



Prevalence of Short Stature in Four-to-Six-Year-Old Children and Its Influencing Factors in the North East of Iran

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Abstract

Background: Growth pattern in children is one of the most important indicators of public health. This study aimed to determine the prevalence of short stature in children and its influencing factors in Shahrood, northeast of Iran.

Methods: In this cross-sectional study, 700 four-to-six year-old children were selected in 2015 through stratified random sampling. First, a list of preschools and kindergartens was prepared and samples were selected from 20 kindergartens and preschools. After coordination with parents and obtaining their respective consent, heights and weights of children were measured. Children with short stature were followed up with further diagnostic tests, including hormonal and biochemical tests, and their bone age was determined.

Results: In this study, there were 378 (54.2%) girls and 322 (45.8%) boys. The prevalence of short stature was 2.3%. In 74.9% of cases, short stature was due to pathological causes, and in 25.1% it was due to natural and familial factors. The results showed that anemia and insulin-like growth factor 1 (IGF1)-related disorders were the most frequent underlying causes of short stature in children. There were significant relationships between short stature at birth ($P=0.001$), positive history of mother's short stature ($P=0.004$), and children's physical activity ($P=0.029$), but no significant relationship was observed between short stature and gender, birth weight, children's living with parents and family's economic status ($P\geq 0.05$).

Conclusions: Birth height, mother's short stature and physical inactivity are risk factors identified in this study which can influence short stature of four-to-six-year-old children.

Keywords: Stunting; Short stature; Children; Child development; Measurement of height; Growth charts.

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Introduction

Short stature is a developmental condition, and genetic factors are associated with longitudinal growth.^{1,2} Growth is a complex process which is influenced by these genetic features, endocrine system function, nutritional status, level of physical activity and chronic diseases. Disruption in any of these conditions can cause growth failure and short stature.³ Regular use of growth charts and serial record of height from infancy are key to the detection of abnormal growth and to the start of

preventive and therapeutic measures.^{4,5} Short stature is defined as a condition where the child's height is below the third percentile on the growth curve, or two standard deviations below the average expected for his/her age and gender in the reference group.^{3,6} In most cases, stunting or short stature results from physiological factors such natural or familial causes, but it may also be caused by important curable diseases. Pathological causes of short stature include gastrointestinal or renal chronic diseases, endocrinopathy and rickets, bone dysplasia, chromosomal disorders, and psychological problems.⁷

Some studies have reported the number of stunted children under 5 years old to be 164 million children.⁸ It is anticipated that the prevalence of nutritional stunting in children in developing countries will reduce from 29.8% in 2000 to 16.3% in 2020.⁸ In this period, the decline of stunting prevalence trend in African countries will be slower and it is anticipated to reduce from 34.9% to 31.1%. In Asia and Latin America the declining trend in the population size of children and in the prevalence of stunting in the same period (till 2020) is expected.^{8,9} Although, among all the communities, with countries of South Asia being the most successful in reducing the prevalence of nutritional stunting, there are still a large number of children with short stature.^{10,11}

The review of Onis et al. of data from 241 national samples shows that the prevalence of stunting decreased from 47% to 33% over a 10 year span (1980–2000). Despite the overall decrease, stunting has increased in eastern and northern Africa.^{12,13}

Since growth changes can be considered a sensitive indicator of public health, scrutiny of the growth pattern of children is essential in any visit to the doctor or healthcare providers during childhood.^{14,15} Since the immediate screening and identification of underlying causes of short stature, before the closure of the growth plate is effective in preventing permanent consequences of nutritional stature, this study aimed to determine the prevalence and identify the causes of stunting in four-to-six-year-old children in Shahrood.

Materials and Methods

In this cross-sectional study conducted in 2015, 700 children aged four to six years were selected through stratified

random sampling. First, a list of preschools and kindergartens was prepared and 700 samples were selected from 20 kindergartens and preschools. The authorities in the kindergartens and preschools were informed of the purpose of the study and, after coordination with them, parents were contacted and oral consent was obtained from all parents. In cases where further follow up was required, written consent was also obtained.

