malnutrition is still a major problem in Uttar Pradesh state (Figure 1). There were only small differences in the level of undernutrition by the age and gender of the child. The proportion of underweight and stunted was lowest for youngest children (<12 months), but they were having the highest wasting (weight for height). Male children (19%) recorded more wasting compared to female children (16.6%). Children born in Schedule Caste (SC) and Scheduled Tribe (ST) households were relatively more malnourished compared to children belonging to other castes households (Table 1). No differences in child nutrition were observed by the religion of the head of household. But children from rural areas were relatively more underweighted (41%) compared to urban (33.7%) areas, however, there was no difference in severely underweighted children by place of residence. In the case of stunting, more rural children were stunted (48.5% vs 37.9%) and severely stunted (22.7% vs 15.4%) compared to their urban counterparts, however, and no such difference was observed in the case of wasting.



Figure 1: Level of malnutrition among children (0-59 months) in NFHS-3 and NFHS-4

Anaemia among Children

Anaemia is a condition that is marked by low levels of haemoglobin in the blood. Iron deficiency is estimated to be responsible for about half of all anaemia globally, but anaemia can also be caused by malaria, hookworm and other helminths, other nutritional deficiencies, chronic infections, and genetic conditions (NFHS-4).

Among children aged 6 and 59 months, more than three-fifth (62.2%) of children were anaemic, including 26.4% mildly anaemic, 34% moderately anaemic, and 2.4% suffering from severe anaemia. The level of anaemia had declined from 73.9% in NFHS-3 to 62.2% in NFHS-4 and severe anaemia level declined from 3.6% in NFHS-3 to 2.4% in NFHS-4 (Figure 2).

