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Original Research Article

Maternal literacy and regional disparities as independent determinants of child malnutrition in Selective Indian states and UTs: an empirical analysis using NFHS-5

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ABSTRACT

Background: Child malnutrition remains a critical public health challenge in India. Despite modest improvements between NFHS-4 and NFHS-5, 35.5% of children under five are stunted, 19.3% wasted, and 32.1% underweight. This study aimed to analyze interstate differences in child malnutrition and examine the relationship between maternal education and nutritional outcomes using NFHS-5 data.
Methods: A cross-sectional, quantitative design was employed. State/UT-level prevalence data from 24 states and 4 Union Territories (UTs) were analyzed using one-way ANOVA to examine regional variation in stunting, wasting, and underweight. Pearson's correlation analysis was conducted to assess the association between maternal years of schooling and mean Z-scores for height-for-age, weight-for-height, and weight-for-age.
Results: ANOVA revealed significant regional variation for wasting ($F=6.393$, $p=0.001$) and underweight ($F=8.525$, $p<0.001$), while stunting variation was marginal ($p=0.061$). Maternal education showed a very strong positive correlation with height-for-age ($r=0.95$, $p=0.003$) and weight-for-age ($r=0.93$, $p=0.006$), and a strong correlation with weight-for-height ($r=0.84$, $p=0.034$). All correlations were statistically significant.
Conclusions: Both geographical region and maternal education are independent determinants of child malnutrition in India. Regional disparities, especially in wasting and underweight, call for location-specific interventions. The strong, graded association between maternal education and improved nutritional outcomes underscores the need for continued investment in female education as a long-term malnutrition reduction strategy.

Keywords: Child malnutrition, NFHS-5, Maternal education, Stunting, Wasting, Underweight, Regional disparities

INTRODUCTION

Malnutrition remains a serious and persistent public health challenge in India, typically beginning in early childhood and rooted in poverty, inadequate healthcare, poor maternal education, and limited access to nutritious food. According to the National Family Health Survey-5, 35.5% of children under five are stunted, 19.3% are wasted, and 32.1% are underweight.[1] These figures, though slightly improved from NFHS-4, still reflect a widespread nutritional crisis. Anaemia continues to affect 67.1% of children aged 6–59 months and 57% of women, while obesity is on the rise, with 24% of women and 22.9% of men classified as overweight—signaling a growing dual burden of undernutrition and overnutrition.

Among the most significant yet modifiable determinants of child nutrition is maternal education. Educated mothers are more likely to adopt recommended infant feeding practices, access healthcare services, maintain hygiene, and ensure dietary diversity. Conversely, limited maternal education often correlates with poor child health and

nutrition, reinforcing cycles of underdevelopment. Thus, tackling malnutrition requires not only nutrition-specific interventions but also a strong focus on improving maternal literacy and empowerment.

The double burden of malnutrition—simultaneous undernutrition and overnutrition—is an emerging concern, demanding urgent policy attention.[2] India ranks 105th out of 127 countries in the 2024 Global Hunger Index, with stunting at 35.5%, wasting at 18.7% (the highest in the world), and under-five mortality at 2.9%.[3] The World Bank notes that 22% of India's disease burden is due to malnutrition, primarily driven by micronutrient deficiencies in iron, vitamin A, and zinc.[4] Maternal education remains a central yet under-addressed determinant in this crisis. Low educational attainment limits women's capacity to make informed nutritional decisions, access services, or understand health risks, making education a powerful tool for long-term impact.

The UNICEF-WHO report "Child Malnutrition: Extension of 2030 Targets" stresses that many countries, especially in Asia and Africa, are not on track to meet global nutrition goals.[5] India contributes significantly to the global burden of stunting and wasting, highlighting the need for localized strategies. While improving food access is critical, addressing root causes—particularly maternal education and health awareness—is equally vital to reducing malnutrition.