A questionnaire containing information about the birth height and weight, family history of stunting or positive history of short stature in parents, family economic status, family problems and separation of parents was completed by parents for the participants. Weight of children was measured with children wearing light clothing and no shoes using a Seca Scale made in Germany, with precision of 100 g. Children’s standing height was also measured with a Seca stadiometer, without shoes and while the legs were placed together and hips and shoulders and back of the head were in contact with the rear wall of the scale, with an accuracy of 5.0 cm. Then, the growth curve of children was drawn and compared with the National Center for Health Statistics (NCHS)/ World Health Organization (WHO) NCHS/WHO cutoffs, and children who were stunted were re-examined and they were referred to the Khatam-ol-Anbia Hospital where, in addition to rigorous examination of the children, x-ray of the left wrist for estimation of bone age, thyroid stimulating hormone (TSH), insulin-like growth factor 1 (IGF1), Creatinine (Cr), blood urea nitrogen (BUN), liver function test (LFT), fasting blood sugar (FBS), cell blood count (CBC), zinc, and retic were taken.

The collected data were entered into SPSS16 and were analyzed through chi-square and t-test. The significance level in all tests was 0.05.

Results

In this study, 700 children aged four to six years were selected, of who 321 (45.9%) were boys and 379 (54.1%) were girls. Parents of 12 (1.6%) children were dead. Parents of 148 (21.5%) children had a family relationship. The children’s average height was 115.73 cm. The results showed that 16 (2%) children had short stature, five (31.25%) of them being boys and 11 (68.75%) being girls (tables 1 and 2).

Table 1. The mean of children’s height, father’s and mother’s height

Variables	Mean±SD
Height	115.7±5.8
Height of birth	49.6±2.9
Father’s height	176.1±7.2
Mother’s height	163.9±8.8

Results showed no significant differences between boys and girls (P=0.313), birth weight, children’s life with parents, and economic status (P>0.05). But the relationship between short stature (−2SD) and birth height was significant, so that many children with short stature had a history of short stature at birth. There was also a significant relationship between children’s short stature and maternal height and children’s physical activity (table 3).

Table 2. Descriptive characteristics of population

Variables	N	Percent
sex		
- Boy	321	45.9
- Girl	379	54.1
Life status		
- Living with parents	664	94.9
- Living with one parent	24	3.5
- Dead parents	12	1.6
Parent’s family relationship		
- Yes	148	21.5
- No	535	76.4
Breastfeeding		
- Yes	684	97.8
- No	29	3.2
Physical activity		
- Yes	207	29.5
- No	393	56.6
Time to fall asleep		
- ≤ 30 minute	527	75.2
- 30–60 minute	62	37.4
- ≥1hour	11	1.4
Diabetes history in the family		
- Yes	140	20.0
- No	560	80.0
History of mother’s pregnancy diabetes		
- Yes	61	7.6
- No	639	92.4

Table 3. Evaluation of the relationship between short stature and demographic, social and economic variables

Variables	4–6 years old children’s height (frequency/percent)		P.V
	−2 SD	Normal	
Sex			
- Boy	5(1.4)	317(98.4)	0.31
- Girl	11(2.5)	367(97.1)	
Birth Weight			
- Normal	15(2.3)	742(97.7)	0.59
- LBW	1(2.9)	34(97.1)	
Height at Birth			
- Normal	10(1.5)	666(98.5)	0.00
- Short stature	6(25.0)	18(75.0)	
Life status			
- Living with parents	15(2.0)	649(97.7)	0.73
- Living with one parent	1(4.2)	23(95.4)	
Economic condition			
- Dead parents	0(0.0)	12(100.0)	0.99
- Poor	4(2.3)	170(97.7)	
- Moderate	8(2.3)	345(97.7)	
- Good	4(2.3)	169(97.7)	
Fathers height			
- Normal	16(2.0)	683(97.7)	0.99
- Short stature	0(0.0)	1(100.0)	
Physical activity			
- Yes	2(0.7)	270(99.3)	0.03
- No	14(3.3)	414(96.7)	
Mother’s height			
- Normal	14(2.0)	681(98.0)	0.00
- Short stature	2(40.0)	3(60.0)	

LBW: low birth weight

The mean chronological age was 69.2±6.8 in boys and 67.0±8.0 in girls. Bone age was 60.8±8.6 months in boys and 61.4±6.3 months in girls. In examining the various causes of short stature in children, results of clinical investigations showed that 74.9% of short stature was due to pathological causes and 25.1% was due to natural and familial causes. The results in table 4 show that anemia and IGF1-level disorders were the most frequent underlying causes of short stature in children.