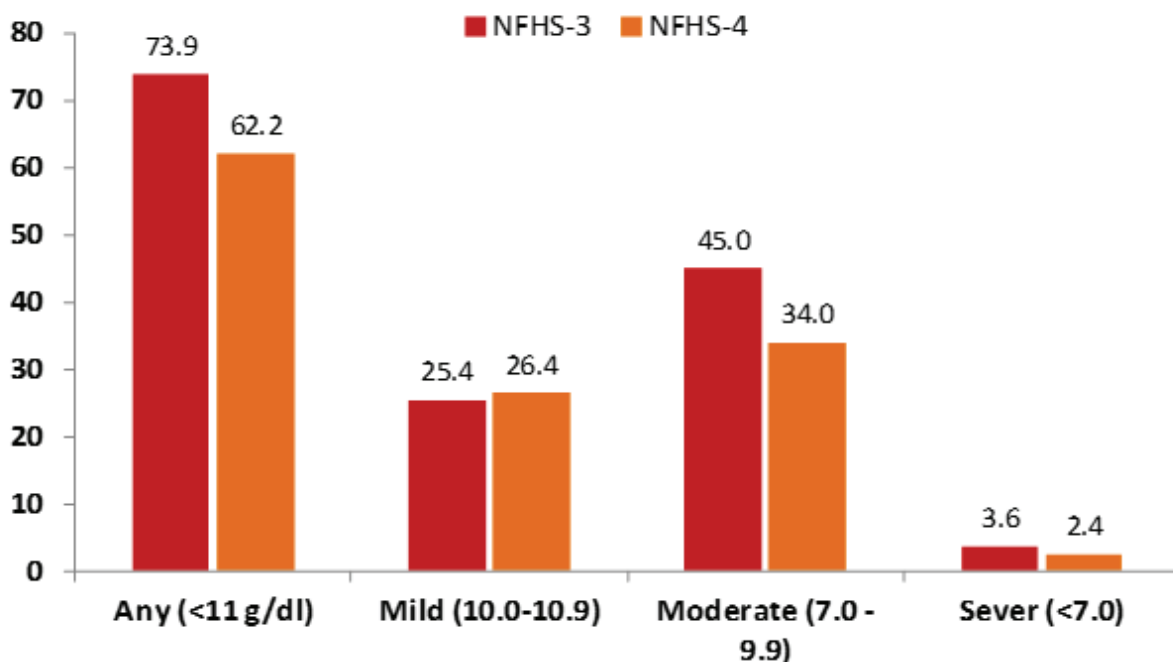


Figure 2: Level of anaemia among children (6-59 months) in NFHS-3 and NFHS-4

The level of anaemia (<11 g/dl) declined by age of children, more than three-fourths of children of age group 12-23 months were anaemic compared to about half of children aged 36-59 months. There was no difference in the prevalence of anaemia among girls and

boys. Similarly, caste wise no difference was observed in the anaemia level, except Scheduled tribe children who had a slightly higher prevalence of anaemia (65.7%). Children belonging to Muslim households and residing in urban areas were relatively more anaemic.

Table 1: Prevalence of underweight (weight-for-age), stunted (height-for-age), wasted (weight-for-height) and anaemia among under-five children by background characteristics, NFHS-4

Background characteristics	Underweight (Weight-for-Age)		Stunted (Height-for-Age)		Wasted (Weight-for-Height)		Anaemia (<11.0 gm/dl)	Sample
	-3SD	-2SD	-3SD	-2SD	-3SD	-2SD		
Child Age								
<12	11.1	31.7	10.6	21.7	12.5	29.5	71.4	7047
12-23	12.9	40.1	23.9	50.4	6.2	20.2	77.1	7396
24-35	13.5	42.0	25.1	54.1	4.8	15.1	69.4	7319
36-59	11.8	41.5	22.9	50.9	3.5	12.8	51.4	15398
Gender								
Male	12.3	39.4	21.6	46.3	6.6	19.1	63.2	19505
Female	12.1	39.6	20.8	46.2	5.4	16.6	63.1	17655
Caste								
SC	14.1	44.4	25.0	52.3	6.6	18.6	63.4	9413
ST	14.6	46.0	26.2	50.9	7.6	22.3	65.7	580
OBC	12.4	40.2	21.1	46.5	5.8	18.0	62.9	20226
Others	8.7	30.0	15.7	36.7	5.4	16.2	63.3	6848
Religion								
Hindu	12.1	39.4	21.2	46.1	6.1	18.0	61.8	29243
Muslim	12.5	39.7	21.2	46.5	5.6	17.5	68.4	7917
Place of Residence								
Urban	10.2	33.7	15.4	37.9	6.6	18.0	65.0	7768
Rural	10.7	41.0	22.7	48.5	5.8	17.8	62.7	29392
Total	12.2	39.5	21.1	46.2	6.0	17.9	63.2	34357

Inequality in child nutrition and anaemia level

The inequality in child nutrition level is studied using four outcome indicators viz. underweight (< -2SD), stunting (< -2SD), wasting (< -2SD) and any anaemia (<11 g/dl). Although nutrition and anaemia levels vary somewhat according to background characteristics, these remain widespread in all groups. In the case of underweight (weight for age), there was an absolute difference of about 10% point and the ratio of 1.3 between the highest and the lowest prevalence of underweight among age-groups. The value of PAR and PAF were 7.8 and 19.7 respectively, indicating a significant decline of 7.8 % points, and 19.7% decline in underweight level if the level of malnutrition in all age groups brought down to the level of the reference group (<12 months). There was no significant difference in underweight level by gender of child and religion of the head of household. But the level of underweight varied

by caste and place of residence, and there would be a decline of 9.5 and 5.8 % points if the level of underweight brought down to the respective level of underweight among ‘other castes’ and urban. In the case of stunting (height for age), the absolute difference was even much larger (32.4 % or a ratio of 2.5) between the level of stunting among children in the age group <12 months and 24-35 months. The PAR and PAF values were 24.2 and 52.8 respectively, indicating that if the percentage of stunting could be brought down to a level of that in <12 months for all age groups, a decline of 24.2% points or 52.8% decline in stunting could be achieved. But there was no significant difference in stunting by gender and religion. However, stunting varied considerably by caste and place of residence, and a decline of 9.5 and 8.4 % in overall stunting could be achieved if the level of stunting could be brought down to the level of that among ‘other castes’ and urban respectively.

