Original Article

A Cross-Sectional Study of the Prevalence of Short Stature Among Children Visiting the Outpatient Department of a Tertiary Care Center

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ABSTRACT

Background: Short stature in children is a significant global health concern, often indicating underlying nutritional, endocrine, or genetic disorders. Identifying the prevalence and associated risk factors in specific populations in regions with limited access to healthcare, poor nutrition, or inadequate prenatal care eg in rural or low-income communities, is essential for early diagnosis and timely intervention. **Objective**: This study aimed to assess the prevalence of short stature among children visiting the outpatient department of a tertiary care center and to explore the sociodemographic (lower SES, nuclear families) and clinical factors {chronic illness like hypothyroidism, diabetes, and bone age} associated with short stature**. Methods**: A cross-sectional observational study was conducted at the Department of Pediatrics, LN Medical College, and JK Hospital, Bhopal. A total of 210 children aged 2-12 years attending the outpatient department were systematically selected (systematic sampling) and approved by the IEC. Inclusion criteria involved children whose parents or guardians provided informed consent, while exclusion criteria included children with hypotension or those whose guardians did not consent. Anthropometric measurements, clinical assessments, and family histories were recorded. Short stature was defined as height-for-age below -2 standard deviations from the WHO growth standards**. Results:** The prevalence of short stature was 4.29%. It was more common among children from lower socioeconomic backgrounds (55.6%) and nuclear families (66.7%). The highest prevalence was observed in children aged 5-8 years (77.8%), with no significant gender difference. Additionally, 77.8% of children with short stature had a chronic illness, such as hypothyroidism or diabetes. And 88.9% showed delayed bone age. The influence of maternal education was also significant, with 55.6% of affected children having illiterate mothers. **Conclusion:** The study found a relatively lower prevalence of short stature compared to other studies, but it was significantly associated with lower socioeconomic status, chronic illness, delayed bone age, and maternal education. Early detection, nutritional interventions, and addressing socioeconomic disparities, enhancing maternal education are essential to improve growth outcomes in children. Further research is needed to investigate the long-term outcomes of children with short stature and the effectiveness of targeted interventions.

Keywords: Short stature, chronic illness, bone age, pediatric stunting, socioeconomic factors, nutritional interventions

Child malnutrition, particularly stunting, remains a significant challenge to growth and development, with far-reaching implications for both physical and cognitive health. According to the World Health Organization (2021), differentiating between undernutrition and overnutrition is essential, as both conditions contribute to adverse health outcomes [1]. Stunting, often defined as low height-for-age, is a key indicator of chronic undernutrition, and its impact is especially profound during the critical early years of childhood. Data from the National Family Health Survey (NFHS-5) reveals some progress in addressing child malnutrition across India, but it also highlights persistent disparities across states and socioeconomic groups, with stunting affecting a significant proportion of children. For instance, NFHS-5 data indicates that approximately 35% of children under the age of five in India are stunted, showcasing the ongoing challenge in improving nutrition across diverse populations [2].

Research into stunting prevalence among children aged 2 to 12 is essential to identify at-risk populations and guide the development of targeted interventions [3]. These interventions are critical, particularly given the long-term consequences of stunting on health, education, and economic outcomes. UNICEF emphasizes the need for continued investment in nutrition and health strategies to address this issue and improve outcomes for children Worldwide [4].

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This study seeks to assess the prevalence of short stature in children aged 2 to 12 years in India, focusing on anthropometric measurements to quantify the extent of the problem. In addition to examining the overall prevalence, the secondary objective explores the correlation between mid-parental height and short stature, offering insights into genetic and environmental factors influencing growth. The findings of this study will be instrumental in developing targeted interventions and informing public health strategies aimed at improving child nutrition and health in the region.

MATERIALS AND METHODS

This cross-sectional observational study aimed to assess the prevalence of short stature and its associated risk factors in children aged 2 to 12 years at LN Medical College and JK Hospital in Bhopal. The study was conducted over a period from December 2022 to May 2024 and received ethical clearance from the Institutional Ethical Committee. Informed consent was obtained from the parents or guardians of all participants, and data confidentiality was strictly maintained throughout the study.

