Analysis of Anthropometry Index of Rural Primary School Children in PIRANSHAHR City using Body Mass Index during Educational Year 2011-2012

Mohammad Soleimani[1*], Ali Reyhani[2*]

1. Ph.D. Student, Urmia University of medical Sciences, Jahad Ave, Urmia, Iran.
Postcode: 57147-83737,P.O.Box: 1138
[2.] General practitioner, health care administrator, Piranshahr, Iran
Health_194@yahoo.com

Abstract: Background and Objective: Taking into account that natural growth is the most important sign of children's health, and the fact that, the simplest and most reliable way to assess natural growth is measurement of height and weight and calculation of body mass index or analysis of anthropometry parameters, thus due to significance of this subject, the current study was designed and conducted with the intention of determining the body mass indices of rural primary school children of PIRANSHAHR City during educational year 2011-2012.
Materials and Methods: In the current study, 1797 rural primary school students were selected out of total 7132 students using two-stage randomized method. Height and weight were measured and recorded using standard meter and scale according to the related directions. Slimness status, overweight and obesity were assessed based on body mass index for age and gender compared to standard percentiles of Center for Diseases Control (CDC 2000). Available percentiles were used to assess short height for gender and age and percentiles below 3 was considered as short height with chronic malnutrition. Also, SPSS19 software and k-2 and t-test were used for data analysis.
Findings: According to research findings, 11.55% of the children under study suffer from underweight and 2.2 of them are prone to overweight and obesity risks. Based on height versus weight standard diagram, 7.75% of children had percentile below 3 i.e. were short and 2.35% of children had percentile above 97 i.e. were tall. Short height was more frequent in girls compared to boys with significant difference (respectively, 8.5% and 7%; p=0.001).
Discussion and Conclusions: Research results are suggestive of the fact that malnutrition in the form of slimness, overweight and short height is existent as a significant health problem in rural primary school students of PIRANSHAHR City.

Introduction:

Today, increase of body mass index is considered among the health problems of Iran and other countries of the world. Considering changes in lifestyle and rapid transformations in the nutrition diet patterns, exceeded prevalence of obesity is not far from expectation. Furthermore, parallel to increase of obesity, prevalence of slimness and weight loss has been remarkably high among the Iranian children. Although these figures have decreased to some extent but the aforementioned problems are still regarded among the most prevalent health disorders of childhood in Iran [1].

Slimness and obesity are multi-factor phenomena which are caused by interaction of several intricate parameters such as genetics and behavioral elements. Behavioral elements in turn consist of physical activities and nutrition, which are affected by social, cultural and environmental contexts [2].

Model of physical activity has also changed in children as a consequence of the increase in time devoted to watch TV, emergence of video games and reduction of time allocated for physical activity in schools and so on [3].

Since natural growth is the most important sign of children's health and the simplest and most reliable way to assess natural growth is measurement of height and weight and calculation of body mass index or analysis of anthropometry parameters, thus due to significance of this subject, the current study was designed and conducted with the intention of determining the body mass indices of rural primary school children of PIRANSHAHR City during educational year 2011-2012.

The following items can be mentioned as instances of the standard criteria to evaluate body mass index: growth cards of National Center for Health Statistics (NCHS), Gomez classification (weight for age), Mc Lauren's scale (weight to height) and Waterloo scale (height for age) and also

BMI (body mass index). Body mass index was initially designed for adults; this criterion was codified by Center for Diseases Control (CDC) for children and adolescents aging 2-18 years in 2000. This index provides an applicable and reliable method for determining obesity and slimness of children.

Research Background:

Numerous studies have been so far conducted on anthropometric features and assessment of nutritional status of children. In a study in Brazil, children were compared and evaluated using two criteria namely NCHS and CDC; the values in terms of CDC were larger than NCHS values [4].

Prevalence percentages of overweight, obesity, slimness, and low weight were respectively reported 18.4%, 8.6%, 4.3% and 1.2% in a study carried out on African immigrant children of Australia [5].

In a research in Tabriz, malnutrition percentage of low-nutrition type was equal for girls and boys aging 6-12 years in terms of height for age index. Malnutrition of gluttony type was observed to be larger in girls than boys in terms of weight for height index (8.41% versus 6.61%) [6].

