Original Article

Prevalence of Short Stature Among Children Aged 5-12 Years Old in Taif City, Saudi Arabia

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Abstract

Background: Short stature is one of the most common and frequent diagnosis in children investigated by pediatricians in everyday practice. The aim of this study was to analyse the prevalence of short stature in children between 5 to 12 years of age in Taif City, Saudi Arabia.

Methods: This is a cross-sectional study performed on children where height was measured for all participants and an average of three measurements was recorded. A questionnaire on various parameters influencing short stature such as height of parents, birth history, history of illness, family history of short stature and chronic illness were completed by the children's guardian.

Results: Out of 314 children, 188 children were male (59.87%) and 126 were female (40.13%). The overall prevalence rate of short stature was 33.68%. Regarding male participants, 29 were identified as short stature (15.43%) compared to 23 females that were identified as short stature (18.25%). One male and two females with short stature were born prematurely. The most common etiology for short stature was familial short stature with 40.8% followed by malnutrition which was 24.2%. Growth hormone deficiency was the most common endocrinological cause for short stature (9.7%) followed by hypothyroidism (7.6%). Chronic kidney disease was the most common non-endocrinological cause (3.4%). Meanwhile, other disorders were found such as celiac disease (0.5%) and Turner's Syndrome (0.3%).

Conclusion: Short stature was more common in females compared to males. The most common etiology for short stature was familial short stature followed by malnutrition. Growth hormone deficiency, hypothyroidism, chronic kidney and celiac disease were found among the participants. Additional research utilizing growth charts designed for local populations and larger studies with stratified age groups is necessary for accurate assessment of short stature in children.

Keywords: short stature, children, prevalence, etiology, saudi arabia

Introduction

Growth is a steady, continuous process and is the most significant indicator of health and development in children. It is strongly influenced by an interplay of genetic, environmental, hormonal and nutritional factors (1, 2). Growth statue of children is most evident during puberty which is associated with changes in physique, body composition, enhanced bone growth and bone mineralization (3). Normal patterns of growth corresponding to age and gender are indicators of the child's developmental well-being (4). Scientifically, height vertex can be defined as the height of an individual measured from the ground to the vertex, with the head held in the Frankfurt- Horizontal plane. It can be measured using tape, stadiometer, anthropometric rod and infantometer (5). Evaluation of patient's growth rate is done through the correlation between chronological age and bone maturity (6). This can prompt pediatricians to investigate for short stature with a complete history, thorough physical examination and relevant laboratory investigations (7). Furthermore, short stature can be defined as the standing height Z-score of less than -2 or more than 2 standard deviation below the mean height for a specific age and gender, or to be found below the third percentile in a particular racial-ethnic group (1, 2, 4). Short stature is one of the most common reason for referrals and visit to the pediatric endocrinologist (7-9).

Anthropometric measurements and growth charts can aid in identification of short stature in children (10). The Centers for Disease Control and Prevention (CDC) recommends monitoring the growth of infants and children up to 2 years of age using the World Health Organization (WHO) growth charts while measuring the growth of children of two years of age and older by the CDC charts. The measurement of linear growth in children less than two years of age is through recumbent length, whereas in children older than two years of age is by standing height (4, 11). Height velocity, which is the changes in length and height over time, is the most sensitive indicator to detect abnormalities in growth, during early stages of chronic illness. Height velocity should be 4 centimeters per year in healthy children of aged two years or older. However, during peak growth, height velocity spurts can reach up to 5-10 centimeters per year (4).

The prevalence of short stature in children varies markedly across the world (12). Globally, the highest prevalence of short stature is reported in Bangladesh with 73.6% rate in 1991. On the other hand, the lowest prevalence of short stature was in Australia with 0% prevalence for the year 1995. In Jordan, the overall prevalence of short stature in children was 4.9 % with the highest prevalence of children with short stature in their Southern region (7.0%) as compared to Northern (5.3%) and Central regions (3.4%) with a p-Value <0.001. However, there was no significant association of gender with the prevalence rate, as short stature occurred in 5.1% males and 4.9% females (12). Similarly, a higher incidence of short stature has been reported in the southwestern region of Saudi Arabia, however no statistically significant difference was reported in the prevalence of short stature among both genders (12).

