Turkish Online Journal of Qualitative Inquiry (TOJQI)
Volume 12, Issue 7 July 2021: 12719 – 12732

Research Article

Study Of Anthropometric Measurements Among Rural And Urban Area School Boys Of Kashmir Region

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Abstract

Children are an important part of our society, and their health issues were too prevalent. Child growth has been recognized as an important pointer for evaluating health trends in a population and developing appropriate strategies. As a result, it is essential that children be healthy, and their health assessment is important worldwide. An acceptable method for assessing health status is anthropometry (height & weight). This study was done to evaluate the anthropometric measurements of rural and urban school boys of Kashmir region. The study was done in government schools of Kashmir region. The study design was cross sectional study. The sample size selected for this study was 1200 school boys comprised of (600 rural and 600 urban) aged between 11-13 years. The selected anthropometric measurements were height and weight. The stadiometer was used to measure the subjects' height and the standard weighing machine was used to determine weight. The collected data was analyzed using 2 × 3 factorial ANOVA to determine the significant difference; if the interaction effect was found to be significant, the simple effect was determined, and the least significant difference (LSD) post hoc test was used to determine the paired mean difference. 0.05 level of confidence was used in all cases to test the hypothesis. The current study's findings revealed a significant difference in height and weight between the interaction of area and age. The findings show that the children's anthropometric measurements were influenced by their dietary and place of residence.

Keywords

Anthropometric measurements, height, weight, school boys, rural and urban.

Introduction

Anthropometry is a widely used technique that consists of several body measurements. It is portable, inexpensive, simple, and easy to use. Anthropometry parameters such as height, weight, and body mass index (BMI) are the most effective tools for assessing children's and adults' nutritional status

[22]. This technique is not only inexpensive and simple, but it has also proven to be accurate and widely accepted [25]; being a non-invasive method of assessing human body growth Anthropometric measures are used to monitor long-term health values/indicators for describing growth patterns, trends in body growth and development over time, disease risks, nutritional and general health status in children and adolescence [6].

The primary factors influencing an individual's health are lifestyle, genetics, and environment. The most important contributing factor is one's way of life. It is controllable, manageable, sustainable, and changeable by the individual. It is critical to instill healthy lifestyle habits in children at a young age, which requires a balance of proper diet and physical activity [15]. Obesity, excess weight gain, and related complications are common outcomes of a child's lack of physical activity, insufficient and inappropriate nutrition, and genetic predisposition to gain weight [11, 26]. “Children's health is the nation's wealth.” The school-age period is nutritionally significant because it is the optimal time to build up nutrient stores in preparation for the rapid growth of adolescence. [23] Malnutrition remains a leading cause of illness and death among children in developing countries. It is a major public health issue, accounting for roughly half of all cases [24].

The study of child growth should be viewed on a larger scale because this continuous process begins with foetal development and continues through infancy, early childhood, and adolescence. Somatic growth during childhood and adolescence is critical because it lays the groundwork for an individual's future health status [2] and linked to adult weight status and cardiovascular health [20]. Monitoring children's growth is an important tool for defining normative reference values for a population, assisting healthcare providers in identifying any abnormalities in growth patterns, and devising preventive measures to avoid growth abnormalities.

Accurate height and weight measurements serve as the foundation for anthropological attributes that measure excess and underweight in relation to body height. Physical educators discovered that individuals of the same age will differ significantly in body size and shape, and individuals of the same height will also differ significantly in body weight. Furthermore, two subjects with the same height and weight may be treated as normal, but their body composition may differ, and one of these two subjects may be considered over-weight or obese. As a result, human body characteristics are so variable that no two people can have the same height, body weight, body size, or shape [14].

According to recent research, there is a decrease in physical activity among school children as a result of the heavy workload of studies [18]. This sedentary lifestyle increases the risk of developing health issues such as heart disease, obesity, high blood pressure, diabetes, and cancer [17, 5]. According to a recent report based on 450 nationally representative cross-sectional surveys from 144 countries, 43 million adolescent and young adults (35 million in developing countries) are overweight or obese, while 92 million are at risk of being overweight [7]. Many research reports have recently been published concerning the alarming rate of declining physical activity among school children [21, 8]. Physical activity guidelines for Americans recommended that adolescent and young adults should work out for 60 minute or more physical activity daily. Moderate to vigorous intensity aerobic physical fitness should be included to achieve health benefits. Moreover, they reported that children and adolescents should also include muscle strengthening exercises for at least 3 days a week in their 60 minutes of daily workout [10,

16]. Therefore, the purpose of the study is to evaluate the height and weight among rural and urban area school boys of Kashmir region.