Sampling Method and Justification: A total of 210 children were recruited using systematic random sampling. The inclusion criteria required children aged 2 to 12 years who were able to participate in anthropometric measurements and interviews. The age range was selected to include children during critical growth periods, as this is when stunting and growth retardation are most prominent.

Exclusion Criteria: Children with severe physical or mental disabilities that would prevent accurate measurement of height, or those with serious health conditions that might interfere with normal growth patterns, were excluded. Additionally, children whose parents or guardians did not consent to participation were excluded from the study.

Data Collection: Data were collected in two phases: structured interviews and anthropometric measurements. Structured interviews were conducted with the parents or guardians to assess socioeconomic factors, nutritional status, and any chronic health conditions affecting the child's growth. Anthropometric measurements were taken using standard equipment, including stadiometers for height measurement, following WHO guidelines for height-for-age Z-scores. Height-for-age Z-scores below -2.0 SD were used to define short stature. Anthropometric measurements were performed by trained personnel to ensure consistency and reliability, with a supervisor overseeing the process to ensure data accuracy and adherence to ethical standards.

Statistical Analysis: Descriptive statistics were used to assess the overall prevalence of short stature, while bivariate analysis was employed to explore associations between short stature and potential risk factors such as nutritional status, socioeconomic status, and parental height. Statistical significance was set at $p < 0.05$.

Ethical Considerations: The study adhered to ethical guidelines as outlined by the Institutional Ethical Committee. Ethical principles such as voluntary participation, informed consent, and confidentiality were maintained throughout the study. No compensation was provided to the participants, and the study was self-funded.

This methodology provides a robust approach to assessing the prevalence of short stature in children, while also considering the social, economic, and nutritional factors that contribute to it. This cross-sectional study assessed the prevalence of short stature and its associated risk factors in children aged 2 to 12 years at LN Medical College and JK Hospital in Bhopal. Conducted between December 2022 and May 2024, the study received ethical clearance from the Institutional Ethical Committee and included phases for planning, data collection, and analysis. The primary outcome measured was the prevalence of short stature, while secondary outcomes included factors such as nutritional status and socioeconomic influences. Short stature was defined according to WHO guidelines as height-for-age Z-scores below -2.0 SD.

A total of 210 children were recruited through systematic random sampling, with informed consent obtained from their parents or guardians. Data were collected via structured interviews and anthropometric measurements using a refined data collection form. A supervisor ensured data accuracy and ethical compliance through regular monitoring. Descriptive and bivariate statistics were employed to analyze the relationships between short stature and its determinants. The study was self-funded, and no compensation was provided to participants.

RESULTS

Out of the 210 participants, 9 (4.29%) were classified as having short stature, while the remaining 201 participants (95.71%) were of normal height.

Table 1: Prevalence of Short Stature Among Participants

Status	Number of Participants	Percentage
Short Stature	9	4.29%
Normal Height	201	95.71%
Total	**210**	**100%**

Among the 201 participants with normal stature, 113 (56.2%) were male and 88 (43.8%) were female. In the short-stature group, 5 (55.6%) were female and 4 (44.4%) were male. The difference in gender distribution between the two groups was not statistically significant (P = 0.487).