Malnutrition in India is not evenly distributed. Stark regional disparities persist. States like Bihar (42.9%), Jharkhand (39.6%), and Uttar Pradesh (39.7%) report some of the highest stunting rates, reflecting structural inequities in access to healthcare, education, and sanitation. In contrast, southern states such as Kerala (23.4%), Goa (21.4%), and Tamil Nadu (25%) perform better but continue to face challenges like widespread anaemia. Even urban centers like Delhi and Mumbai are affected by "hidden hunger," where adequate calories mask deficits in micronutrient-rich foods. Tribal children aged 12–23 months suffer from some of the poorest nutrition outcomes in under-resourced areas, indicating a need for targeted policy efforts.[6]

Good nutrition in early childhood is fundamental for long-term physical and cognitive development.[2] Around 45% of global under-five deaths are linked to malnutrition, and in India, 7.56% of children suffer from severe forms. Traditional anthropometric indicators like stunting, wasting, and underweight fail to capture the full extent of the problem. In this context, composite indices such as the Composite Index of Anthropometric Failure (CIAF) and neo-CIAF offer a more holistic view of child malnutrition.

Research from Jangalmahal reveals coexisting undernourishment and overweight in preschool children, a phenomenon that standard indicators overlook.[7] Similarly, adoption of CIAF is advocated to capture multidimensional nutritional deficits more effectively.[8] Other critical factors include household food insecurity and poor dietary diversity, and low nutrition literacy in semi-urban communities.[9,10] These socio-behavioral dimensions significantly influence child nutrition but are often neglected in program design. Moreover, intra-urban disparities are evident in states like West Bengal, where child stunting varies widely by location.[11]

Global child growth standards like those developed under the Multicentre Growth Reference Study (MGRS) are important for cross-national comparisons but require careful localization in India to reflect diverse ethnic and environmental contexts.[12] To effectively combat malnutrition, a multivariable, index-based approach is needed—one that integrates India's social, economic, and demographic diversity.[13]

This study aims to examine spatial variations in child malnutrition across Selective Indian states and union territories, explore the relationship between maternal education and child nutritional outcomes, and propose evidence-based, equitable policies. By integrating health, education, and socio-economic data, it seeks to contribute to India's progress toward Sustainable Development Goal 2: Zero Hunger, and promote a healthier, more inclusive future for the country's children.

Research objectives

To analyze interstate differences in child malnutrition indicators (stunting, wasting, and underweight) using NFHS-5 data.

To identify high-burden states and UT with critical levels of malnutrition.

To examine the relationship between maternal education and access to healthcare services with child malnutrition at the state and UT level.

To suggest policies for reducing child malnutrition.

Hypothesis 1: regional differences in child malnutrition

H_{01}: There is no significant variation in child malnutrition indicators (stunting, wasting, and underweight) across Indian states.

H_{11}: There is a significant variation in child malnutrition indicators (stunting, wasting, and underweight) across Indian states.

Hypothesis 2: relationship between maternal education and child malnutrition

H_{02}: There is no significant correlation between child malnutrition rates and maternal education.

H_{12}: There is a significant correlation between child malnutrition rates and maternal education.

METHODS

The data used in this study was derived from the National Family Health Survey (NFHS-5), conducted in 2019–21 by the Ministry of Health and Family Welfare, Government of India. NFHS-5 provides nationally representative, disaggregated health and nutrition data across all states and union territories of India. The data includes anthropometric measurements of children under five years of age, as well as socioeconomic and educational information about their mothers.

This study adopts a quantitative, cross-sectional research design. A total of 28 states were included for regional analysis, while nationally aggregated data was used to examine the impact of maternal education on child nutrition indicators. The study is constrained by the unavailability of data pertaining to certain indicators for all states. Consequently, the analysis has been restricted to 24 states and 4 Union Territories (UTs) for which complete and comparable data were available. The states included in the study are: Delhi, Haryana, Himachal Pradesh, Punjab, Rajasthan, Uttarakhand, Chhattisgarh, Madhya Pradesh, Uttar Pradesh, Bihar, Jharkhand, Odisha, West Bengal, Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, Goa, Gujarat, and Maharashtra. The UTs included are: Chandigarh, Jammu and Kashmir, Ladakh, and Dadra and Nagar Haveli and Daman and Diu. This ensures consistency and reliability of the results. Therefore, the findings should be interpreted within the context of the selected states/UTs rather than as a representation of the entire country. The unit of analysis varies across objectives: for regional comparisons, state-level prevalence rates were utilized, whereas for correlation analysis, mean Z-scores across different levels of maternal education were considered. The study uses child anthropometric indicators as dependent variables, namely stunting (Height-for-Age Z-score), wasting (Weight-for-Height Z-score), and underweight (Weight-for-Age Z-score). The independent variables are defined according to the study hypotheses. For Hypothesis 1, region is treated as a categorical variable and classified into five groups—North, Central, East, Northeast, and West. For Hypothesis 2, maternal education is considered as an ordinal variable with six categories and is further transformed into approximate years of schooling for correlation analysis.