Materials and Methods

Subjects

This study included 1200 school boys ranging in age from 11 to 13 years old. The sample frame consisted of school boys aged 11 to 13 years, who were enrolled in various Government schools in Kashmir region during the academic year 2019-2020. The stratified random sampling technique was used to achieve the study's objectives. After being informed about the study's objectives and protocol, all subjects gave their consent and volunteered to participate in it.

Study Design

The design of the study was cross-sectional. The anthropometric measurements of the study participants were taken in an indoor sports hall to determine their height and weight. All testing was carried out under the direct supervision of respective school principals and physical education teachers. Subjects were given detailed instructions about the testing procedure and were allowed to practice the tests being administered by the researcher prior to all data collection sessions. Following that, data was gathered with the assistance of trained assistants.

Variables and Tests

The anthropometric measurements taken for the assessment of subjects were height and weight. To measure these parameters, following procedures were adopted:

Height

Height measurements were taken without shoes. The subjects were positioned with their feet together and flat on the base plate with their head and back straight against the vertical measuring rods. Once the correct position was achieved the investigator lowered the head plate until it just touched the top of the student's head, and while maintaining this position, subject was asked to stand as tall as possible, without lifting the heels. Measurements were made to the nearest 0.1 cm.

Weight

The weight of the subject was measured with the help of standard weighing machine. Weight measurements were taken in light clothing; standing on weighing machine bearing equal weight on both feet. Accuracy of the weighing machine was checked before starting the test. Weight was recorded to the nearest 0.1 kg.

Statistical Analysis

The collected data on selected criterion variables (height and weight) of school boys were statistically analyzed by using 2 × 3 factorial ANOVA to find out the significant difference, whenever the interaction effect was found to be significant; the simple effect and then least significant difference (LSD)

post hoc test was applied to find out the paired mean difference. In all the cases 0.05 level of confidence was fixed to test the hypothesis.

Results

Height

The descriptive statistics on height among school boys of rural and urban area are presented in table 1.

Table 1: Descriptive Statistics on Height among School Boys of Rural and Urban Area of Kashmir region

Age Group		Rural Area	Urban Area
11 years	**Mean**	142.62	143.35
	S.D.	2.25	2.55
12 years	**Mean**	145.18	147.56
	S.D.	2.20	3.73
13 years	**Mean**	149.15	152.29
	S.D.	4.17	3.47

Table 1, reflects the descriptive values of school boys of age group 11, 12 and 13 years on height, which indicates that the mean and standard deviations of school boys of rural and urban area of Kashmir region.

The statistical analysis among school boys from rural and urban area on height are presented in the table 2.

Table 2: Summary of ANOVA (2 × 3) Factorial Design on Height

Tests of Between –Subjects Effects

Dependent Variable: Height					
Source of Variation	**Sum of Square (SS)**	**df**	**MS**	**F**	**Sig**
Factor A (Area)	1300.001	1	1300.001	130.165	0.000
Factor B (Age)	12012.662	2	6006.331	601.394	0.000
Interaction (Area × Age)	303.312	2	151.656	15.185	0.000
Error	11924.885	1194	9.987		

**Significant at 0.05 level*

(Table value, df of 1 to 1194 & 2 to 1194 are 3.84 & 3.00 respectively)

It is clear from the above table that height measured between rural and urban area reveals a significant difference, irrespective of age as the obtained F ratio of 130.165 is greater than the required table value of 3.84 at $\alpha = 0.05$ for the df of 1 and 1194. Further, the findings disclose that there is also significant difference on height between ages irrespective of areas, since the obtained F of 601.394 is greater than the required table value of 3.00 at $\alpha = 0.05$ for the df of 2 and 1194.

Moreover, the findings disclose that significant difference in height was found between the interaction of area and age as the obtained F ratio of 15.185 is greater than the required table value of 3.00 at $\alpha = 0.05$ for the df of 2 and 1194. Since, the interaction between area and age is significant, simple effect and post hoc test was applied and presented in the table 3.

Table 3: Simple Effect on Area and Age Wise on Height

Source of Variance	SS	df	MS	F	Sig.