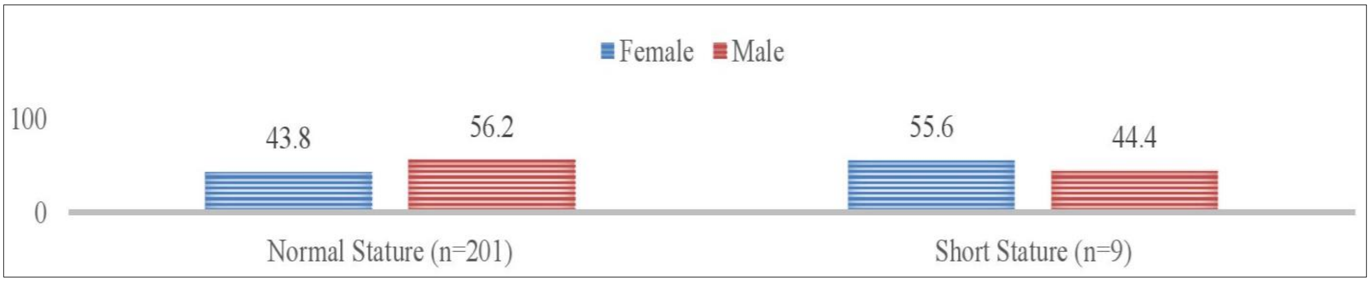

Fig1: Distribution of Participants based on Gender

The age distribution of participants showed that no children aged 2-4 years had short stature. In the 5-8 years age group, 7 (77.8%) had short stature, while in the 9-12 years age group, 1 (11.1%) had short stature. In the 13-15 years group, 1 (11.1%) had short stature, compared to 2 (0.995%) with normal stature. Among participants with normal stature, 110 (54.7%) were from rural areas, while 3 (33.3%) of those with short stature lived in rural settings. Conversely, 91 (45.3%) with normal stature were urban residents, compared to 6 (66.7%) with short stature. The difference in residence distribution was not statistically significant (P = 0.208).

Table 2: Age Distribution of Participants

Age Group (Year)	Short Stature (n)	Normal Height (n)	Percentage with Normal Height
2-4	0	38	18.9%
5-8	7	94	46.8%
9-12	1	67	33.3%
13-15	1	2	0.995%
Total	**9**	**201**	**100%**

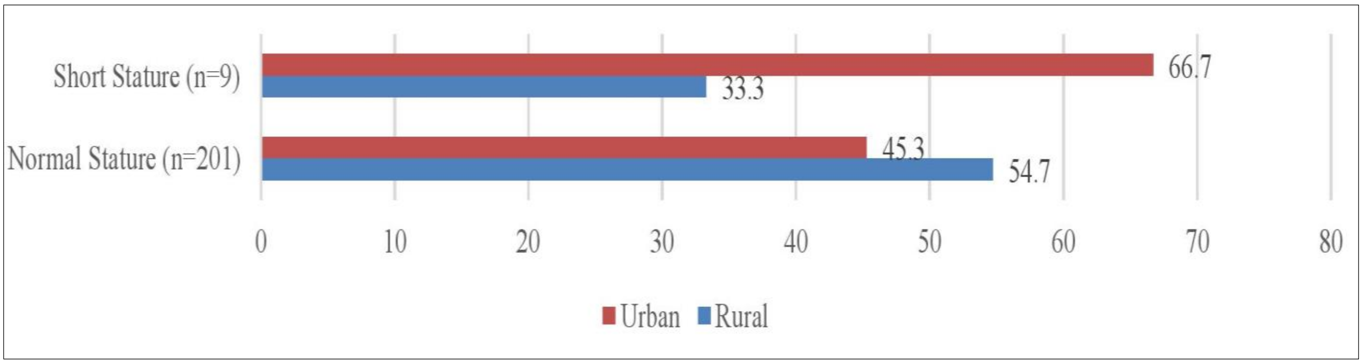

Fig 2: Distribution of Participants based on Residence

Among participants with normal stature, 110 (54.7%) were from rural areas, and 91 (45.3%) were urban residents. In contrast, 33.3% of those with short stature lived in rural settings, and 66.7% were from urban areas. The difference in residence distribution was not statistically significant (P = 0.208).

In terms of family type, 88 (43.7%) of participants with normal stature were from joint families and 113 (56.2%) were from nuclear families. Among those with short stature, 33.3% were from joint families, and 66.7% were from nuclear families. This difference was not statistically significant (P = 0.098).