Table 4. Assessment of background causes in children with short stature

Variables	Frequency
Thyroid disorder	1
IGF1 disorder	4
FBS disorder	1
Anemia	5
A history of prematurity	1
other disorders (liver, kidney, zinc, urine, blood pressure)	0
No disorder	4
Total	16

Discussion

The results of this study showed that short stature was more prevalent among girls, which is consistent with the findings of Fesharakinia et al.,¹⁶ Tahery et al.¹⁷ and Sheikholeslam et al.⁹ In their study, Bony-Westphal reported that short stature in girls was 0.8%–3.2% less than in other participants in the study,¹⁸ which is not consistent with recent results. Lack of relationship between short stature and gender in this study is consistent with results of Rachmi et al.¹⁹ Perhaps one of the reasons for higher prevalence of stunting in girls is that families pay more attention to boys, which is rooted in myths and cultural problems of society.

No significant relationship was observed between short stature and economic situation of the family. Rachmi et al. in their study showed a significant relationship between short stature and economic situation, which is not consistent with the present results.¹⁹

There existed no significant relationship between short stature and breastfeeding either. The study by Rachmi et al. also reported a significant relationship between short stature and breastfeeding, which does not accord with the results of this study.¹⁹ Moreover, Rachmi et al., reported a significant relationship between short stature and living with parents, while the present study results do not verify this relationship.

The present results also show no significant relationship between birth weight and short stature. However, Rachmi et al. in their study did find such a relationship.¹⁹

The prevalence of stunting in the sample was 2%. In a study by Sheikholeslam et al., this figure stood at 4.7%, and in the study by Fesharakinia et al., it was 43.6%. Motlagh et al. report this figure to be 6.5%, and in the study by Vaghari et al., 34.93% of boys and 31.49% of girls had short stature. Sharif-Zadeh et al. also reported that 3.9% of the participants in their study were stunted.^{9,16,20-22} In the study by Rachmi et al., the prevalence of stunting was 36.7% in 2007, which is not consistent with recent results.¹⁹

Various causes of stunting in 25.1% of the cases were due to natural and familial factors. Familial short stature is a natural form of short stature in which bone age is consistent with chronological age. People with this kind of short stature usually have short parents.¹⁹ Our study showed that a significant relationship exists between the height of mothers and children's height. This is consistent with the results of Hosseinian et al.²³ Rachmi et al. also referred to this relationship which is consistent with recent results.¹⁹ The relationship between birth height and short stature was confirmed in this study, which is consistent with the results of Hosseinian et al.²³

In examining the causes of stunting in children, impaired IGF1 levels and thyroid disorders were the most common pathological causes of short stature, which are consistent with the results of some studies.²⁴⁻²⁶ In cases where stunting is not due to metabolic and endocrine disorders and other medical diagnoses, it is because of genetic or heterozygous defects, and this is called idiopathic short stature. These people have overall natural height growth rate, especially in the lower extremities, and there are no biochemical findings or growth hormone disorders.²⁷ Growth failure in children can be accompanied by acute and chronic diseases caused by increased energy consumption or nutritional deprivation. Moreover, therapies used in the treatment of some diseases, such as hyperactivity, attention deficit disorder (ADD), or chemotherapy and radiotherapy can cause developmental disorders.²⁸⁻³⁰

Birth weight, mother's short stature and lack of physical activity were among the risk factors identified in this study which can influence stature in six-to-four-year-old children.

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Conflict of Interest

The authors declared that they have no conflict of interest.

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