Through another research in BANDAR ABBAS, percentages of acute malnutrition, chronic malnutrition or growth underdevelopment, and low weight were respectively 15.7%, 11.7%, and 12.2% in students.

Results of a study in BABOL implied that based on GOMEZ scale, 40.3% of boys and 40.9% of girls suffered from some degrees of malnutrition. And according to Mc Lauren's scale, 34.8% and 32.8% of girls suffered from some degrees of malnutrition. Also, based on Waterloo index, 25.5%v of boys and 23.8% of girls suffered from chronic malnutrition [8].

An anthropometric investigation on male students aging 11-14 years in KHOUSHAB City was conducted by members of SHAHROUD's University of Medical Sciences in 2008. The results were published in the quarterly of "Science and Fitness, Series 5, Number 2 and 3, Summer and Autumn 2010" as shown in Table 1 [9].

Table 1 - Results of anthropometric status investigation for 11-14 years male students in KHOUSHAB City, 2008

Results of anthropometric status investigation for male students in KHOUSHAB City, 2008			**Boys**
Body Mass Index	Over 85 percentile (overweight and obese)	Between 5-85 percentile (normal)	Below 5 percentiles (Slim)	
16.8 ±2.4	%4.8	%85.4	%9.8	**11 years old**
16.9 ±3.1	%6.5	%78.8	%14.7	**12 years old**

Results of study on the relationship between eating breakfast and body mass index of male students in primary, secondary and high schools of Zahedan City in 2006 was declared in Journal of Endothermic Glands ad Metabolism of Iran (SHAHID BEHESHTI University of Medical Sciences and Health Services), 12th Series, Number 4, Pages 345-351, October 2010. These results are demonstrated in Table 2 [10].

Table 2 – Results of BMI in male students of Zahedan in 2006

Results of study on anthropometric status of male students in Zahedan City, 2006			
Over 95 percentiles (Obese)	Between 85 to 95 Percentiles (Overweight)	Between 8 to 85 percentiles (Normal)	Below 5 percentiles (Slim)
% 2.8	% 5	% 70	% 22.3

In addition, results of study in anthropometric characteristics of primary school children of RAFSENJAN City using Mass Body Index in 2008 were published in Scientific-Research Journal of Kerman University of Medical Sciences as shown in table 3 [11].

Table 3 – Results of study on anthropometric characteristics of primary school students in RAFSANJAN City, 2008

BMI Classification	Frequency (Percentage)			Probability
	Female	Male	Total Sum	
Low weight	% 8.3	% 21.2	% 13.3	
Normal	% 71	% 57.8	% 65.8	0.0001
Prone to overweight risk	% 11.8	% 10.8	% 11.5	
Overweight	% 8.9	% 10.2	% 9.4	
Sum	% 100	% 100	% 100	

Materials and Methods:
1-   Determination of Sample Size and Sampling Method:
Samples were taken randomly in two stages. In the first stage, 12 schools were randomly chosen among the all rural primary schools of PIRANSHAHR City. Then, size of samples was determined proportional to the population of students in each school. OCRAN''s formula was used to determine the sample size with acceptable error of 2%. Accordingly, taking into account 7132 persons population of rural primary school students in PIRANSHAHR City in the educational year of 2011-2012, sample size was obtained 1797 individuals using the aforementioned formula. To prevent from potential loss of samples, 1845 samples were selected:
COCRAN's formula:

Assumptions: Confidence level: 95%, Z= 1.96, p=q=0.5

$$n = \frac{Nz^2 pq}{Nd^2 + z^2 pq}$$

2-Measurement Method of Body Mass Index:
In the current sectional-descriptive research, weight and height were measured and recorded using standard meter and scale in accordance with the related standards.
Students were weighed using plate scale with minimum clothes and without shoes and accuracy of ± 100 grams.
Heights were measured in standing position against the wall-mounted meter without shoes as ankles were placed together and dorsal head area, buttocks and shoulders were in the same alignment. The measurement was made with accuracy of 0.5 centimeter after touching the square to the head parting.
Following measurements, body mass index is determined through the specific formula as explained below. CDC percentiles are used for determining low weight and obesity. Nutrition status is defined in the following way using this index:
● BMI less then five percentiles: low weight
● BMI in the range 5-85 percentiles: normal weight
● BMI between 85-95 percentiles: prone to overweight risk
BMI equal to or greater than 95: overweight
Statuses of slimness, overweight and obesity were evaluated in terms of body mass index for gender and

