

Trends and Challenges in Child Growth Monitoring in India (2018-2023): A Systematic Review"

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Abstract

Background: In India, malnutrition and growth faltering in children continue to be a major public health challenge, with socioeconomic, dietary and environmental disparities being the most prominent factors in certain regions. In order to make accurate diagnoses and plan appropriate interventions, the development of appropriate assessment tools and growth references based on regions would be highly valuable.

Objective: This review seeks to summarize new evidence about the growth and nutritional status of Indian children from birth to the age of 18 years, focusing and reviewing methods of assessment, prevalence, region, and impact of intervention.

Methods: A systematic literature review was performed, focusing on the period 2018 to 2023 and studying anthropometric and digital methods across regions of India. Information relating to study design, sample size, assessment methods, and findings was captured and synthesized.

Results: There were studies conducted across the regions which reported high prevalence of undernutrition, stunting, wasting, and overweight. The socioeconomic status, urban-rural gap, and the instruments used for the assessment had a considerable impact on the classification. For scalable screening, the new digital instruments like 'DEEP' are promising. The use of region-specific growth references leads to less misclassification than the WHO standards.

Conclusion: There are efforts on-going geared towards addressing malnutrition, which is still evident among Indian children. This shows the need for regional personalised assessment and socioeconomic synergy. The digital technology is promising for large scale screening.

Introduction

Childhood growth and nutritional status is of primary importance to health, development, and productivity in the long run. Even with large health initiatives, all of India still has high rates of undernutrition with stunting, wasting, and being underweight. The reasons are always complicated, involving many different socioeconomic dietary and health environmental issues, and inequities with access to health services.

Without the correct measurement of growth and nutritional status, there will always be a lack of prompt identification and intervention. Historically, these measurements use anthropometric data described by the WHO growth standards. Newer data, however, highlight the potential of region-specific growth references to offer a more tailored and precise classification specific to the Indian population. Furthermore, the development of new technologies has automated these basic screening assessments and made digital instruments more accessible and practical for large-scale assessments and screening purposes.

This review offers a synthesis of recent studies conducted on the growth and

nutrition of children in India, which focuses on the assessment approach, variations by region, outcomes of interventions, and how these can help guide future policy and practice.

Methodology

- **Search Strategy:** To gather relevant literature from 2018 to 2023, we conducted a search across PubMed, Google Scholar, and various Indian journal repositories. We used keywords like “child growth India,” “malnutrition assessment India,” “anthropometric standards India,” and “digital assessment tools children,” among others.
- **Inclusion Criteria:** Studies conducted in India involving children aged 0-18 years, utilizing anthropometric or digital assessment tools, and reporting prevalence or intervention outcomes.
- **Data Extraction:** Data on study design, sample size, age group, region, assessment tools, outcomes, and interventions were extracted.

Review of Studies

Study	Design	Sample Size	Age Group	Region	Evaluation Method	Outcomes
Bhavnani et al.	Proof-of-concept	Not specified	3 years	Rural India	Digital tool (DEEP), BSID-III, growth measures	Positive association between growth and cognition; socioeconomic influence
Raghuvanshi et al.	Cross-sectional	753 children	6-14 years	Western & Eastern Uttar Pradesh	Anthropometry, WHO standards	Below WHO standards; higher stunting in Western UP; girls more deficient in protein
Kalyan et al.	Descriptive	140 children	<5 years	Haryana	WHO growth charts	61.4% normal; malnutrition presents in many children
Prabhu et al.	Cross-sectional	10,730 children	0-18 years	Central India	WHO standards, anthropometry	45.7% underweight, 40.4% stunted, 22% wasted
Ghorai et al.	Cross-sectional	230 adolescents	12-18 years	Kolkata	Anthropometry, CDC/IAP, SPSS	Growth increases with age; urban children show more growth
Elangovan et al.	Cross-sectional	972 children	11-13 years	Tamil Nadu	WHO standards	58% underweight; high undernutrition prevalence
Singh & Sharma	Cross-sectional	897 children	5-18 years	Punjab	SPSS, AnthroPlus	Severe undernutrition

						n; girls affected more during middle childhood
Verma et al.	Secondary data analysis	897 children	5-18 years	Punjab	WHO AnthroPlus	High undernutrition; gender and regional differences
Vastrad et al.	Cross-sectional	2700 children	6-15 years	Karnataka	WHO AnthroPlus	45.3% underweight, 19.5% stunted, 43% thinness
Krishna et al.	Cross-sectional	580 children	6 months -6 years	Tumkur	Anthropometry, dietary intake	High undernutrition; socio-economic factors significant

Outcomes of Interventions

- **Digital Tools:** Bhavnani et al. demonstrated that digital assessment platforms like DEEP could reliably correlate with established growth measures, facilitating scalable screening.
- **Nutritional Supplementation:** Bhasin et al. reported significant improvements in anthropometric z-scores after 6 months of nutritional supplements.
- **Region-specific References:** Majumder et al. introduced Indian-specific growth charts, reducing

misclassification and better reflecting the growth patterns of Indian children.

