Original Article

Short Stature for Age in Children of 5 to 16 Years: The First Research from the Northern Himalayan Region of India

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Abstract

Introduction: Anthropometric parameters play vital role in monitoring growth in pediatrics. Many etiological factors lead to short stature. So, before assessing the etiological factors short stature needs to be addressed. This study aimed to screen short stature for age in school-going children aged 5 to 16 years in Uttarakhand. **Material and Methods:** In this cross-sectional observational study, the height (through stadiometer) and weight (through weight machine) of 4189 students of government and private school in Rishikesh (Uttarakhand) aged 5–16 years were measured after the verbal assent of the students and individual's height is in the 3rd percentile for the mean height of a given age, sex, and population group and was considered short stature. The data collection was performed from October 2019 to July 2021. The data were categorized according to different age groups to 5–8 years, 9–12 years, and 13–16 years. The data were recorded in Microsoft (MS) Excel spreadsheet program. Statistical Package for the Social Sciences (SPSS) v23 (IBM Corp.) was used for data analysis. Descriptive statistics were elaborated in the form of means or standard deviations and medians or Interquartile range IQRs for continuous variables and frequencies and percentages for categorical variables. The Chi-square test was used for group comparisons for categorical data. **Results:** 7.1% of children were short stature (height 143.16 ± 15.09 cm) in the Himalayan belt, and males were more prone to short stature at age of 9–12 years. **Conclusion:** In the growing phase of children, the etiology of short stature has to be rectified, so the children can achieve such proper growth. Parents and physicians have to assess and monitor the growth of children timely. This study can be a stepping stone for further epidemiological studies.

Keywords: Growth monitoring, Himalaya, prevalence, short stature for age, students, Uttarakhand

Introduction

Anthropometric evaluation is a key component of pediatric medical visits, allowing for the early identification of growth abnormalities and detecting potentially treatable conditions or known genetic syndromes.[1] Weight and height (for children >2 years) and length (for children <2 years) are the critical aspects of this evaluation.[2]

Short stature is defined as a condition in which the height of an individual is 3rd percentile for the mean height of a given age, sex, and population group and is an indicator of chronic malnutrition or diseases—which, if unrecognized, could lead to blunting of cognitive development, and motor and psychological development are also impacted, with effects that last into adulthood, such as an increased risk for chronic noncommunicable diseases with greater susceptibility to infectious diseases.[3,4] In recent literature studies, the prevalence of SS in school-going children is 2–3%.[5,6]

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No similar studies and literature are available on the prevalence of short stature in school-going children in the Himalayan belt of India for this age group. In this study, we intend to determine the prevalence of short stature in school-going children of age 5–16 years in Rishikesh, situated in the Himalayan foothills.

Study Design

Uttarakhand is a state in the foothills of the Himalayas and has a population of 10,086,292, according to the 2011 Census of India.[7] This observational cross-sectional study was conducted

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on various government and private school-going children aged 5 to 16 years in Rishikesh, Uttarakhand. The data collection was performed from October 2019 to July 2021.

Sample size calculation

According to previous studies, the prevalence of short stature was 2.86% in school-going children aged 4 to 16 years in the South Indian District. The total number of target students from seven schools in this study was 6833, and with 95% of a confidence interval, the sample size was 3942; after convenient sampling, 4189 were enrolled according to exclusion criteria.

Inclusion criteria

After ethical approval from the All India Institute of Medical Sciences, Rishikesh, Uttarakhand, India, school-going children (government, aided, and private schools) of Rishikesh in the Dehradun District between 5 and 16 years of age were included in the study. A total of seven schools were included. Consent was taken from principal of schools, and the forms were sent to the parents through children for their consent. Verbal assent was taken from the participants.

Exclusion criteria

Children with congenital disabilities and other chronic illnesses and immunodeficiency were excluded. The exclusion criteria were verified clinically.

Data collection

The height of all children was measured by keeping their head in the Frankfurt plane with occiput, shoulder, buttocks, and heel touching the vertical board of a wall-mounted stadiometer. It was recorded to the nearest 0.1 cm.

Height was plotted on Indian Academy of Pediatrics (IAP) Khalidkar's[8] growth chart. Children with heights less than the 3rd centile were considered short stature.[9] Children with short stature were advised to follow-up in Out patient department (OPD) for detailed evaluation and management.

Statistical analysis

Comparisons of short stature between genders and across various age groups were made, and finally, the prevalence of short stature among these children was calculated.

The data were coded and recorded in MS Excel spreadsheet program. SPSS v23 (IBM Corp.) was used for data analysis. Descriptive statistics were elaborated in the form of means or standard deviations and medians or IQRs for continuous variables and frequencies and percentages for categorical variables [Table 1]. The Chi-square test was used for group comparisons for categorical data [Tables 2-4].

Results

Seven schools were included in the study, which had 4243 children participating. Data analysis was done for 4189 of them, and the rest was omitted according to the exclusion criteria. The comparison was made between genders and across three age groups: 5–8 years, 9–12 years, and 13–16 years. The mean age was found to be 11.67 ± 2.60 years, with 1960 (46.8%) males and 2229 (53.2%) females, and 14.9% of the participants lied in the age group of 5–8 years, 40.2% of the participants lied in the age group of 9–12 years, and 44.9% of the participants lied in the age group of 13–16 years [Table 1].

The mean height for the age group of 5–8 years was 119.67 cm, and the median was 121 centimeters. The same for 9–12 years was 137.63 and 138 centimeters, respectively. Children between 13 and 16 years had a mean height of 154.43 centimeters, and the median was 154 centimeters. The prevalence of short stature was 7.1% in the present study.