Regarding socioeconomic status, a significant difference was observed (P-value = 0.004). Among the participants with short stature, 55.6% were from the lower class, and 33.3% were from the upper-lower class. In contrast, most participants with normal stature were from the upper middle class (45.8%), with no short-stature participants in this group. The difference in the number of siblings was statistically significant (P = 0.0126). Among participants with short stature, 55.6% had two siblings, while 26.4% of those with normal stature had three siblings.

Table 3: Distribution of Participants based on Type of Family

	Normal Stature (n=201)		Short Stature (n=9)	
	N	%	N	%
Type of Family				
Joint	88	43.7	3	33.3
Nuclear	113	56.2	6	66.7
	P = 0.098			

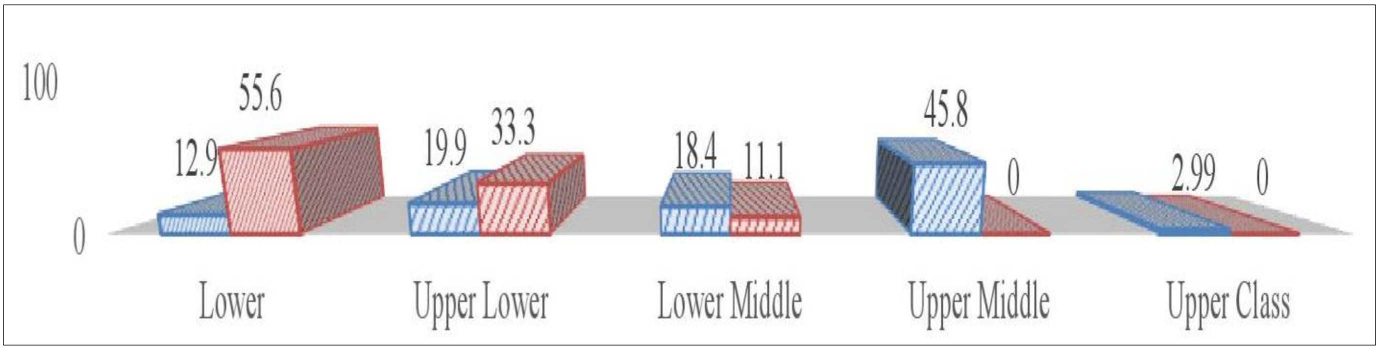

Fig 3: Distribution of Participants based on Socioeconomic Status

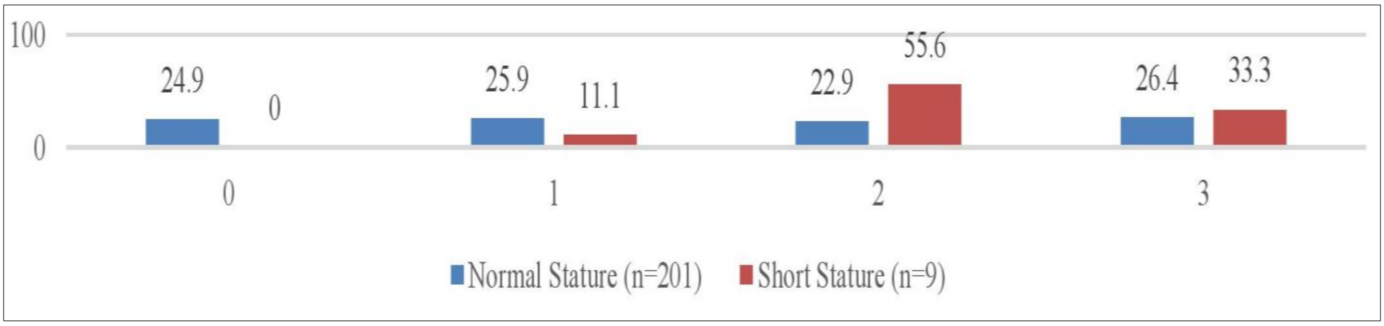

Fig 4: Distribution of Participants based on Siblings

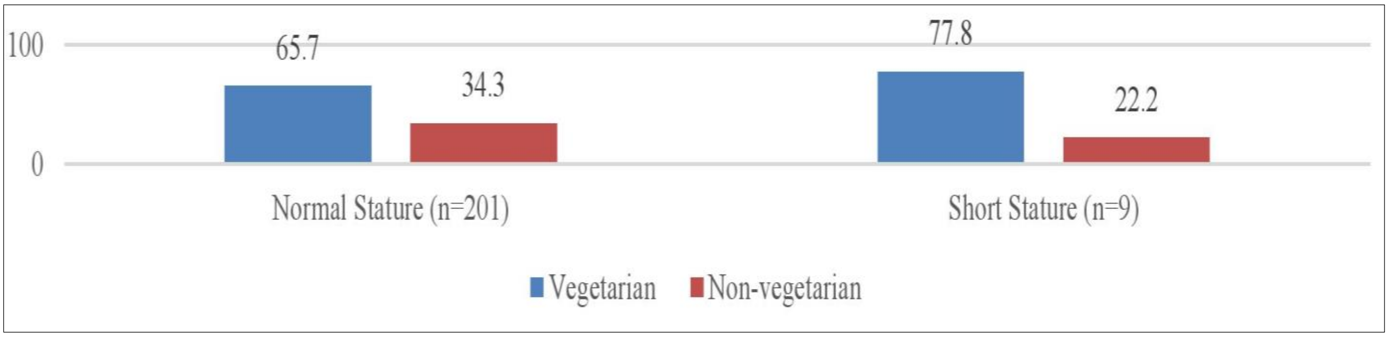

Fig 5: Distribution of Participants based on Type of Diet

A strong association was observed between short stature and chronic illness (P <0.0001). Seven (77.8%) of the children with short stature had chronic illnesses, while none of the normal stature group had chronic conditions. Chronic illnesses identified included hypothyroidism, insulin-dependent diabetes mellitus, KDS syndrome, thalassemia, tuberculosis, and kyphoscoliosis, each affecting 11.1% of short-stature participants.