The study employs multiple statistical techniques to analyze the data. Descriptive statistics were used to summarize the distribution of stunting, wasting, and underweight rates across states, including measures such as minimum, maximum, mean, and standard deviation. To test Hypothesis 1, a one-way Analysis of Variance (ANOVA) was applied to examine whether malnutrition indicators differ significantly across the five geographical regions, with a p-value of less than 0.05 considered statistically significant. For Hypothesis 2, Pearson's correlation coefficient was used to assess the strength and significance of the relationship between maternal education (measured in years) and the mean Z-scores of stunting, wasting, and underweight, with the results interpreted based on the correlation coefficient (r) and corresponding p-values.

RESULTS

Hypothesis 1: regional variation in malnutrition.

Across 28 states/UTs, the mean stunting rate was 32.2% (SD=6.1), ranging from 22.3% to 46.5%. Mean wasting was 16.9% (SD=4.8), ranging from 8.4% to 25.6%. Mean underweight was 26.4% (SD=8.4), ranging from 12.7% to 41.0%.

Height for age: The p-value (.061) is slightly above the typical alpha level of .05, indicating no statistically significant difference in "Height for Age" across the groups. However, the result is close to significance, suggesting a potential trend that might become significant with a larger sample size or more sensitive measurement.

Weight for height: The p-value (0.001) is much less than 0.05, indicating a statistically significant difference in "Weight for Height" across the groups. This means that at least one group mean is significantly different from the others for this variable.

Weight for age: The p-value (.000) (effectively less than 0.001) shows a highly significant difference among groups for "Weight for Age". This indicates a strong effect, with clear differences between groups in terms of this measurement.

There are statistically significant differences between groups in Weight for Height and Weight for Age. Height for Age differences were not statistically significant, though the result was marginal and could warrant further investigation.

The analysis reveals a clear positive association between maternal education and improved child nutritional outcomes across all three indicators.

For height-for-age (stunting), the mean Z-score improves steadily from -1.7 among children of mothers with no schooling to -1.0 for those whose mothers have completed 12 or more years of education, indicating a strong inverse relationship between education and stunting.

In the case of weight-for-height (wasting), the improvement is more modest- from -1.0 to -0.7- suggesting that while maternal education contributes to better outcomes, wasting, which reflects acute malnutrition, may also be driven by short-term factors such as illness or food insecurity. For weight-for-age (underweight), the trend is again strong and consistent, with Z-scores improving from -1.8 to -1.1, highlighting

that children of more educated mothers are significantly less underweight, likely due to cumulative benefits of improved care practices, nutrition knowledge, and health-seeking behavior. Overall, the findings underscore the critical role of maternal education in reducing both chronic and acute forms of child malnutrition. Graphs are given below: the findings indicate a strong and statistically significant relationship between maternal education and child nutritional status across all three indicators.

The null hypothesis (H_{02}), which stated that there is no significant correlation between maternal education and child malnutrition, is rejected, while the alternative hypothesis (H_{12}) is accepted. Pearson's correlation analysis using national-level data shows a very strong positive correlation between maternal education and height-for-age (r=0.95, p=0.003), a strong positive correlation with weight-for-height (r=0.84, p=0.034), and a very strong positive correlation with weight-for-age (r=0.93, p=0.006).

Table 1: Regional variation in child malnutrition.

	N	Minimum	Maximum	Mean	SD
Height for age	28	22.3	46.5	32.189	6.1001
Weight for height	28	8.4	25.6	16.904	4.8187
Weight for age	28	12.7	41.0	26.425	8.4316

Table 2: One-way ANOVA results for differences in child malnutrition indicators across geographical regions.

		Sum of squares	DF	Mean square	F	Sig.
Height for age	Between groups	314.925	4	78.731	2.625	0.061
	Within groups	689.781	23	29.990		
	Total	1004.707	27			
Weight for height	Between groups	330.055	4	82.514	6.393	0.001
	Within groups	296.875	23	12.908		
	Total	626.930	27			
Weight for age	Between groups	1146.322	4	286.580	8.525	0.000
	Within groups	773.151	23	33.615		
	Total	1919.472	27			

Table 3: Summary of statistical results for the relationship between regional variation and child malnutrition.

