Short Stature and Low Weight in Schoolchildren

Okul Çocuklarında Boy Kısalığı ve Düşük Ağırlık

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Özet

Amaç: Mardin ilinde, iki ilköğretim okulunda 6-16 yaş çocuklarda, 2010 ve 2011 yıllarındaki boy kısalığı ve düşük ağırlık sıklığı araştırılmıştır. Gereç ve Yöntem: İki ilköğretim okulundaki çocukların, boy uzunlukları ve vücut ağırlıkları ölçüldü. Vücut kitle indeksi (BMI), vücut ağırlığı (kg)/ boy (m2) formülü ile hesaplandı. Boy kısalığı ve düşük ağırlık, istatistiksel olarak araştırıldı. Bulgular: 834 erkek (%51), 804 kız (%49) çalışmaya alındı. Öğrencilerin boy ortalaması 143.21±13.58, ağırlık ortalaması 38.38±13.06, BMI ortalaması 17.86±3.56, yaş ortalaması 11.07±2.00'dir. Erkeklerin boy ortalaması 142.58±13.92, kilo ortalaması 37.87±12.83, kızların boy ortalaması 143.86±13.19, kilo ortalaması 38.90± 13.29'dur. Cinsiyetler arasında, boy ve kilo farklılığı anlamlı iken ($P < .05$), BMI'leri arasında fark yoktur ($P > .05$). Kısa boylu çocuklar arasında ≥85p. çocuk bulunması istatistiksel olarak anlamlıdır ($P < .00$). Düşük kilolu çocukların, hiç birinin uzun boylu olmaması anlamlıdır ($P < .00$). Büyüme hızları arasında cinsiyet farkı yoktur ($P > .05$). Okulların, BMI'leri ($P < .00$), boy uzunlukları ($P < .05$) ve kiloları ($P < .00$) istatistiksel olarak farklıdır. Tartışma: Çocukların büyüme gelişme durumlarının değerlendirilmesinde antropometrinin çok kullanışlı bir araç olduğu yaygın olarak kabul edilmektedir. Okul sağlığı çalışmaları içerisinde çocuk ve aile eğitimi birlikte ele alınmalı ve mutlaka öğretmen işbirliği sağlanmalıdır. Öğretmenlere büyüme referanslarının alt ve üst persentilleri verilerek yapılan ölçümlerdeki düşük ya da yüksek değerlerin hekim kontrolüne gönderilmesi önerilmelidir.

Anahtar Kelimeler

Çocuk; Boy Kısalığı; Düşük Ağırlık; Antropemetrik Ölçüm

Abstract

Aim: Evaluated the frequency of short stature and low weight between two primary school children aged 6-16 years of children in Mardin province in 2010 and 2011. Material and Method: Two elementary school children', heights and body weights were measured. Body mass index (BMI) was calculated with the formula; body weight (kg)/ body height (m2). Short stature and low weight were statistically analyzed. Results: There were 834 (51%) boys and 804 (49%) girls. The mean body height, weight, BMI and age was 143.21±13.58. 38.38±13.06, 17.86±3.56 and 11.07±2.00, respectively. Boys mean body height. weight were 142.58±13.92, 37.87±12.83, respectively. Girls mean body height, weight were 143.86±13.19, 38.90± 13.29, respectively. Height and weight difference was so significantly between gender ($P < .05$), there was no difference between BMI ($P > .05$). ≥85p. presence of children was statistically significant among the children with short stature ($P < .00$) There was no one of the children tall in short stature children' ($P < .00$). There were no difference between growth speed ($P > .05$). Between schools' in the children BMI ($P < .00$), height ($P < .05$) and weight ($P < .00$) were statistically different with each other. Discussion: Evaluate of growth and development status for children anthropometry is widely known as a very useful instrument. In school health working children' and family education should be handled together and teachers cooperation should be provide. Growth references lower and upper percentiles. should given to the teachers low or high measurement values should be advise to send the physician control.

Keywords

Child; Short Stature; Low Weight; Anthropometric Measurement

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Introduction

Longitudinal development in children is one of the most essential indicators of healthy growth. Thus keeping track of longitudinal growth and determining the deviations from normal in growth assessment carry a lot of weight with catching possible pathological causes early.[1,2] Naturally, the effects of genetic, prenatal, postnatal and environmental factors on growth differ in each country. Because of that, distribution of etiological factors of short stature varies from country to country.[3] Growth assessment is the only indicator which portrays children's health and nutrition status, because factors affecting health and nutrition negatively will no doubt affect the growth of the child. Health and nutrition problems in children, insufficient nutritional intake and/or serious and frequent infections are consequences of a wide range of factors. Height for age shows linear growth and long term growth failures and weight for height shows body proportions, growth pattern and acute growth failures. Growth failure in children is a multifactorial problem. Insufficient nutrient intake, especially not meeting energy and protein requirements and the presence of a disease are underlying causes.[4] Child's lack of knowledge about how much and what kind of nutrients he/she requires, irregular meal pattern, wrong choice of nutrients, lack of inspection about nutrition in schools and schools' neighborhood, family's lack of knowledge about food consumption are public health issues affecting all age groups throughout life. This research was aiming to observe growth and development of children' identify with easy, quick and inexpensive method. That can be applied with anthropometric measurement, to determined the short stature and low weight.