Table 2: Inequality indices for underweight (< -2SD), stunted (< -2SD), wasted (< -2SD) and anaemic (<11 gm/dl) among under-five children by background characteristics in Uttar Pradesh, NFHS-4

Characteristics	Index	Underweight (Weight-for-Age)	Stunting (Height-for-Age)	Wasting (Weight-for-Height)	Anaemia
Child age	D	10.3 (8.8 – 11.9)	32.4 (30.9 – 33.9)	16.7 (15.5 – 17.9)	25.7 (24.5 – 26.9)
	R	1.3 (1.3 – 1.4)	2.5 (2.4 – 2.6)	2.3 (2.2 – 2.4)	1.5 (1.5 – 1.5)
	PAR	7.8 (6.8 – 8.8)	24.2 (23.3 – 25.1)	5.1 (4.6 – 5.5)	12.5 (11.9 – 13.1)
	PAF	19.7 (17.2 – 22.2)	52.8 (50.8 – 54.7)	28.4(26.0 – 30.9)	19.5 (18.6 – 20.4)
Sex	D	0.2 (0.8 – 1.2)	0.1 (-0.9 – 1.1)	2.5 (1.7 – 3.3)	0.1 (-0.9 – 1.1)
	R	1.0 (1.0 – 1.0)	1.0 (1.0 – 1.0)	1.2 (1.1 – 1.2)	1.0 (1.0 – 1.0)
	PAR	0.1 (-0.4 – 0.6)	0.1 (-0.5 – 0.6)	1.3 (0.9 – 1.7)	0.1 (-0.5 – 0.6)
	PAF	0.2 (-1 – 1.4)	0.1 (1.0 – 1.3)	7.3 (5.0 – 9.6)	0.1 (-0.7 – 0.9)
Caste	D	16.0 (11.8 – 20.2)	15.6 (14.1 – 17.1)	6.1 (2.6 – 9.6)	2.8 (-1.1 – 6.7)
	R	1.5 (1.4 – 1.7)	1.4 (1.4 – 1.5)	1.4 (1.2 – 1.6)	1.0 (1.0 – 1.1)
	PAR	9.5 (8.5–10.5)	9.5 (8.5 – 10.6)	1.7 (0.9 – 2.5)	0.2 (-0.2 – 0.7)
	PAF	24.0 (21.5 –26.5)	20.6 (18.4 – 22.9)	9.4 (5.0 – 13.9)	0.4 (-0.3 – 1.1)
Religion	D	0.3 (-0.9 – 1.5)	0.4 (-0.9 – 1.6)	0.5 (-0.5 – 1.4)	6.6 (5.5–7.8)
	R	1.0 (1.0 – 1.0)	1.0 (1.0 – 1.0)	1.0 (1.0 – 1.1)	1.1 (1.1 – 1.1)
	PAR	0.1 (-0.2 – 0.3)	0.1 (-0.2 – 0.3)	0.4 (-0.4 – 1.1)	1.4 (1.2 – 1.7)
	PAF	0.2 (-0.5 – 0.8)	0.2 (-0.4 – 0.7)	2.1 (2.0 – 6.3)	2.2 (1.8 – 2.6)
Place of residence	D	7.3 (6.1 – 8.5)	10.6 (9.4 – 11.8)	0.2 (-0.8 – 1.2)	2.3 (1.1 – 3.5)
	R	1.2 (1.2 – 1.3)	1.3 (1.2 – 1.3)	1.0 (1.0 – 1.1)	1.0 (1.0 – 1.1)
	PAR	5.8 (4.8 – 6.7)	8.4(7.4 – 9.4)	0.0 (-0.2 – 0.2)	0.5 (0.2 – 0.7)
	PAF	14.6 (12.2 – 17.0)	18.1(16.0 – 20.2)	0.2 (-0.9 – 1.4)	0.8 (0.4 – 1.2)

Note: D = Absolute Difference; R = Ratio; PAR = Population Attributable Risk; PAF= Population Attributable Fraction.