Difference between Rural and Urban area school boys of age group 11 years.		53.290	1	53.290	5.336	0.021
Difference between Rural and Urban area school boys of age group 12 years.		564.062	1	564.062	56.478	0.000
Difference between Rural and Urban area school boys of age group 13 years.		985.960	1	985.960	98.721	0.000
Difference on rural area with respect to the age groups	11 years	4323.363	2	2161.682	216.442	0.000
	12 years					
	13 years					
Difference on urban area with respect to the age groups	11 years	7992.610	2	3996.305	400.137	0.000
	12 years					
	13 years					
Error		11924.885	1194	9.987		

From the above table , it is clear that there is significant difference between rural and urban area school boys of age group 11 years in height since the obtained F ratio 5.336 is greater than the table value of 3.84 at $\alpha = 0.05$ for the df of 1 and 1194. Similarly, significant difference exists between rural and urban area school boys of age group 12 years in height, since the obtained F ratio 56.478 is greater than the table value of 3.84 at $\alpha = 0.05$ for the df of 1 and 1194. Also significant difference exists between rural and urban area school boys of age group 13 years in height, since the obtained F ratio 98.721 is greater than the table value of 3.84 at $\alpha = 0.05$ for the df of 1 and 1194.

Table 3, clearly shows that there is significant difference in height between different age groups i.e. 11, 12 and 13 years in rural area school boys, since the obtained F ratio 216.442 is greater than the table value of 3.00 at $\alpha = 0.05$ for the df of 2 and 1194. Further, from the results it is clear that there is significant difference in height between different age groups i.e. 11, 12 and 13 years in urban area school

boys, since the obtained F ratio 400.137 is greater than the table value of 3.00 at α = 0.05 for the df of 2 and 1194.

Table 4: Pair Wise Comparison (Post Hoc Test) on Area and Age Wise on Height

Source of Variance			Post hoc test		95% of C.I	
			M.D	Sig.	L.B.	U.B.
Difference between Rural and Urban area school boys of age group 11 years.			0.730	0.021	1.350	0.110
Difference between Rural and Urban area school boys of age group 12 years.			2.375	0.000	2.995	1.755
Difference between Rural and Urban area school boys of age group 13 years.			3.140	0.000	3.760	2.520
Difference on rural area with respect to the age groups	11	12	2.560	0.000	3.180	1.940
	12	13	3.965	0.000	4.585	3.345
	13	11	6.525	0.000	5.905	7.145
Difference on urban area with respect to the age groups	11	12	4.205	0.000	4.825	3.585
	12	13	4.730	0.000	5.350	4.110
	13	11	8.935	0.000	8.315	9.555

Table 4, exhibits that statistically significant paired mean difference exists among school boys of rural and urban area in the age groups 11, 12 and 13 years on height as the obtained paired mean difference of 0.730 ($p< 0.05$), 2.375 ($p< 0.05$) and 3.140 ($p< 0.05$) were respectively obtained.

Table 4, exhibits that statistically significant paired mean difference exists among age group 11 and 12 years on height as the obtained paired mean difference of 2.560 ($p< 0.05$) were respectively obtained. Similarly, significant paired mean difference exists among age group 12 and 13 years on height as the obtained paired mean difference of 3.965 ($p< 0.05$) were respectively obtained. Also, significant paired mean difference exists among age group 13 and 11 years on height as the obtained paired mean difference of 6.525 ($p< 0.05$) were respectively obtained.

Table 4, exhibits that statistically significant paired mean difference exists among age group 11 and 12 years on height as the obtained paired mean difference of 4.205 ($p< 0.05$) were respectively obtained. Similarly, significant paired mean difference exists among age group 12 and 13 years on height as the obtained paired mean difference of 4.730 ($p< 0.05$) were respectively obtained. Also, significant paired mean difference exists among age group 13 and 11 years on height as the obtained paired mean difference of 8.935 ($p< 0.05$) were respectively obtained.

Weight

The descriptive statistics on weight among school boys of rural and urban area are presented in table 5.

Table 5: Descriptive Statistics on Weight among School Boys of Rural and Urban Area of Kashmir region

Age Group		Rural Area	Urban Area
11 years	**Mean**	34.06	35.17
	S.D.	1.70	2.41
12 years	**Mean**	36.35	37.56
	S.D.	2.46	2.54
13 years	**Mean**	38.48	40.88
	S.D.	2.50	2.21

Table 5, reflects the descriptive values of school boys of age group 11, 12 and 13 years on weight, which indicates that the mean and standard deviations of school boys of rural and urban area of Kashmir region.