Material and Method

Our research is a cross-sectional and a retrospective work. In two randomly elected schools in Mardin city center, after getting required permissions and informed consents of all the students in these schools (n=3371), heights and weights of these students are measured in the period of April 2011 – May 2011. Their weights are measured with electronic scales sensitive to 10 grams with their summer school uniform and their heights are measured with tape measures with 1 mm intervals, their shoes removed, feet and heels together, buttocks and shoulders against the wall. Body mass index (BMI) is calculated with body mass (kg) / height (m2) formula. Measurements are evaluated about height for age and weight for age with the help of percentile curves which have reference values of weight, height, head circumference and body mass index of Turkish children in 2008.[5] Acquired values are assessed according to age groups and gender and divided into 8 groups by their percentile scores (below 3p, 3-10p, 10-25p, 50-75p, 90-97p and above 97p). Children whose heights are below 3rd percentile, according to growth curves determined by age and gender, are considered to have short stature. Children whose heights are above 97th percentile are tall and whose weights are below 3rd percentile are underweight. BMI for age results are acknowledged as children below 5th percentile are underweight, between 5th and 84th percentiles are normal, between 85th and 94th percentiles are overweight and above 95th are obese. To evaluate growth and development, randomly elected 1638 students' height and weight data are used, which are measured by their teachers in 2010. The sample size formula is based on the known number of individuals in the population, and according to literature the estimated prevalence of obesity is 20%. A 2% error rate was allowed and the degree of confidence was calculated as 95 %. Ethical approval was given from Mardin Artuklu University and Mardin Educational and Health Directorate Office. Defining statistics are done with average ± standard deviation value for constant variables and by giving frequency and percentage for numerable variables. To see if there is a difference about frequency between the groups, the chi-squared test is used. For statistical analyses SPSS 16.0 program is used and $P < .05$ value is considered statistically significant.

Results

834 males (51%) and 804 females (49%) are taken into the study. Students' height average is 143,21 ±13,58, weight ave-

Table 1. Percentile values of BMI, height and weight according to gender in 2011.

	BMI percentile (2011)								*P*
	<5P	≥5p- <15p	≥15p-<25p	≥25p-<50p	≥50p- <75p	≥75p- <85p	≥85p- <95p	≥95p	> .05*
Boys	57	113	95	221	175	74	48	15	
Girls	74	100	93	198	147	74	64	18	
Percentage	8.0	13.0	11.5	25.6	19.7	6.4	9.0	6.8	
Mean	14.00	15.04	15.86	16.67	18.54	20.20	22.00	25.94	
Height percentile (2011)									
	<3p	≥3p- <10p	≥10p- <25p	≥25p-<50p	≥50p- <75p	≥75p- <90p	≥90p- <97p	≥97p	< .05*
Boys	44	115	137	232	155	91	45	15	
Girls	61	88	130	209	172	102	24	18	
Percentage	6.4	12.4	16.3	26.9	20.0	11.8	4.2	2.0	
Mean	131.25	135.94	138.28	143.31	148.17	149.59	154.33	154.75	
Weight percentile (2011)									
Boys	41	95	190	193	147	95	49	24	< .00**
Girls	67	92	129	196	142	87	45	46	
Percentage	6.6	11.4	19.5	23.7	17.6	11.1	5.7	4.3	
Mean	27.58	30.47	32.85	35.51	40.80	47.08	52.91	65.12	

*$P < .05$ **$P < .01$

Table 2. Percentile values of BMI, height and weight according to gender in 2010.