There was a significant difference of 16.7% (15.5–17.9%) and a ratio of 2.3 (2.2–2.4) between the level of wasting among children <12 months and 36-59 months. Overall, a decline of 5.1 % points (PAR) or 18.5% (PAF) decline in overall wasting could be achieved if wasting in all age group brought down to a level of 36-59 months. There was an absolute difference of 2.5% and 6.1% in wasting by sex of child and caste of the head of household. However, a 7% and 9% decline in overall wasting level could be achieved if all respective groups could arrive at a level of the lowest category, i.e. females and 'others' castes. However, there was no significant difference was observed by the religion of the head of household and place of residence. In the case of anaemia, only child age showed major variation, all inequality indexes illustrated significant variation. An absolute difference of 25.7% (24.5–26.9%) points

and a ratio of 1.5 was observed in the level of anaemia between the age group <12 months and 36-59 months. The overall level of anaemia could be brought down by 12.5% points or a 19.5% decline in anaemia level if all age groups had anaemia level equal to that in 36-59 months. No inequality by sex of the child and caste of the head of the household was observed. However, the religion of the head of household and place of residence showed minor variation in anaemia level.

Discussion

Malnutrition among children has been a major problem in Uttar Pradesh - the most populous state of India⁶. This paper contributes to growing empirical literature on inequalities in child malnutrition that are predominantly unnecessary, avoidable and unjust. The findings suggest that Uttar Pradesh have a very high

burden of underweight, stunting, wasting, and anaemia among under-five children. Inequality was more predominant in underweight and stunting compared to wasting and anaemia. Similar results were also reported by some other studied^{16,17}. The higher prevalence of child malnutrition in the state may be attributed to poverty and maternal undernutrition¹⁸. Undernutrition during pregnancy has been reported as one of the major causes of low birth weight because underweight women are likely to give birth to low birthweight babies^{18,19}. Other than poverty, the factors associated with maternal undernutrition in India, such as the early marriage of women, adolescent pregnancy, shorter birth intervals, beliefs and taboos associated with pregnancy, and breastfeeding practices, rearing and caring of children are also responsible for child malnutrition²⁰⁻²⁷. The studies revealed that though the anaemia levels varied somewhat according to background characteristics, anaemia among under-five children is widespread in all socio-demographic groups. Anaemia among children impaired cognitive performance, motor development, and scholastic achievement. Anaemia is a major health problem in Uttar Pradesh, especially among under-five children⁶.

The underweight and stunting were lower in younger children (< 12 months), whereas wasting and anaemia was higher among children less than two years. Malnutrition during the first two years of a child's life is quite important because if the foundation for good nutrition is not properly established during this period a child may not be able to grow to its full potential in the future^{21,30-32}. The proportion of children who were underweight or stunted increased rapidly with age, till months 24-25 months, whereas wasting among children decreases with increasing child's age. The study showed no significant gender differences in underweight, stunting and anaemia level in Uttar Pradesh, however, wasting was significantly higher among male children compared to female children. But similar to the present study, Jose (2017)³¹ reported no gender gap in malnutrition at the all India level according to NFHS-III (2005–2006) data. However, the state-level analysis showed gender differential in malnutrition level in many states and reported higher wasting among male children compared to female children in many states of India. Some studies reported a significant difference in

stunting between male and female children³²⁻³⁵, while others did not find any such difference²³. Zere et al. (2003)³⁵ reported significantly higher stunting among male children but no gender difference was reported in underweight and wasting in south-Africa.