age in comparison with standard percentiles of Center for Diseases Control (CDC 2000). The available percentiles for gender and age were used for assessing short height and the percentiles below 3 were considered as short height or chronic malnutrition.
Body Mass Index is proportional to age of students and weight, height and exact age of students shall be primarily determined for its calculation. Three following methods can be applied to calculate body mass index:
A- **Calculation through formula**: In this method, weight measured in kilograms is written in the numerator of the fraction and square of height in meters in in the denominator:
Body Mass Index (BMI): weight (kg) / height*height (m^2)
B- Using BMI Diagram: This diagram is made of three calibrated perpendicular lines. The first line represents weight in kilograms, the middle line pertains to body status (slim, normal, overweight and obese) and determines the body mass index (BMI), and the third line is related to height in centimeters.
Following weight measurement, the related figure is marked on the weight column in kg. Height is marked in centimeters on the height column. Two marked points are connected toe ach other using a ruler. The intersection of this connecting line and BMI column (middle line) denotes the body mass index of student.
C- **Applying software:** As the simplest method, the following website can be used on-line for calculating the body mass index:
http://www.halls.md/body-mass-index/av.htm
Statistical Analysis Method:
SPSS19 software and k-2 and t-tests were used for data analysis.
Findings:
Body mass indices of 1797 rural primary school students of PIRANSHAHR City was studied in the current research; among the samples, 877 students were girls (48.8%) and 920 students were boys (51.2%).
According to the findings, 11.55% of the children under study suffered from underweight and 2.2% of them are prone to risks of overweight and obesity. As observed in standard height to age diagram, 7.75% of children were classified below 3 percentiles i.e. they had short heights, and, 2.35% of them were classified over 97 percentile i.e. they were tall. Short height was more prevalent in girls than boys and the difference between two genders was significant (respectively, 8.5% and 7%, P = 0.011).

Table 4- Comparison of mean values of anthropometric variables in male and female rural primary school students of PIRANSHAHR City

P value	Per total sample size under study (girls and boys)	Boys	Girls	Mean ±Standard Deviation / Variable
0.0001*	28.6209 ±7.0657	28.7360 ±6.5030	28.5058 ±7.6284	Weight (kg)
0.011*	132.59 ± 10.3151	132.79 ±9.8265	132.39 ±10.8037	Height (cm)
0.464	9.2733 ±1.5763	9.3137 ±1.5869	9.2310 ±1.564	Age (years)
0.0001*	16.0920 ±2.2601	16.1310 ±2.1264	16.0543 ±2.3939	Body Mass Index (kg/m^2)
0.0001*	34.2676 ±23.822	32.4711 ±24.589	36.1523 ±22.854	Percentile

*Significant difference - t-test

Table 5 – Frequency distribution of low height and tallness among rural student population of PIRANSHAHR City

P-value in k-2 test	Status of students' height (percent)			Gender
	Tall	Normal	Short	
0.0001	2.1	89.4	8.5	Female
0.0001	2.6	90.4	7	Male
0.0001	2.35	89.9	7.75	In total sample size under study

K-square test: p = 0.0001 – significant difference

Table 6 – Frequency distribution of rural primary school students (girl and boy) in PIRANSHAHR City in terms of percent and according to BMI classification and comparison with CDC chart during 2011-2012 educational years

P-value in k-2 test	Status of Anthropometry Index				Gender
	Over 95 percentile (Obese)	Between 85-95 percentiles (overweight)	Between 5-85 percentiles (normal)	Below 5 percentiles (Slim)	
0.0001	%1	%1.3	%85.7	%12	Girl
0.0011	%1.3	%0.8	%86.8	%11.1	Boy
0.0001	%1.15	%1.05	%86.25	%11.55	Per total sample size under study