	BMI percentile past year (2010)								*P*
	<5P	≥5p- <15p	≥15p-<25p	≥25p-<50p	≥50p- <75p	≥75p- <85p	≥85p- <95p	≥95p	< .05*
Boys	56	81	89	215	214	70	64	45	
Girls	82	92	86	195	177	45	70	53	
Percentage	8.4	10.6	10.7	25.0	23.9	7.0	8.2	6.0	
Mean	13.19	14.56	15.45	16.37	17.65	19.15	20.73	25.30	
Height percentile past year (2010)									
	<3p	≥3p- <10p	≥10p- <25p	≥25p-<50p	≥50p- <75p	≥75p- <90p	≥90p- <97p	≥97p	< .00**
Boys	50	72	151	213	171	87	50	40	
Girls	13	23	63	126	173	177	117	112	
Percentage	3.8	5.8	13.1	20.7	21.0	16.1	10.2	9.3	
Mean	125.71	131.15	131.47	137.16	138.89	140.14	142.65	144.12	
Weight percentile year (2010)									
Boys	41	52	156	215	198	101	47	24	< .00**
Girls	57	92	121	211	163	80	45	35	
Percentage	6.0	8.8	16.9	26.0	22.0	11.1	5.6	3.6	
Mean	24.40	29.85	30.16	32.97	36.21	37.02	43.48	45.45	

rage is 38,38±13,06, BMI average is 17,86±3,56, age average is 11,07 ±2,00, male height average is 142,58±13,92, male weight average is 37,87±12,83, female height average is 143,86±13,19, female weight average is 38,90± 13,29. In the year of 2010, age average was 10,07 ±2,00, height average was 137,74±13,39, previous year's weight average was 33,91±9,75 and previous year's BMI average was 17,26±7,31. Height, weight and BMI for age values of female and male students in 2010 and 2011 can be seen in table 1 and 2. There were height and weight differences in favor of female students (P < .05), but there weren't any differences between their BMI's (P > .05). Between the ages of 11 and 13, female students' weights and BMI's are significantly different (P < .01).

In children with short stature there were more (6,7%) with BMI values above 85p (n=7) than children without short stature and this is statistically significant (P < .00). It is also remarkable that none of the lower weight children had tall stature (P < .00). 55 students with their heights below 3p have yearly growth rates below 4 cm and they consist mostly of male students (P < .05). Longitudinal growth rates don't differ by gender (P > .05). It is statistically significant that children who have height growths below 4 cm are under the age of 11 (P = .00). Between the ages of 11 and 13, 6 to 10 cm height growth carries statistical significance (P < .05). Among the schools, there are differences between their BMI's (P < .00), their heights (P < .05) and their weights (P < .00).

Discussion

Turkey, from the standpoint of nutrition, has the problems of both developing and developed countries. In our country short stature and low weight are frequently seen causes of growth failure. Most important cause of short stature is malnutrition caused by socioeconomic factors.[6] In the report of 2008 Turkey Demographic and Health Survey it is stated that short stature for age frequency in children is throughout Turkey 10%, in cities 7%, in country 17%. When it's regionally analyzed, short stature frequency is in the west, north and south 7%, in the central regions 4%, in the east 21%.[7]

In a study with 392 students in Ankara between the ages of 7 and 15, 12.8% of the students are found to have short stature. No significant differences in terms of short stature were found in gender distribution.[8] The frequencies of children with heights below 3p are found in Diyarbakir 9.9%, in Iğdır 16.2%, in Göcek 3.3%, in Şile %11.6 and in Yozgat 6.9%. In Manisa 7.46% of the children and in Kırıkkale 1.8% of the children were below 2SD. In Mersin 10.4% of children in kindergartens and 5.7% of children in orphanages were found to have short stature.[9,10,6,11-13] In studies made in developing countries, short stature frequency is found in Malaysia 40.4%, in Nigeria 40.5%, in Kenya 16.6%.[8] In Brazil it is 40.4% and in USA it's 2.4%.[8,14] Short stature frequency in studies made in several cities of Turkey is compatible with 6.4% of children being below 3p in our study and their rate of previous years' 6.0%. Results seem better than undeveloped countries but in this sense worse than developed countries. Naturally, the effects of genetic, prenatal, postnatal and environmental factors on growth differ in each society. In short stature genetic factors also have an effect. Consequently, distribution of etiological factors causing short stature differs from country to country and even region to region in the same country.[3] In fact, as it can be seen in our study, it even differs from school to school. 80% of children with short stature are variants of normal and the rest constitutes from pathological causes. Constitutional growth delay is the most common cause of short stature and pubertal delay in boys[15] and thus in our study children with height growth below 4 cm being under the age of 11 tells us that these children will have a height close to normal after the pubertal growth spurt. In Ankara rate of normal variant short stature is found 71.1%.[3] However we think that additional problems and endocrine causes that effects height growth negatively like iron deficiency anemia, zinc deficiency and osteoporosis[3] should be investigated in children in our study.