The key findings of the study suggest that Uttar Pradesh have vast social disparities on several indicators of malnutrition including underweight, stunting, and wasting. It showed that the socially backward castes have a higher burden of child malnutrition and the resultant inequalities were higher for all malnutrition indicators except for anaemia. These findings are consistent with the results of previous studies that socioeconomic backward groups have a disproportionately higher burden of malnourishment^{16,20-22,28,36-38}. The contribution of social castes to the inequalities in childhood malnutrition could be due to differences in their economic status, availability of food and other resources, utilization of maternal and childhood health services. However, no such difference was observed by the religion of the head of household. But some studies reported that Hindu children were malnourished compared to Muslim children in India^{34,39}. The rural-urban difference was significant in underweight and stunting, but no such difference was observed in wasting and anaemia level. Several earlier studies have also reported a higher prevalence of underweight and stunting among children from rural areas³⁵⁻³⁷.

The use of simple and complex measurement of absolute and relative inequalities in childhood malnutrition makes this paper very unique. Furthermore, inequalities in indicators of malnutrition by social castes are notable finding in this study. The PAR and PAF measurement revealed that a considerable improvement can be achieved in the average underweight, stunting if malnutrition indicator reached to the level of 'other castes' children. However, the study has some limitations, it analysed select socio-demographic indicators, and several important maternal and household level indicators are not considered in the present study.

Conclusion

The recent Lancet series on maternal and child undernutrition progress 2021 reiterated the importance of delivering nutrition interventions within the first

1,000 days of life to curtail child malnutrition and mortality⁴⁰. The present study also added that apart from these international experiences and guidelines, and the ongoing national nutrition programmes and interventions in the state, more specific efforts are required to design and implement these programmes on a priority basis, keeping in view the nature of social inequality in childhood malnutrition in the Uttar Pradesh state. The study revealed that the sorry state of malnutrition continued in the state despite ongoing national programme. Programme like integrated child development scheme (ICDS), Mid-day meal schemes, Special Nutrition Programs (SNP), Balwadi Nutrition Programs (BNP) has not brought the desired results. The social gradient of long-term malnutritional status among children needs special focus. More intensive and community focused nutrition programmes involving all stakeholders need to improve child nutrition across all social group within the state. The constant monitoring of social inequalities in child nutrition will help in lining up the targets of interventions for improving child health and survival and assessing the progress towards the SDGs goals.

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Ethical Clearance – The study is based on secondary data and reports freely available in the public domain.

References

1. UNICEF. The State of the World's Children 2019: Children, food and nutrition; Growing well in a changing world. <https://www.unicef.org/media/63016/file/SOWC-2019.pdf>. Accessed on 25th March 2021.
2. FAO, IFAD, UNICEF, WFP and WHO. The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets. Rome: Food and Agriculture Organization. <https://doi.org/10.4060/ca9692en>. Accessed on 25th March 2021.
3. UNICEF, WHO, IBRD. Levels and trends in child malnutrition: key findings of the 2019 Edition of the Joint Child Malnutrition Estimates. Geneva: World Health Organization. <https://www.unicef.org/media/60626/file/Joint-malnutrition-estimates-2019.pdf>
4. UNICEF. The State of the World's Children 2019: Children, food and nutrition; Growing well in a changing world. South Asia. <https://www.unicef.org/media/60841/file/SOWC-2019-SA.pdf>. Accessed on 25th March 2021.
5. IIPS and Macro International. 2007. National Family Health Survey (NFHS-3), India, 2005-06: Uttar Pradesh. Mumbai: International Institute for Population Sciences (IIPS).
6. IIPS and ICF. National Family Health Survey (NFHS-4), India, 2015-16: Uttar Pradesh. 2017. Mumbai: International Institute for Population Sciences (IIPS).
7. Development Initiatives Poverty Research Ltd. 2020 Global Nutrition Report: Action on equity to end malnutrition. Bristol, UK: Development Initiatives. <https://globalnutritionreport.org/reports/2020-global-nutrition-report/>. Accessed on 25th March 2021.
8. India State-Level Disease Burden Initiative Child Mortality Collaborators. Subnational mapping of under-5 and neonatal mortality trends in India: the Global Burden of Disease Study 2000–2017. *Lancet*, 2020;12. [http://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(20\)30471-2/fulltext](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30471-2/fulltext). Accessed on 25th March 2021.
9. India State-Level Disease Burden Initiative CGF Collaborators. Mapping of variations in child stunting, wasting and underweight within the states of India: the Global Burden of Disease Study 2000-2017. *EClinicalMedicine*, 2020; 12. <https://www.thelancet.com/pb-assets/Lancet/pdfs/ECM-GBD-India.pdf>. Accessed on 25th March 2021.
10. Kumar S, Sahu D, Mehto A, Sharma RK. Health Inequalities in Under-Five Mortality: An Assessment of Empowered Action Group (EAG) States of India. *J Health Econ Outcomes Res*. 2020;7(2):189-196. doi:10.36469/jheor.2020.18224
11. Swaminathan A, Kim R, Xu Y, Blossom JC, Joe W, Venkataramanan R, Kumar A, Subramanian SV. Burden of Child Malnutrition in India: A View