- **Educational Programs:** Several studies highlighted the importance of parental education, socioeconomic upliftment, and health awareness in reducing malnutrition.

Results

Recent research conducted between 2018 and 2023 highlights the persistent challenge of childhood malnutrition across different regions of India. The prevalence of

undernutrition indicators such as stunting, wasting, and underweight remains alarmingly high, emphasizing the urgent requirement for comprehensive assessment and targeted intervention measures. For example, Prabhu et al. reported that nearly 45.7% of children aged 0-18 years in Central India were underweight, with 40.4% exhibiting signs of stunted growth.

In a similar vein, Ghorai et al. reported that in Kolkata, 58% of adolescents aged 12-18 years were underweight, and 19.5% were stunted, revealing significant regional differences and ongoing nutritional challenges. Additionally, studies indicate that girls often face higher rates of malnutrition during middle childhood. Singh and Sharma observed that girls in Punjab tend to experience more severe forms of undernutrition. Factors such as socioeconomic status and the urban-rural divide significantly influence these nutritional outcomes, with children from lower socioeconomic backgrounds and rural areas exhibiting higher malnutrition rates. The methods used to assess growth varied across studies, although most adhered to WHO growth standards. However, research by Majumder and colleagues suggested that utilizing region-specific growth references could enhance diagnostic precision by better aligning with local growth patterns, thereby reducing the

likelihood of misclassification. Additionally, Bhavnani and his team introduced the 'DEEP' platform, which demonstrated that digital assessment tools can serve as reliable and scalable screening options. These tools showed good agreement with traditional anthropometric measurements, making them suitable for large-scale applications, especially in resource-limited settings. Furthermore, intervention studies have indicated that nutritional supplementation programs can lead to significant improvements in growth parameters over time, underscoring the importance of early detection and targeted nutritional interventions.

Discussion

The persistent challenge of undernutrition—including issues like stunting, wasting, and being underweight—remains a major concern across different regions of India. This situation underscores the complex interplay of factors that contribute to childhood malnutrition. Despite the implementation of nationwide programs such as the Integrated Child Development Services (ICDS) and the National Nutrition Mission, achieving optimal growth outcomes continues to be difficult. This highlights the urgent need to refine assessment techniques to more accurately identify children at risk and to

customize intervention strategies accordingly.

A significant focus of recent research is the applicability of global growth standards, such as those provided by the WHO, to the Indian population. Studies, including one conducted by Majumder et al., suggest that utilizing growth references tailored to Indian children offers a more accurate reflection of actual growth patterns. Such localized charts help reduce the chances of misclassification and enable more targeted nutritional interventions. Given the diversity in growth trajectories caused by genetic, environmental, and socioeconomic influences, region-specific reference charts are essential for precise assessments.

In addition, socio-economic factors like parental education, household income, food security, sanitation, and healthcare access play a vital role in influencing growth outcomes. Consistent research indicates that children from less privileged backgrounds are more vulnerable to undernutrition. This highlights the importance of comprehensive strategies that combine nutritional support with efforts to improve overall socioeconomic conditions.

The advent of digital tools like DEEP presents promising opportunities for scalable and cost-effective screening, especially in resource-constrained settings.

These technologies can facilitate early detection and prompt intervention, though challenges remain in validating them across diverse populations and integrating them into existing health systems.

Regional disparities in nutritional status, as revealed by various studies, emphasize the necessity for customized approaches that consider local dietary habits, healthcare infrastructure, and environmental conditions. A universal solution is unlikely to be effective; instead, tailored, context-specific strategies are essential.

Finally, while supplementation programs and educational initiatives have yielded positive outcomes, ensured their sustainability and maintained long-term commitment are crucial for enduring impact. Engaging communities and strengthening health systems are key steps toward ensuring consistent and effective delivery of nutritional services.

Conclusions

Childhood undernutrition continues to pose a significant public health challenge in India, affecting millions of children and impeding their physical and cognitive development. Despite numerous ongoing initiatives and intervention programs, the prevalence of stunting, wasting, and underweight remains alarmingly high across many regions, underscoring the

complexity of this issue. Addressing this problem requires a multifaceted approach that involves adopting region-specific growth standards to improve assessment precision, leveraging innovative digital technologies for large-scale screening, and implementing focused nutritional and socioeconomic support measures. It is also crucial to engage communities actively and strengthen healthcare infrastructure to achieve sustainable progress. Future policies should emphasize these strategies, ensuring that interventions are tailored to local contexts, culturally appropriate, and accessible to all children, particularly those in marginalized and underserved communities.

Furthermore, raising awareness about proper nutrition, sanitation, and hygiene practices is vital to prevent malnutrition from an early age. Strengthening collaboration between government agencies, NGOs, and local communities can create a more effective support system. Investments in maternal health and education are equally important to break the cycle of undernutrition. Only through coordinated, evidence-based efforts can India effectively combat childhood malnutrition and promote healthy growth for its future generations.

Conflict of Interest Statement

The authors confirm that there are no conflicts of interest to disclose.

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