The statistical analysis among school boys from rural and urban area on weight are presented in the table 6.

Table 6: Summary of ANOVA (2 × 3) Factorial Design on Weight

Tests of Between –Subjects Effects
Dependent Variable: Weight

Source of Variation	Sum of Square (SS)	df	MS	F	Sig
Factor A (Area)	742.613	1	742.613	137.322	0.000
Factor B (Age)	5140.727	2	2570.363	475.306	0.000
Interaction (Area × Age)	103.007	2	51.503	9.554	0.000
Error	6456.920	1194	5.408		

**Significant at 0.05 level*

(Table value, df of 1 to 1194 & 2 to 1194 are 3.84 & 3.00 respectively)

It is clear from the above table that weight measured between rural and urban area reveals a significant difference, irrespective of age as the obtained F ratio of 137.322 is greater than the required table value of 3.84 at $\alpha = 0.05$ for the df of 1 and 1194. Further, the findings disclose that there is also significant difference on weight between ages irrespective of areas, since the obtained F of 475.306 is greater than the required table value of 3.00 at $\alpha = 0.05$ for the df of 2 and 1194.

Moreover, the findings disclose that significant difference in weight was found between the interaction of area and age as the obtained F ratio of 9.554 is greater than the required table value of 3.00 at $\alpha = 0.05$ for the df of 2 and 1194. Since, the interaction between area and age is significant, simple effect and post hoc test was applied and presented in the table 7.

Table 7: Simple Effect on Area and Age Wise on Weight

Source of Variance	SS	df	MS	F	Sig.
Difference between Rural and Urban area school boys of age group 11 years.	123.210	1	123.210	22.784	0.000
Difference between Rural and Urban area school boys of age group 12 years.	146.410	1	146.410	27.074	0.000

Difference between Rural and Urban area school boys of age group 13 years.		576.000	1	576.000	106.513	0.000
Difference on rural area with respect to the age groups	11 years	1954.293	2	977.247	186.710	0.000
	12 years					
	13 years					
Difference on urban area with respect to the age groups	11 years	3289.240	2	1644.620	304.120	0.000
	12 years					
	13 years					
Error		6456.920	1194	5.408		

From the above table , it is clear that there is significant difference between rural and urban area school boys of age group 11 years in weight since the obtained F ratio 22.784 is greater than the table value of 3.84 at $\alpha = 0.05$ for the df of 1 and 1194. Similarly, significant difference exists between rural and urban area school boys of age group 12 years in weight, since the obtained F ratio 27.074 is greater than the table value of 3.84 at $\alpha = 0.05$ for the df of 1 and 1194. Also significant difference exists between rural and urban area school boys of age group 13 years in weight, since the obtained F ratio 106.513 is greater than the table value of 3.84 at $\alpha = 0.05$ for the df of 1 and 1194.

Table 7, clearly shows that there is significant difference in weight between different age groups i.e. 11, 12 and 13 years in rural area school boys, since the obtained F ratio 186.710 is greater than the table value of 3.00 at $\alpha = 0.05$ for the df of 2 and 1194. Further, from the results it is clear that there is significant difference in weight between different age groups i.e. 11, 12 and 13 years in urban area school boys, since the obtained F ratio 304.120 is greater than the table value of 3.00 at $\alpha = 0.05$ for the df of 2 and 1194.

Table 8: Pair Wise Comparison (Post Hoc Test) on Area And Age Wise on Weight

Source of Variance	**Post hoc test**		**95% of C.I**	
	M.D	**Sig.**	**L.B.**	**U.B.**

Difference between Rural and Urban area school boys of age group 11 years.			1.110	0.000	1.556	0.654
Difference between Rural and Urban area school boys of age group 12 years.			1.210	0.000	1.666	0.754
Difference between Rural and Urban area school boys of age group 13 years.			2.400	0.000	2.856	1.944
Difference on rural area with respect to the age groups	11	12	2.290	0.000	2.746	1.834
	12	13	2.130	0.000	2.586	1.674
	13	11	4.420	0.000	3.964	4.876
Difference on urban area with respect to the age groups	11	12	2.390	0.000	2.846	1.934
	12	13	3.320	0.000	3.776	2.864
	13	11	5.710	0.000	5.254	6.166

Table 8, exhibits that statistically significant paired mean difference exists among school boys of rural and urban area in the age groups 11, 12 and 13 years on weight as the obtained paired mean difference of 1.110 ($p< 0.05$), 1.210 ($p< 0.05$) and 2.400 ($p< 0.05$) were respectively obtained.