- from Parliamentary Constituencies. *Economic & Political Weekly*, 2019. LIV (2).
12. Agarwal N, Chaudhary N, Pathak PK, Randhawa A. Composite indexing for nutritional status evaluation: A snapshot of malnutrition across India. *Indian Journal of Community Medicine*. 2020; 45 (3): 343-347.
 13. WHO. Multicentre Growth Reference Study Group. WHO Child Growth Standards based on length/height, weight and age. *Acta Paediatrica*, 2006; Suppl 450: 76-85.
 14. WHO. Health Equity Assessment Toolkit Plus (HEAT Plus): Software for exploring and comparing health inequalities in countries. Upload database edition. 2020, Version 3.0 (Beta). Geneva: World Health Organization.
 15. Hosseinpoor AR, Nambiar D, Schlottheuber A, Reidpath D, Ross Z. Health Equity Assessment Toolkit (HEAT): software for exploring and comparing health inequalities in countries. *BMC Medical Research Methodology*, 2016; 16:141.
 16. Singh SK, Srivastava S, Chauhan S. Inequality in child undernutrition among urban population in India: a decomposition analysis. *BMC Public Health*, 2020; 20, 1852. <https://doi.org/10.1186/s12889-020-09864-2>
 17. Van de Poel E. Socioeconomic inequality in malnutrition in developing countries. *Bull World Health Organ*. 2008;1;86(4):282–91.
 18. Ramalingaswami V, Jonson U, Rohde J. *The Asian enigma. The progress of nations*. New York: UNICEF, 1996.
 19. WHO. Administrative Coordinating Committee/Sub-Committee on Nutrition. Low birth weight. Nutrition policy paper no. 18. Geneva: World Health Organization, 2000.
 20. Bamji MS. Early nutrition and health—Indian perspective. *Curr Sci* 2003;85:1137–42.
 21. Sen J, Mondal N. Socio-economic and demographic factors affecting the Composite Index of Anthropometric Failure (CIAF). *Annals of Human Biology*, 2012; 39, 129–136.
 22. Basit A, Nair S, Chakraborty K, Darshan B, Kamath A. Risk factors for under-nutrition among children aged one to five years in Udupi taluk of Karnataka, India: A case control study. *Australas Med J*. 2012;5(3):163-7.
 23. Ansuya, Nayak BS, Unnikrishnan, George A, Shashidhara YN, Mundkur SC, Guddattu V. Risk factors for malnutrition among preschool children in rural Karnataka: a case-control study. *BMC Public Health*, 2018; 18:283.
 24. Mazumdar S. Determinants of inequality in child malnutrition in India. *Asian Population Studies*, 2010; 6, 307–333.
 25. Shyam AG, Fuller NJ, Shah PB. Is child undernutrition associated with antenatal care attendance in Madhya Pradesh, India?. *J Family Med Prim Care* 2020;9:1380-5.
 26. Martorell, R. and Zongrone, A. Intergenerational Influences on Child Growth and Undernutrition. *Paediatric and Perinatal Epidemiology*, 2012; 26: 302-314.
 27. Striessnig E, Bora JK. Under-Five Child Growth and Nutrition Status: Spatial Clustering of Indian Districts. *Spatial Demography*, 2020; 8:63–84. <https://doi.org/10.1007/s40980-020-00058-3>.
 28. Singh A. Childhood Malnutrition in India, Perspective of Recent Advances in Acute Diarrhea. In Sujit K. Bhattacharya, IntechOpen, 2020. DOI: 10.5772/intechopen.89701. Available from: <https://www.intechopen.com/books/perspective-of-recent-advances-in-acute-diarrhea/childhood-malnutrition-in-india>.
 29. Pal A, Pari AK, Sinha A, Dhara PC. Prevalence of undernutrition and associated factors: A cross-sectional study among rural adolescents in West Bengal, India. *International Journal of Pediatrics and Adolescent Medicine*. 2017;4(1):9–18.
 30. Bhutta ZA, Das JK, Rizvi A, Gaffey MF, Walker N, Horton S, Webb P, Lartey A, Black RE. Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost?, *The Lancet*, 2013; 382 (9890):452-477.
 31. Jose S. Decomposition of gender differential in malnutrition in Indian children. *J. Soc. Econ. Dev.* 2017; 19, 299–322. <https://doi.org/10.1007/s40847-017-0047-x>
 32. Pillai VK, Ortiz-Rodriguez J. Child Malnutrition and Gender Preference in India: The Role of Culture.