Variable	F-value	P-value	Significance
Height for age	2.625	0.061	Not significant (but close)
Weight for height	6.393	0.001	Significant
Weight for age	8.525	0.000	Highly significant

Table 4: Correlation of child malnutrition with maternal education (Pearson's correlation).

Education	Years		Height-for-age	Weight-for-height	Weight-for-age
1	No schooling	0.0	-1.7	-1.0	-1.8
2	<5 years	2.0	-1.6	-1.0	-1.7
3	5-7 years	6.0	-1.5	-0.9	-1.6
4	8-9 years	8.5	-1.4	-0.9	-1.5
5	10-11 years	10.5	-1.2	-0.9	-1.4
6	>=12 years	12.0	-1.0	-0.7	-1.1

Table 5: Summary of statistical results for the relationship between maternal education and child malnutrition.

Indicator	Correlation (r)	P-value	Strength	Significance
Height-for-age	0.95	0.003	Very strong	Significant
Weight-for-height	0.84	0.034	Strong	Significant
Weight-for-age	0.93	0.006	Very strong	Significant

Table 6: Hypothesis testing results: regional variation and maternal education effects on child malnutrition indicators.

Hypothesis	Null hypothesis (h_0)	Result	Conclusion
Hypothesis 1: regional variation in malnutrition	No significant difference in malnutrition across Indian states/UTs	P<0.05 for wasting and underweight	Null rejected
		P=0.061 for stunting	Null not rejected
Hypothesis 2: correlation between maternal education and child malnutrition indicators	No significant correlation between maternal education and malnutrition	P<0.05 for all 3 indicators	Null rejected

Since all p values are below the 0.05 significance level, the results confirm that higher levels of maternal education are significantly associated with improved child nutritional outcomes.

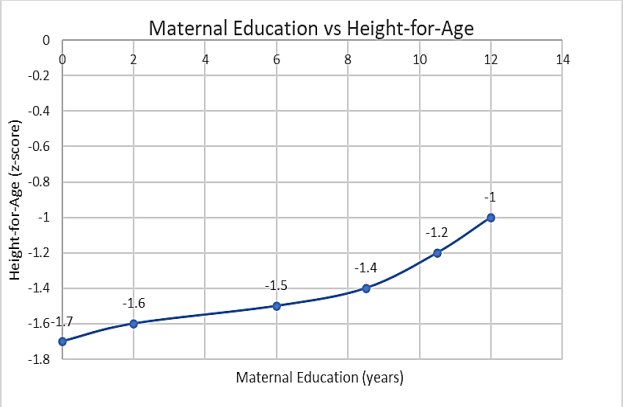

Figure 1: Maternal education vs height-for-age Z-score.

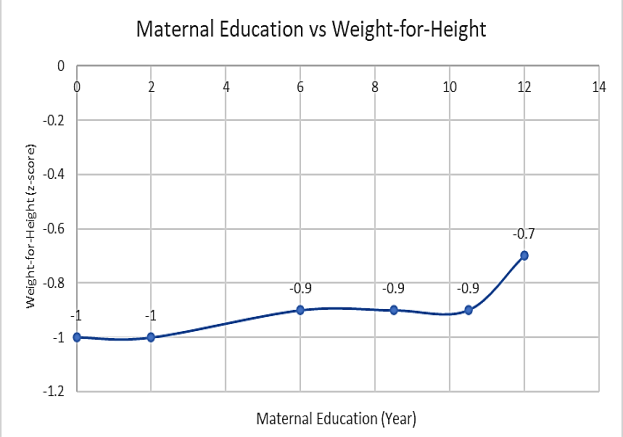

Figure 2: Maternal education vs. Weight-for-height Z-score.

Given the strength and significance of the correlations across all three indicators, we reject the null hypothesis and accept the alternative hypothesis. This confirms that there is a significant and positive association between maternal education and improved child nutritional outcomes. These findings underscore the crucial role of maternal education in mitigating child malnutrition, indicating that investing in female education, particularly secondary and tertiary education, can be a powerful long-term strategy to combat undernutrition in children. The empirical findings indicate that regional variation in child malnutrition is not uniform across all indicators.