In Önsüz's study in Ümraniye[8] 1.6% of the students are found underweight and 7.3% of them are overweight and according to their weight status there was significant difference between both genders. In studies made in Aydın and Urfa no significant difference between genders is found.[8] In a study in Sivas 5.9%

of the students are found underweight and 2.2% of them overweight. In the study in Ankara 3.1% of the students are found underweight and 5.1% overweight. Also in another study in Istanbul 5% of the students are found underweight and 2% of them overweight.[8] 2.8% of children in Denizli are found underweight and 5.8% overweight,[16] 13.2% of children in the kindergarten in Mersin and 3.8% of children in the orphanage in Mersin are found underweight and in the study Güler et al.[13] made in Mersin with children between the ages of 7 and 15, 5.9% of the children are found underweight. Thereby, our study's 6.6% rate of underweight students shows that it is higher than the rates of the studies in the west. Although low weight indicates to a socioeconomic problem, high rate of underweight children in the kindergarten makes us think that healthy and elaborate care of children is the essential parameter in child growth.

In Sivas 5.9% of 234 students between the ages of 6 and 14 are short and 0.9% of them are tall, in Istanbul 4% of 301 primary school students are short and 2% of them tall,[8] in Denizli 7.4% of the students are short and 2.6% are tall.[16] In our study, high short stature rate in 2010 and decrease of the rate of tall statured children suggest that at the previous years' measurements done by the teachers, students had their shoes on. The result of our work, 2.0% of tall stature rate, is compatible with nationwide studies. Differences in terms of height, weight and BMI even between two schools remind us that in studies like this, variables don't depend only on socioeconomic status and also personal, familial and nutritional factors should be reviewed. As much as nutrition looks like it is associated with economic status; storing and presenting and choice of foods and consumption of seasonal fruits associated with educational level. Defect in energy balance caused by early malnutrition can lead to increase in central adiposity in short statured children. In addition to low lipid oxidation in short statured children, depending on insufficient food uptake, proportion of cortisol to insulin increases and insulin resistance occurs. Also, because of the decrease of insulin like growth factor, muscle hypertrophy and linear growth decreases and lipolysis and lipid oxidation break down.[6] In the study in Yozgat, obesity prevalence in short statured children is 7.5%, in our study it is 6.9%.

In our study it has been seen that children's height, weight and BMI values increases in years. This supports the same results of comparative studies made in several countries.[17] It confirms the idea that over the years changing life conditions, socioeconomic development and increasing education level contribute to anthropological measurements and lifespan. In our study, girls' height and BMI increase concentrates on the ages of 10 and 13 and at the ages of 14 and 15 a slowdown in the rate of increase is seen. In prepubertal period a second increase in the rate of overweightness in both boys and girls. During the beginning of menstruation an increase in weight is seen in a significant proportion of girls. As for boys, with the progression of puberty a decrease in adipose tissue draws attention.[18] This information supports our study. After an active and playful childhood, at the puberty in which the body changes and growth continues, several social and local pressures push girls to immobility and confine them to closed doors and to an inactive life. So naturally, changing of the puberty, in which the growth spurt continues, return to girls as more weight.

13.2% of children in the kindergarten in Mersin and 0.9% in the orphanage are found to have BMI values below 2SD.[13] Again Arı and Süzek found 6.5% of children underweight, Sur et al. found 12% of children below 5p, Manios et al. found 15.3% of children below 5p (4). In Mardin 2.9% of children are found below 3p in terms of BMI.[18] In Brazil 9.5% of children are found below 5p.[19] Although in our study the rate of the group with a BMI below 5p remains almost stable over the years, increase in the rates of overweight and obese groups supports the opinion that 'in developed countries obesity correlates with worse economic status but in developing countries, obesity is more frequent in wealthy families'.[18] Regression of socioeconomic level increases the incidence of short stature and malnutrition and improvement of socioeconomic level increases the incidence of obesity. We can also think that non-homogeneity of economic indicators in our country causes this circumstance. Our study, in which 8% of children have BMI's below 5p and 15.8% of them have BMI's above 85p and in which overweightness and obesity increases in comparison to last year's results, can be taken as an evidence of how malnutrition can damage public health. More and more we will be facing not only short stature and low weight as indicators of malnutrition, but also excessive calorie and food intake as a public health issue.

Conclusion

Both being related to feeding problems, short stature and low weight still are serious health

care problems in our country. Evaluate of nutritional status for children, anthropometry is widely known as a very useful instrument. In school health working, children' and family education should be handled together and teachers cooperation should be provide. This may be an important step to follow the growth and development of children 6-12 years of age in our country. Schoolchildren' anthropometric measurements importance and necessity should also be considered in the schools. Because, teachers observe children closely and their observation and measurements, about children' growth and development will help to determine problem.

Competing interests

The authors declare that they have no competing interests.

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