Table 8, exhibits that statistically significant paired mean difference exists among age group 11 and 12 years on weight as the obtained paired mean difference of 2.290 ($p< 0.05$) were respectively obtained. Similarly, significant paired mean difference exists among age group 12 and 13 years on weight as the obtained paired mean difference of 2.130 ($p< 0.05$) were respectively obtained. Also, significant paired mean difference exists among age group 13 and 11 years on weight as the obtained paired mean difference of 4.420 ($p< 0.05$) were respectively obtained.

Table 8, exhibits that statistically significant paired mean difference exists among age group 11 and 12 years on weight as the obtained paired mean difference of 2.390 ($p< 0.05$) were respectively obtained. Similarly, significant paired mean difference exists among age group 12 and 13 years on weight as the obtained paired mean difference of 3.320 ($p< 0.05$) were respectively obtained. Also, significant paired mean difference exists among age group 13 and 11 years on weight as the obtained paired mean difference of 5.710 ($p< 0.05$) were respectively obtained.

Discussion

The results show that the anthropometric variables namely weight and height among school boys of rural and urban area were found significant as the interaction between the two sources i.e. area and age were found significant at the level of 0.05. Further, the results of the study revealed that selected anthropometric variables were better in urban area as compared to rural area. These findings identify several aspects of anthropometric parameters among school boys that may need to be improved in order to improve both their personal health and performance. The findings of the study are in conformity with the previous studies, according to the findings, the results showed that nutritional status of children from urban and rural areas was lower compared to the NCHS standard. The boys had reported significantly greater anthropometric measurements than the girls. The children from urban area were found to have significantly greater in all the anthropometric measurements than the rural children [3]. Furthermore, studies revealed that height and weight of the urban school children were significantly higher compared to those of rural children [13, 1]. Similarly, the findings of the present study are in line with various studies. It has been found that urban children have greater height and weight than their rural counterparts [9, 19, 4]. The results are not in line with the results reported by some other investigators, revealed in their studies that rural children scored over urban children on majority of the anthropometric characteristics[12].

Conclusion

Based on the study's major findings, it was concluded that urban area school boys between the age group of 11, 12 and 13 years were significantly taller and heavier than rural area school boys of age group 11 to 13 years. The conclusion is that the location of residence has a significant impact on the anthropometric measurements of children in the study. The differences between children from different settings could be attributed to differences in lifestyle, food habits, and food constituents. Curriculum implementation has a significant impact on students' healthy habits. The successful implementation of the curriculum in urban schools had a direct impact on student attitudes. In schools, for example, sanitary condition posters, awareness dramas, and programmes helped pupils learn about healthy practices in depth. In contrast, the absence of such ideas and the failure to implement a proper and updated curriculum in rural schools resulted in a lack of knowledge of healthy habits among students living in rural areas. The findings and discussion suggest that all humans, particularly growing children, require a proper and balanced diet. A seminar should be organized to raise awareness of underweight and its consequences. It is not necessary to provide luxurious food, but it is necessary to provide good quality food and proper food that fulfils the nourishment of the child rather than the hunger of the child. As a result, it is suggested that future research consider the food intake, educational background, and economic status of rural and urban school boys.

Acknowledgement

I am thankful to Annamalai University, for providing us an opportunity to conduct this study and would like to emphasis special thanks to the subjects, school principles, physical education teachers and trained assistants who cooperated and gave whole hearted support in the completion of this study.