The analysis reveals that stunting exhibits a marginal level of statistical significance (p=0.061), suggesting that although regional differences are observable, they do not meet the conventional 5 percent threshold for statistical significance. However, this near-significant result may still indicate underlying regional disparities that warrant further investigation. In contrast, wasting and underweight show statistically significant variation across regions, highlighting substantial geographical inequalities in acute and chronic forms of malnutrition. Furthermore, maternal education demonstrates a strong and positive association with child nutritional outcomes, with all estimated relationships being statistically significant. This underscores the critical role of maternal education as a key socio-economic determinant in improving child health and nutritional status.

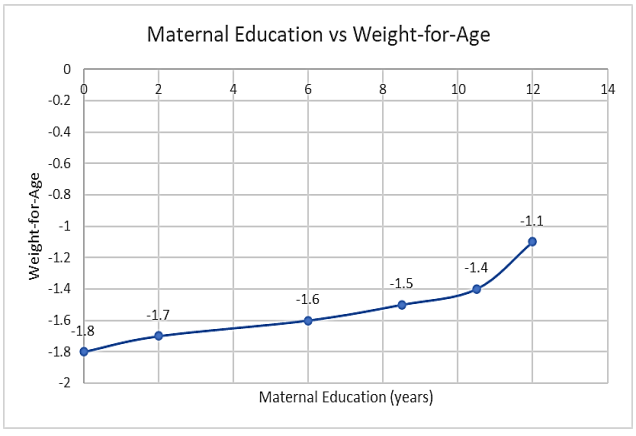

Figure 3: Maternal education vs weight-for-age.

DISCUSSION

The findings from this study provide strong evidence for regional disparities and educational influences on child

malnutrition in India.[1,2] Hypothesis 1 revealed significant variation in wasting and underweight indicators across different regions of India, with ANOVA results showing statistically significant F-values and p-values well below the 0.05 threshold.

This indicates that geographic location plays a notable role in child nutritional outcomes, likely influenced by disparities in socioeconomic conditions, public health infrastructure, and regional program effectiveness.[3,4] Although height-for-age (stunting) did not show a statistically significant difference across regions (p=0.061), the result was marginal, suggesting a potential trend that merits further investigation.[5]

Hypothesis 2 further strengthens the argument for maternal education as a critical determinant of child nutrition.[6,7] Pearson's correlation analysis demonstrated very strong and statistically significant positive relationships between years of maternal education and all three malnutrition indicators. As maternal education increased, the severity of stunting, wasting, and underweight declined significantly. This suggests that educated mothers may possess better knowledge of nutrition, healthcare practices, and hygiene, contributing to improved child health outcomes.[8,9] These findings align with previous research highlighting the role of maternal literacy in reducing child undernutrition.[10,11]

CONCLUSION

The study concludes that child malnutrition in India is shaped by both regional disparities and maternal education levels. Higher prevalence of stunting, wasting, and underweight in certain regions reflects underlying socio-economic inequalities and uneven access to healthcare and nutrition services. At the same time, the strong association between maternal education and improved child health outcomes highlights the importance of investing in women's education as a long-term and sustainable strategy.

The findings also point towards emerging nutritional challenges, particularly the coexistence of undernutrition and increasing levels of overweight and obesity. This shift indicates changes in dietary patterns and lifestyle behaviours, even among economically disadvantaged groups. Addressing these complex issues requires an integrated approach that combines improvements in education, healthcare access, and targeted nutrition interventions. Policy measures must be inclusive, region-specific, and supported by effective implementation mechanisms. A coordinated effort across sectors will be critical to achieving sustained reductions in child malnutrition and advancing broader goals of human development.

Policy recommendations

The findings of this study call for a comprehensive and context-specific policy approach to address child malnutrition in India. A key priority should be the promotion of female education and empowerment, as maternal education has emerged as a critical determinant of child nutritional outcomes. Expanding access to secondary and higher education for girls, delaying the age of marriage, and strengthening awareness related to reproductive and child health can significantly improve household-level decision-making related to nutrition. At the same time, policy interventions must be regionally differentiated, with particular attention to high-burden states such as Uttar Pradesh, Bihar, and Jharkhand, where malnutrition remains widespread. Strengthening local service delivery systems, including community health workers and Integrated Child Development Services, is essential to ensure effective implementation at the grassroots level.