Participants with normal stature had a significantly higher mean weight (22 kg, SD = 9.0) compared to the short stature group (17.6 kg, SD = 6.11; P < 0.0001). The mean upper segment to lower segment (US: LS) ratio was also significantly higher in the normal stature group (1.1, SD = 0.14) than in the short stature group (0.99, SD = 0.13; P < 0.0001). The mean BMI (Body Mass Index) did not differ significantly between the two groups (P = 0.982).

Table 4: Distribution of Participants based on Chronic Illness

Chronic Illness	Normal Stature (n=201)		Short Stature (n=9)	
Yes	0	0	7	77.8
No	201	100.0	2	22.2
P < 0.0001				
Type of Chronic Illness				
Hypothyroidism	0	0	1	11.1
IDDM	0	0	1	11.1
(Acquired Hypothyroidism)	0	0	1	11.1
Thalassemia	0	0	1	11.1
Tuberculosis	0	0	1	11.1
Kyphoscoliosis	0	0	1	11.1

Table 5: Distribution of Participants based on Anthropometric Parameters

	Normal Stature (n=201)		Short Stature (n=9)		P-value
	Mean	SD	Mean	SD	
Weight	22	9.0	17.6	6.11	< 0.0001
US: LS	1.1	0.14	0.99	0.13	< 0.0001
BMI	15.1	2.12	15.3	2.51	0.982

All participants with normal stature had a bone age equal to their chronological age. In contrast, 88.9% of the short-stature group had a bone age that was less than their chronological age, which was statistically significant (P < 0.0001).

Table 6: Distribution of Participants based on Radiological Age

	Normal Stature (n=201)		Short Stature (n=9)	
	N	%	N	%
Bone Age = Chronological Age	209	100.0	1	11.1
Bone age > Chronological Age	0	0	0	0.0
Bone Age < Chronological Age	0	0	8	88.9
	P < 0.0001			

Among participants, 132 (65.7%) with normal stature were vegetarians, while 7 (77.8%) of those with short stature were also vegetarians. In contrast, 69 (34.3%) with normal stature and 2 (22.2%) with short stature were non-vegetarians. The difference in dietary habits between the two groups was not statistically significant (P = 0.453).