Table 1: Categorical presentation of sample according to age, sex, and prevalence of short stature

Variables	Mean±SD	Median (IQR)	Frequency (%)
Age (years)	11.67±2.60	12.00 (10.00-14.00)	
Age group			
5–8 years	624		(14.9%)
9–12 years	1684		(40.2%)
13–16 years	1881		(44.9%)
Gender			
Male	1960		(46.8%)
Female	2229		(53.2%)
Height (cm)	143.16±15.09	144.00 (132.00-154.00)	
Short stature (present)	296		(7.1%)

Table 2: Short stature in age group of 5–8 years (*n*=623)

Short stature	Gender			Chi-square test	
	Male	Female	Total	χ^2	*P*
Present	13 (4.5%)	10 (3.0%)	23 (3.7%)	1.051	0.305
Absent	274 (95.5%)	326 (97.0%)	600 (96.3%)		
Total	287 (100.0%)	336 (100.0%)	623 (100.0%)		

Table 3: Short stature in age group of 9–12 years (*n*=1684)

Short stature	Gender			Chi-square test	
	Male	Female	Total	χ^2	*P*
Present	80 (9.6%)	55 (6.5%)	135 (8.0%)	5.563	0.018
Absent	754 (90.4%)	795 (93.5%)	1549 (92.0%)		
Total	834 (100.0%)	850 (100.0%)	1684 (100.0%)		

Table 4: Short stature in age group of 13–16 years (*n*=1881)

Short stature	Gender			Chi-square test	
	Male	Female	Total	χ^2	*P*
Present	51 (6.1%)	87 (8.3%)	138 (7.3%)	3.477	0.062
Absent	787 (93.9%)	956 (91.7%)	1743 (92.7%)		
Total	838 (100.0%)	1043 (100.0%)	1881 (100.0%)		

Table 5: Short stature in different age groups ($n=4189$)

Short stature	Age group				Chi-square test	
	5–8 years	9–12 years	13–16 years	Total	χ^2	*P*
Present	23 (3.7%)	135 (8.0%)	138 (7.3%)	296 (7.1%)	13.325	0.001
Absent	600 (96.3%)	1549 (92.0%)	1743 (92.7%)	3892 (92.9%)		
Total	623 (100.0%)	1684 (100.0%)	1881 (100.0%)	4189 (100.0%)		

In male participants, short stature was larger in proportion compared with females in the 9–12 years of age group.

However, there was no significant difference in the distribution of short stature between the age groups of 5–8 years and 13–16 years. Participants in the group age group of 9–12 years had the most significant proportion of short stature as shown in [Table 5]. It was also noticed that 58% of all the children were below the 50th centile.

Discussion

Short stature can be a variant of average growth or secondary to pathological causes. It is essential to differentiate between the two as their management varies. Nonfamilial stunting is a predictor of long-term insufficient calorie intake or chronic malnutrition, leading to impaired cognitive development, motor delay, increase in the risk of chronic noncommunicable diseases, and secondary immunodeficiency.[10]

Prevalence studies estimate the problem and are essential for surveillance purposes.[11] Knowing how big the problem is important to plan for subsequent interventions. This study estimated the prevalence of short stature in school-going children aged 5–16 years in Rishikesh, Uttarakhand.

Our study found that the prevalence of short stature in school-going children was around 7.1%, which is higher than the prevalence in previous studies of India and other parts of the world. The overall majority of SS was 2.86% in a cross-sectional study of schoolchildren aged 4–16 years in the South Indian District.[5] In a study conducted in China, the SS rate was around 3.26% among 6- to 18-years age group.[12] According to Wang *et al*.,[6] the average SS detection rate in primary and middle school students in Anhui Province was 3.16 percent.

It was also noticed that 58% of them were below the 50th centile, showing that most were shorter than the national average as most of the students' families belong to hilly areas in our study. A study from the University of Cambridge stated that high altitude is a challenging environment with low oxygen levels and poor crop yield. Hence, the conversion of food into energy is not very efficient. Limited energy is available for growth, explaining the higher prevalence of short stature among people living in mountain areas.[13] The higher prevalence of iodine deficiency disorders among people living in the mountains is also one factor responsible for shorter height in this population.[14] However, various other factors such as socioeconomic status, level of education, nutritional status, and genetic potential determine an individual's height.[15]

Prevalence was studied for various age groups; within the age group of 5–8 years, short stature was reported at 3.7% (23/623), which was the least in all age groups; this might be due to the smaller sample size, besides that low height velocity with environmental and genetic factors,[16] and it was 7.3% (138/1881) in the age group of 13–16 years, while in children in the age group of 9–12 years, 8% (135/1684) of short stature was found, which was the most significant proportion [Table 3], and males have more short stature than females in this age group of 9–12 years because males attain late peak height velocity as compared to females.[17]

Further evaluation for short stature was done in the referral centers. Limited studies compared children's height and their growth potential on plains to those living in hilly areas, which can be a potential area of research in the future.

However, the school health services should be linked to the Ayushman Bharat program, and the health and wellness center initiatives can use Ayushman Bharat Program (ABP).[18]

Conclusion

The identification of short stature in the growing phase of children is crucial. The males were more prone to short stature in the age group of 9–12 years. Adequate health education should be imparted in parents, teachers, and school management regarding the growth and evaluation by healthcare workers. Primary physicians who practice in these regions will have to cater to children.

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Conflicts of interest

There are no conflicts of interest.

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