In addition, enhancing nutrition awareness through community-based initiatives is crucial for promoting behavioural change. Information, education, and communication campaigns tailored to local contexts can improve knowledge related to child feeding practices, dietary diversity, and hygiene. Integrating nutrition interventions with water, sanitation, and hygiene initiatives, along with social protection schemes such as POSHAN Abhiyan and Pradhan Mantri Matru Vandana Yojana, can address both immediate and structural causes of malnutrition. Improved monitoring mechanisms, including the use of composite indicators like the Composite Index of Anthropometric Failure, can provide a more comprehensive understanding of nutritional deprivation, particularly among vulnerable groups such as tribal and peri-urban populations.

Furthermore, emerging concerns related to the coexistence of undernutrition and rising obesity require a balanced policy response. School-based nutrition programmes, regulation of unhealthy food environments, and the promotion of locally available nutritious foods can contribute to healthier dietary patterns. There is also a need to adapt global child growth standards, including those developed by the World Health Organization, to better reflect regional variations and improve their practical application at the field level. Such integrated and multi-sectoral strategies are essential to break the persistent cycle of malnutrition and promote equitable health outcomes.

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REFERENCES

1. International Institute for Population Sciences (IIPS) and ICF. National Family Health Survey (NFHS-5), 2019-21: India. Mumbai: IIPS. 2021. Available at: https://dhsprogram.com/pubs/pdf/FR375/FR375.pdf. Accessed on 02 February 2026.
2. Takhelchangbam N, Saxena D, Singh NP, Singh A. Epidemiology of double burden of malnutrition: Causes and consequences. Prev Med Res Rev. 2024;1:305-9.
3. Global Hunger Index. India fact sheet. 2024. Available at: https://www.globalhungerindex.org/pdf/en/2024/India.pdf. Accessed on 02 February 2026.
4. World Bank. Malnutrition in India: Causes and consequences. Washington, DC: World Bank. 2023. Available at: https://documents1.worldbank.org/curated/en/552991468042034521/pdf/368050REVISED0101OFFICIAL0USE0ONLY1.pdf. Accessed on 02 February 2026.
5. WHO. Malnutrition fact sheet. Available at: https://www.who.int/news-room/fact-sheets/detail/malnutrition. Accessed on 02 February 2026.
6. Aryan MG, Mahesh V, Damayanthi MN, Vishma BK, Sneha Sri GR. Nutritional status prevalence and its determinants among children aged 12 to 23 months in tribal settlements of Chamarajanagar district, Southern India. Int J Med Public Health. 2024;14:83-91.
7. Mahanti B, Chowdhury S, Paul S, Adak D, Mahanty S, Das R, et al. Assessment by neo-CIAF formula predicts contrast occurrence of overweight and undernourishment in preschool children of Jangalmahal districts, India. Trends Pediatr. 2024;5:146-56.
8. Singha Roy S, Mondal N. Composite index of anthropometric failure and conventional anthropometric indices of undernutrition among children in India: A systematic review and meta-analysis. Eur J Clin Exp Med. 2024;22:934-53.
9. Yadav SS, Matela H, Panchal P, Menon K. Household food insecurity, dietary diversity with undernutrition among children younger than five years in Indian subcontinent: A narrative review. Lancet Reg Health Southeast Asia. 2024;26:100426.
10. Mukherjee D, Raj R, Kumar S. A review on child nutrition and health awareness in semi-urban communities: A case study of Salampur village. Preprints. 2025.
11. Chakma N, Sen S, Banerjee A, Ali A. Pervasiveness of stunting among children under-5 years of age in urban India with special reference to West Bengal: An examination from the National Family Health Survey (NFHS). In: Sivaramakrishnan L, Dahiya B, Sharma M, Mookherjee S, Karmakar R, eds. Developments in Environmental Science. Vol 15. Elsevier. 2024;19-35.
12. Prasad V, Sinha D, Joseph RJ. Global relevance of MGRS growth standards: the case of India. BMJ Paediatr Open. 2024;8:e002472.
13. Shah G, Siddiqa M, Shankar P, Karibayeva I, Zubair A, Shah B. Decoding India's child malnutrition puzzle: A multivariable analysis using a composite index. Children (Basel). 2024;11:902.

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