References

1. Adak, D.K., Tiwari, M.K., Randhawa, M., Bharati, S. and Bharati, P. (2002). "Pattern of adolescent growth among the brahmin girls: rural-urban variation". *Collegium Antropologicum, 26*(2): 501–507.
2. Best, C., Neufingerl, N., Van Geel, L., van den Briel, T., & Osendarp, S. (2010). "The nutritional status of school-aged children: why should we care?". *Food and nutrition bulletin*, *31*(3): 400-417.
3. Bharati, P., Itagi, S., & Megeri, S. N. (2005) "Anthropometric measurements of school children of Raichur, (Karnataka)". *Journal of Human Ecology*, *18*(3):177-179.
4. Chillon, P., Ortega, F. B., Ferrando, J. A., & Casajus, J. A. (2011). "Physical fitness in rural and urban children and adolescents from Spain". *Journal of Science and Medicine in Sport*, *14*(5): 417-423.
5. Coyle, Y. M. (2009). "Lifestyle, genes, and cancer". *Cancer Epidemiology*, 25-56.
6. De Onis, M., & Habicht, J. P. (1996). "Anthropometric reference data for international use: recommendations from a World Health Organization Expert Committee". *The American journal of clinical nutrition*, *64*(4): 650-658.
7. De Onis, M., Blössner, M., & Borghi, E. (2010). "Global prevalence and trends of overweight and obesity among preschool children". *The American journal of clinical nutrition*, *92*(5): 1257-1264.
8. Douglas, K. A., Collins, J. L., Warren, C., Kann, L., Gold, R., Clayton, S., ... & Kolbe, L. J. (1997). "Results from the 1995 national college health risk behavior survey". *Journal of American college health*, *46*(2): 55-67.
9. Eiben, O.G., Barabas, A. & Nemeth, A. (2005). "Comparison of growth, maturation, and physical fitness of Hungarian urban and rural boys and girls". *Journal of Human Ecology*, *17*(2): 93-100.
10. Grace, T. W. (1997). "Health problems of college students". *J. Am. Coll. Health*, (45): 243-250.(21)
11. Hills, A. P., King, N. A., & Byrne, N. M. (Eds.). (2007). "Children, obesity and exercise: prevention, treatment and management of childhood and adolescent obesity". *International-Studies-in-Physical-Education-and-Youth-Sport*, Routledge.
12. Kharra, B., Ghuman, P. S., & Ratnu, P. S. (2020). "Study of anthropometric measurement status of the rural and urban male students". *International journal of advanced science and technology, 29*(5): 2052-2056.
13. Kolekar, S. M., & Sawant, S. U. (2013). "A comparative study of physical growth in urban and rural school children from 5 to 13 years of age". *International Journal of Recent Trends in Science and Technology*, *6*(2): 89-93.
14. Koley, S., & Sandhu, J. S. (2005). "*An introduction to kinanthropometry"*. Friends Publications (India).
15. Pandey, P., & Sharma, K. (2020). "Healthy living aspect in urban and rural school children through physical education learning". *Indian Journal of Science and Technology*, *13*(45): 4513-4520.
16. Physical Activity Guidelines Advisory Committee. (2008). Physical activity guidelines for Americans. *Washington, DC: US Department of Health and Human Services*, 15-34.
17. Powell, K. E. (1988). "Habitual exercise and public health: An epidemiological view". *Exercise adherence: Its impact on public health*, *champaign, IL. Human Kinetics*, 15-39.

18. Pribis, P., Burtnack, C. A., McKenzie, S. O., & Thayer, J. (2010). "Trends in body fat, body mass index and physical fitness among male and female college students". *Nutrients*, *2*(10): 1075-1085.
19. Reyes, M.E.P., Tan, S.K., & Malina, R.M. (2003). "Urban–rural contrasts in the physical fitness of school children in Oaxaca, Mexico". *American Journal of Human Biology*, *15*(6):800-813.
20. Sabo, R. T., Lu, Z., Daniels, S., & Sun, S. S. (2012). "Serial childhood BMI and associations with adult hypertension and obesity: the Fels Longitudinal Study". *Obesity*, *20*(8): 1741-1743.
21. Sacheck, J. M., Kuder, J. F., & Economos, C. D. (2010). "Physical fitness, adiposity, and metabolic risk factors in young college students". *Medicine and science in sports and exercise*, *42*(6): 1039-1044.
22. Simko, M. D., Cowell, C., & Gilbride, J. A. (1995). "*Nutrition assessment: A comprehensive guide for planning intervention"*. Jones & Bartlett Learning.
23. Sunita, K., & Jain, R. (2005). "Assessment of nutritional status of school children from rural Bihar". *The Indian Journal of Nutrition and Dietetics*, *42*(7): 326-334.
24. UNICEF (2004). "State of World's children", 2004.
25. WHO Multicentre Growth Reference Study Group, & de Onis, M. (2006). "Reliability of anthropometric measurements in the WHO Multicentre Growth Reference Study". *Acta Paediatrica*, (*95*): 38-46.
26. Yanovski, S. Z. (2003). "Binge eating disorder and obesity in 2003: could treating an eating disorder have a positive effect on the obesity epidemic?". *International Journal of Eating Disorders*, *34*(S1): S117-S120.