K-square test: p = 0.0001 – significant difference
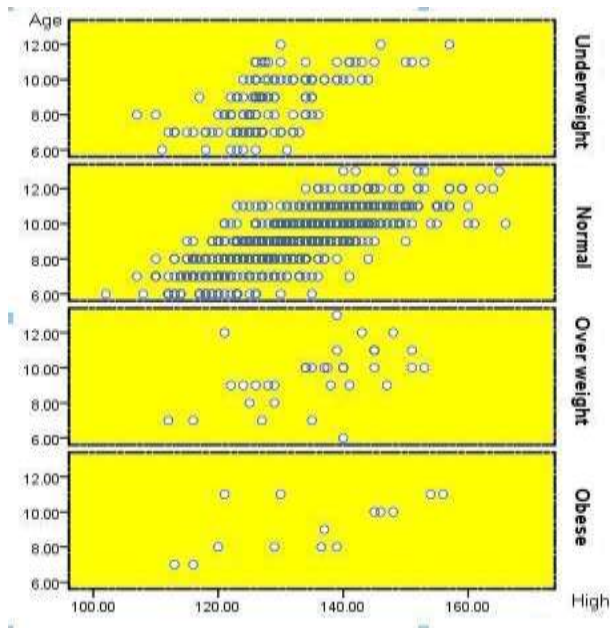

Diagram 1: Frequency distribution of the evaluated status of body mass index for different ages in comparison with students' heights
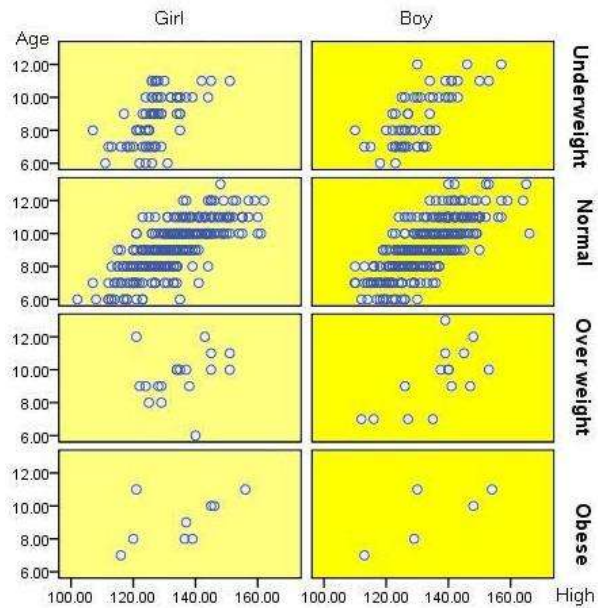

Diagram 2: Frequency distribution of the evaluated status of body mass index for different ages and genders in comparison with students' heights
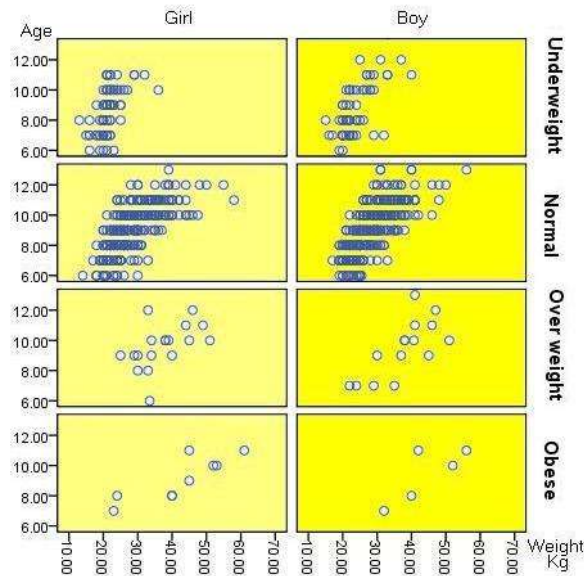
Diagram 3: Frequency distribution of the evaluated status of body mass index for different ages and genders in comparison with students' weights
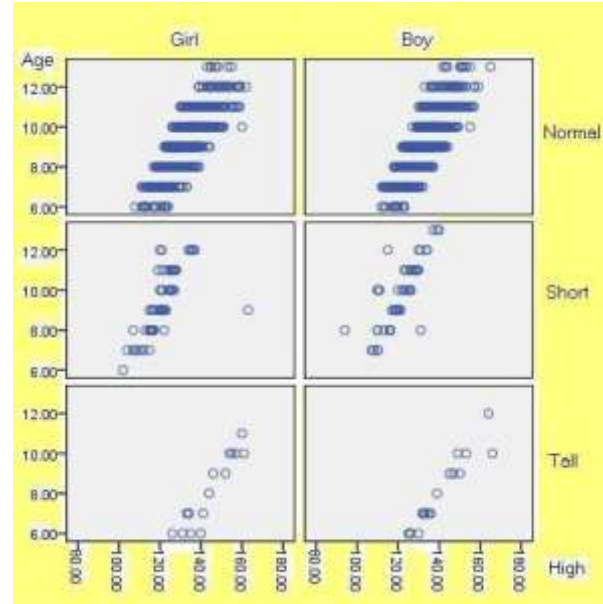