Regarding maternal education, 32 (5.97%) participants with normal stature had illiterate mothers, compared to 5 (55.6%) among those with short stature. Of participants whose mothers had primary or secondary education, 46 (22.89%) had normal stature, while 3 (33.3%) had short stature. For those whose mothers completed high school, 53 (26.37%) had normal stature, and 1 (11.1%) had short stature. None of the short-stature participants had mothers with 12th-grade or college education, whereas 40 (29.85%) and 30 (14.93%) participants with normal stature fell into those categories. This difference in maternal education between the two groups was statistically significant (P = 0.028).

DISCUSSION

The findings of this study align with existing research on short stature prevalence and its associated factors, while also offering unique insights specific to the population studied. The prevalence of short stature in children aged 2–12 years was found to be 4.29%, which is lower than reported by Rajput R et al. and El-Shafie AM et al. [5-6]. This comparatively lower prevalence may reflect the impact of improved healthcare access and nutritional interventions in the study region, though it underscores the need for ongoing monitoring, particularly in rural and underserved areas.

Familial short stature and constitutional growth delay were the most common etiologies, accounting for 66.67% of cases. This aligns with findings from Fulun Li et al. (2021) and highlights the role of genetic and developmental factors in the prevalence of short stature [7]. Importantly, there were no significant gender differences, with females constituting 55.6% of affected children, which is consistent with existing literature.

The age group most affected by short stature was 5–8 years (77.8%), a pattern also noted by Saengkaew T et al. [8]. This suggests that this period may represent a critical window for growth monitoring and intervention. Low socioeconomic status emerged as a significant risk factor, with 55.6% of affected children belonging to this category. This finding corroborates studies by El-Shafie AM et al. (2020) and Rajput R et al. (2021), emphasizing the link between socioeconomic constraints, nutrition, and access to healthcare [5-6].

A notable observation was that 77.8% of children with short stature had a chronic illness. This reinforces the need for early diagnosis and management of chronic conditions, as highlighted by Saengkaew T et al. and Hussein A et al. [8-9]. Moreover, maternal education was strongly associated with short stature prevalence, with 55.6% of affected children having illiterate mothers. This finding aligns with Huang S et al. (2022) and underscores the importance of maternal awareness and education in promoting child health [10].

Delayed bone age was observed in 88.9% of affected children, suggesting underlying systemic or nutritional issues, consistent with Saengkaew T et al. and Hussein A et al. [8-9]. The clinical and public health implications of this finding highlight the need for early diagnostic tools and targeted interventions to address both growth delays and their root causes.

This study has some limitations like it was conducted at a single center and involved a relatively small sample size, which may limit the generalizability of its findings. Additionally, the cross-sectional nature of the study restricts the ability to establish causal relationships. Future research should consider larger, multi-center, and longitudinal studies to validate these findings and explore long-term outcomes of interventions.

Based on the findings, routine monitoring of growth parameters, especially in children from low socioeconomic backgrounds or with chronic illnesses, is crucial. Integrating maternal education into public health initiatives and addressing nutritional deficiencies may also help reduce the prevalence of short stature. Further research should focus on region-specific risk factors and the effectiveness of targeted interventions to improve growth outcomes in vulnerable populations.

CONCLUSION

Short stature was identified in 4.29% of participants, with no significant differences between genders. It was most prevalent in the 5-8 years age group, primarily among urban residents and those from lower socioeconomic backgrounds. A significant association was found between having two or more siblings and short stature, while family type showed no notable differences. Chronic illness was common among participants with short stature, who also had lower weight and upper segment to lower segment ratios, although their BMI was similar to those of normal stature. Most children with short stature exhibited a bone age less than their chronological age. While a higher proportion were vegetarians, this difference was not statistically significant. Additionally, maternal illiteracy was significantly linked to short stature, suggesting that maternal education may influence child growth outcomes.

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