The most common etiology of short stature can be attributed to Normal Variant Short Stature (NVSS), which are non-pathological variants of growth in children (13). NVSS includes Familial Short Stature (FSS) and Constitutional Delay of Growth and Maturation (CDGM) (1). Short stature is also caused by a variety of pathological causes such as endocrine disorders which include growth hormone deficiency, congenital hypothyroidism, insulin-like-growth factor failure 1 (IGF-1), congenital adrenal hyperplasia. Other causes include genetic disorders such as Turner's Syndrome, Down's Syndrome and Noonan syndrome. Moreover, some chronic diseases such as celiac disease and chronic renal insufficiency can contribute to short stature (2, 4). When no identifiable cause for short stature

can be found, it is considered as Idiopathic Short Stature (ISS) and is a diagnosed with exclusion (1, 8, 14). The aim of this study is to analyze the prevalence of short stature etiological distribution of short stature in the children of Taif city, Saudi Arabia.

Methodology

This is a cross-sectional study that was conducted on children between the age of 5 to 12. The eligibility criteria included children from the specified age group (5-12 years old), diverse backgrounds and permanent residents of Taif City, Saudi Arabia. The research first constructed an interview guide and questionnaires. An ethical consent from the patient's guardians was taken with consideration of data collection. The Data was used to obtain figures on the occurrence of short stature at Taif City in children and adolescents aged 5-12 years old. Parents completed the questionnaires based on the specific circumstances of their children and the content of the survey. The survey included questions on height of both parents, birth history, history of illness, family history of short stature and chronic illness, bone age, deficiency of essential minerals, stool and urine analysis.

For height measurement, the participants were made to stand without shoes, upright with their heel, hip, and head against the measuring column while looking ahead. The height was an average of three repeated measurements and an accuracy of 0.1cm was used. The participants of the study were considered to be of short stature if two or more of the following criteria were met: i) the height being lower than average height of a child that age by 2 standard deviations. (ii) The level of growth hormone being less than 10 µg/L (iii) if the bone age was more than 2 years behind the actual bone age according to imaging (iv) Less than 5.0 cm/year increase in height. (v) Average height of parent less than 155.0 cm (vi) Turner syndrome.

Results

A total of 314 children were enrolled in the study of which, 188 children were male (59.87%) and 126 were female (40.13%), after random sampling from Taif City, Saudi Arabia. The overall prevalence rate of short stature was 33.68%. The survey results showed that the average height of males was more than that of the female participants. Out of 188 males, 29 were identified with short stature (15.43%) whereas out of 129 females, 23 were identified with short stature (18.25%). Only one male with short stature was born prematurely, whereas among females with short stature, two were born

prematurely **(Table 1)**. The distribution of the etiology for short stature was largely due to familial short stature with 40.8% and 24.2% of short stature was due to malnutrition. From endocrinal causes growth hormone deficiency was the most common cause for short stature with 9.7% followed by hypothyroidism 7.6%. However, from non-endocrinal causes chronic kidney disease was the most common with 3.4% cases, 0.5% cases due to celiac disease, and 0.3% due to Turner's Syndrome.

Table 1: Demographic data of included patients (N= 314)		
	Male	**Female**
Total Patient screened	188 (59.87%)	126 (40.13%)
Identified Short stature	29 (15.43%)	23 (18.25%)
Mean Age ± SD of short stature	8.6 ± 1.6	7.2 ± 1.6

Discussion

Assessment of growth in children is a significant indicator of the health and well-being of a child in their growing years (1, 2). A comprehensive medical history including a prenatal history investigating if the mother experienced any obstetric difficulties, screening tests for genetic disorders, gestation of the child and birthweight, followed by neonatal history for investigating admissions to Neonatal Intensive Care Units is important. In the event of premature delivery, a developmental history whether the child is achieving their milestones according to their age should be co-related with examination findings. Anthropometric measurements and utilizing growth charts as references can help in achieving a diagnosis and underlying etiology of short stature in children.

In our study, short stature was more prevalent among males as compared to females. A cross-sectional study to evaluate the causes and incidence of short stature in children was conducted in the Department of Pediatric Endocrinology at a children's hospital in Pakistan. A total of 169 children from 2 to 15 years of age who were identified as short stature were included in the study. The authors reported that short stature was associated in 91 males (53.8%) and 78 females (46.8%) (1). Similarly, an observational study was conducted in the pediatric departments of two major hospitals in Pakistan with a total of 214 children identified 140 males (65.4%) and 74 (34.6%) females as short stature (15). Similarly, a cross-

sectional study was conducted in Saudi Arabia by Mouzan et al. on short stature on children and adolescents between the ages of 5 and 18 years using three growth chart references. The charts used in the study were the 2007 WHO growth chart, the 1978 National Centre for Health Statistics/ WHO reference (1978 NCHS/WHO) and the 2000 CDC reference. Based on the 2007 WHO reference for short stature, from 19,372 children, the prevalence of short stature was 11.3% among male children and 10.5% among female children. The prevalence of short stature among boys was significantly higher as compared to girls based on the 1978 NCHS/WHO (12.1% vs. 10.9%; P value =.011). However, no significant difference was observed in the prevalence of short stature between boys and girls using the 2000 CDC (11% vs. 11.3%; P=.518) and the 2007 WHO reference (11.3% vs. 10.5%; P=.086) (16).