Diagram 4: Frequency distribution of the evaluated status of height to age for different ages and genders in comparison with students' heights

Discussion and Conclusion:

Research results are suggestive of the fact that malnutrition in the form of slimness, overweight and short height is existent as a significant health problem in rural primary school students of PIRANSHAHR City.

Based on the results of various studies, not only overweight prevalence differs in different regions of Iran and world but also prevalence of low weight and short height varies in different. Probably, different factors affecting difference in obesity make influence on low weight and short height as well. In other words, different age groups, different sample sizes, and even genetic, economical and social state and time of conducting the study can justify these contrasts.

Taking into account all measures taken with respect to improvement of nutrition, results of studies indicate that malnutrition in terms of deficiency still persists as nutrition styles in many developing countries is associated with further prevalence of overweight. Thus, subsided supportive nutrition plans are recommended to be strengthened in the schools for alleviating extent of students' malnutrition. Sport activities are advised to increase in the school schedule for compensating immobility of students.

References:
1- Ziaee V , Kelshdi R, Ardalan, G, Gheiratmand R , Majdzadeh R , Monaazzam MM. physical activity in Iranian student , Caspian study.Iran J pediatr 2006;16(12):157-164
2- Ekelund U, Neovius M, Linne Y, Brage S, Wareham NJ, Rossner S, Associations between physical activity and fat mass in adolescents: the Stockholm Weight Development study. Am J Clin Nutr 2005; 81(2):355-360
3- Janssen I, Katzmark PT, Boyce WF, King MA , Pickett W,. Overweight and obesity in canadian adolescents and their asociations with dietary habits and physical activity patterns. Hournal of Adolescent Health 2004;35:360-367
4- Maia MM,Fausto MA,Vieira EL,Benetton ML, Carneiro   M. The of malnutrion and its risk factors in children attending outpatient clinics in the city of Manaus , Amazonas ,Brazil.Arch latino Am Nutr 2008;58(3) : 23440.

5- Renxaho AM, Gibbons C, Swinborn B , Jolley D ,Burns C ,Obesity and under nutrition in sub – Saharan African immigrant and refugee children in Victoria ,Australia.Asia Pac j CLIN Nutr 2066 ;15(4) : 482-90.

6- Mahboub S,Gaemmaghami J,Shraki M,Mahdavi R . The study of nutritional cpndition in children of 6-12 years old.

7- Agha Moulaei T, Sobhani A .Anthropometric of nutritional sataus in primary school student at Bandar Abbas (2001-2002). Journal of school of Public health and Institute of Public Health 2003; 2(3(7)); 49-56 (Persian).

8- Hajian K.Study of nutritional status of the primary school children age based of the anthropometric measurements in Babol 1998.Daneshvar Medicine October 2000 ; 8(29: Special Edition on Medical Scien Articles) : 55 -60 (Persian).

9- Mehdi Boroughani, Mohammad Reza Hamedi, Mohammad Reza Asad and Mehdi Zarei, Investigation of BMI and physical activity in 11 to 14 years old boys of Khoushab City, Iran. University of Medical and Health Services, Journal of Science and Health, Volume 5, Issue 2 & 3, summer and Fall 2010.

10- Zinat Mortazavi, Masoud Roudbari. The relationship between breakfast consumption and body mass index in male students of primary schools, secondary guidance and Zahedan in 2006. Journal of Endocrinology and Metabolism, Iran (Shahid Beheshti University of Medical Sciences and Health Services (Course XII, No. 4, pages 351-345, 2010.

11- Zinat Salem, Anthropometric characteristics of children with BMI Bdnydr Rafsanjan 1387 - Journal of Kerman University of Medical Sciences, eighteenth course, number one, pp. 48-40, 2010.

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