- Health Science Journal, 2015; 9(6-8). <https://www.hsj.gr/medicine/child-malnutrition-and-gender-preference-in-india-the-role-of-culture.pdf>.
33. Jawaregowda SK, Angadi MM. Gender differences in nutritional status among under five children in rural areas of Bijapur district, Karnataka, India. *Int J Community Med Public Health*. 2015 Nov;2(4):506-509.
 34. Anandi BS, Reddy SB, Indupalli AS. 2018. Assessment of Nutritional Status among Under Five Children in a Rural Area of Kalaburagi District. *National Journal of Community Medicine*, 9(8): 599-604.
 35. Zere E, McIntyre D. Inequities in under-five child malnutrition in South Africa. *Int J Equity Health*, 2003;11;2:7.
 36. Kanjilal B, Mazumdar P, Mukherjee M, Rahman MH. Nutritional status of children in India: household socio-economic condition as the contextual determinant. *Int J Equity Health*. 2010;9(1):19.
 37. Ekholuenetale M, Tudeme G, Onikan A, Ekholuenetale CE. 2020. Socioeconomic inequalities in hidden hunger, undernutrition, and overweight among under-five children in 35 sub-Saharan Africa countries. *Journal of the Egyptian Public Health Association*, 95:9.
 38. Shyam AG, Fuller NJ, Shah PB. Is child undernutrition associated with antenatal care attendance in Madhya Pradesh, India? *J Family Med Prim Care*, 2020;9(3):1380-1385.
 39. Gondikar A, Sangrulkar TV, Brahmankar TR. Anthropometric assessment of nutritional status of children attending Anganwadi in urban slums of Miraj city, Maharashtra. *Int J Community Med Public Health*. 2017; 4(11):4157-4164
 40. The Lancet. 2021. Maternal and child undernutrition Progress. Executive summary. <https://www.thelancet.com/series/maternal-child-undernutrition-progress>. Accessed on 25th March 2021.