Premature babies are born prior to completion of their term and can be defined as birth prior to completion of 37 weeks gestation. They are at an increased risk of short stature and it is one of the most common complications when born as small for gestational age (SGA) (17). Around 10% of children born as SGA remain less than -2 SD for height from childhood to adulthood (18). Another longitudinal multicenter study in Japan discussed follow-up height or catch-up growth in preterm children at 1, 3 and 5 years of age, along with risk factors for no catch-up at 5 years of age.

Based on etiological distribution conflicting results have been reported in various studies. A descriptive observational study was conducted at a tertiary care hospital in Egypt by Hossein et al. (10). A total of 637 children and adolescents were included in the study. Out of them, 354 boys and 238 girls with short stature based on -2 SD or a height velocity of < 4 cm/ year. Furthermore, around 63% of children were between the age of 6 to 12 years old. The various etiologies of short stature were classified into three major categories: non-pathological, endocrinological diseases and non-endocrinological diseases. The predominant etiology causing short stature in children were non-pathological with FSS reported in 68.2% and CDGM occurring in 25.7% children, which was in concordance with our findings. Short stature caused by children Small for gestational age (SGA) accounted for 3.3% cases whereas 2.8% cases of short stature were idiopathic in nature. Furthermore, similar to our results in endocrinological causes, growth hormone deficiency was the most common occurring in 41.6% children, followed by hypothyroidism in 34.9%. However, uncontrolled

diabetes was an additional reported etiology in 10.2% of children. The results regarding non-endocrinological pathologies were in contrast to our findings as celiac disease was the most common illness with 21.5% cases, while Renal Tubular Acidosis and Juvenile Rheumatoid Arthritis both accounted for 8.9% cases (10). A cross-sectional study conducted by Rabbani et al. reported discrepancies on etiological causes of short stature as compared to our findings. A total of 169 children identified with short stature were recruited in the study, of which 91 were males (53.8%) and 78 were females (46.2%). Out of 169 children, 48.5% of children were between the ages of 5 to 11 making it the most common age group. Colaco et al. reported similar findings in a study on short stature in Indian children, wherein endocrinological causes were the most common etiology (1). Moreover, an observational study by Sultan et al. reported, out of 214 children with identified short stature, non-endocrinological disorders as a group were the most common group with 46.7% cases of short stature, followed by NVSS accounting for 37.4% and endocrinological causes were the least common etiology with 15.9% cases of short stature (15). From the non-endocrinological etiologies, malnutrition accounted for 9.8% of cases whereas celiac disease accounted for 6.5% of cases with short stature.

The major limitation of this study is a low sample size as well as its descriptive nature. Further studies on children with short stature including stratified age groups should be conducted to produce comparable results. Furthermore, studies using international growth charts and references on regional populations do not represent true stature of children in the local population of interest and may show exaggerated or skewed results. Therefore, national growth charts and references representing stature and other health parameters of local populations should be designed and implemented for assessment in growing children.

Conclusion

Assessment of growth in children is essential to monitor health and wellness in children. Short stature is one of the most common conditions to visit the pediatrician. Short stature was more common in females as compared to males which is contradictory to various studies in literature. The most common etiology for short stature was familial short stature followed by malnutrition. Among endocrinological diseases, growth hormone deficiency was the most common cause for short stature followed by hypothyroidism, whereas from non-endocrinal causes, chronic kidney disease was the most

common followed by celiac disease, and the least common was Turner's Syndrome.

Disclosure

Statement

The authors declare no conflict of interest.

Funding

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Ethical consideration

A written consent of the patient's guardians was obtained for data collection. Institutional review board approval was granted by Taif Children's Hospital IRB HAP-02-T-067 approval No: 649. The study was conducted ethically according to the principles of the Declaration of Helsinki.

Data availability

Data that support the findings of this study are embedded within the manuscript.

Authors' contribution

All authors contributed equally to the drafting, writing, sourcing, article screening and final proofreading of the manuscript.

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