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Pediatrics

A STUDY OF NUTRITIONAL STATUS AMONG SCHOOL CHILDREN IN NORTHERN INDIA

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ABSTRACT **INTRODUCTION:** Improper nutrition during childhood can have long lasting consequences on health, schooling and later on, productivity as national resource. India faces the double burden of overnutrition and undernutrition in the community. Keeping the importance of nutrition among children and adolescents in mind, this study was conducted to assess the nutritional status among school children in northern India.

AIMS AND OBJECTIVES: To determine the Body Mass Index (BMI) among school children from 5 to 18 years of age, to measure mid upper arm circumference and skin fold thickness (Triceps, Biceps, Subscapular, Supra-iliac) and to compare BMI and skin fold thickness with weight and their correlation.

RESULTS: The anthropometric data was collected from 2997 children studying in various schools of the cantonment. The prevalence of underweight among the children in the present study was 4.7% among the females and 7% among the males and that of stunting among the children was 4.3% among the females and 3.0% among the males. The prevalence of overweight was 0.4% among the females and 0.4% among the males.

RECOMMENDATION: The mothers and healthcare personnel should be sensitized to the problem of malnutrition for timely intervention. A multi-centric study needs to be carried out amongst healthy children to set reference standards for children of various ethnic groups and geographic locations in the country.

KEYWORDS : Nutritional Survey, Malnutrition, Body Mass Index, Skin Fold Thickness

INTRODUCTION

Children are an invaluable resource of any nation. Their nutritional status is an essential component of a country's overall development. Poor nutritional status *in-utero* and during childhood can have long lasting consequences on health, schooling and later on, productivity as national resource. India has made a slow and steady progress in human development ever since independence. Severe and florid forms of malnutrition have declined substantially, infant mortality has declined from 74 per 1000 live births in 2005-6 to 50 per 1000 live births in 2015-16 (1) and life expectancy has increased from 37 years at the time of independence to 63 years. In spite of all these impressive developments, one third of newborns start their life with low birth weight and more than half of young children below five years of age continue to suffer from moderate to severe malnutrition (2). Ironically, with improvement in socioeconomic conditions and changes in lifestyle and dietary practices among affluent class of the society, particularly in urban areas, the prevalence of childhood and adolescent obesity is also rising to epidemic proportions, thereby creating the double burden of over nutrition and under nutrition in the community (3,7).

The lag in physical growth has both long term and short-term consequences. The immediate implications are in the form of decreased scholastic performances, lower IQ levels, poor psychosocial development and decreased cognitive functions. Childhood stunting leads to a significant reduction in adult size. One of the consequences of small adult size resulting from childhood stunting is reduced work capacity, which in turn has an impact on economic productivity at the individual and the national level. Another important outcome is that, women who were malnourished during childhood have more chances of delivering low birth weight babies leading to a vicious intergenerational cycle of malnutrition.

For the last three decades, a number of studies have measured child nutritional status in developing countries using, as reference, growth charts introduced in 1977 by the Center for Disease Control and Prevention (CDC) and the National Center for Health Statistics., estimated from a population of US children. Multicenter Growth Reference Study (MGRS) under auspices of WHO released the new standards for six milestones as growth indicators in 2005: weight for age, weight for length/height, Body mass index (BMI) for age, and length/height for age as well as "windows for achievement" (4). These standards were implemented in 2006. Most countries currently use the WHO/NCHS standards.

India has adopted the new WHO Child Growth Standards across the country for use in Integrated Child Development Services (ICDS), National Rural Health Mission (NRHM), professional bodies and incorporated into institutional training (5). According to the National Family Health Survey-4 (2015-2016), children in India suffer from some of the highest levels of stunting, wasting and underweight in the world and the situation has not improved markedly in the recent years. The percentage of under nourished children, boys and girls alike, under 5 years is: 38.4% stunted, 35.8% underweight, 21% wasted and 7.5% severely wasted (1). According to NFHS inadequate nutrition is higher in rural areas, urban slums, underprivileged children and in children with high birth order. Keeping the importance of nutrition among children and adolescents in mind, this study was conducted to assess the nutritional status among school children in northern India.

AIMS AND OBJECTIVES

To determine the Body Mass Index among school children from 5 to 18 years of age, to measure mid upper arm circumference and skin fold thickness (Triceps, Biceps, Subscapular, Supra-iliac) and to study comparisons of Body Mass Index and skin fold thickness with weight and their correlation.

MATERIAL AND METHODS

This was a cross sectional observational study, spread over a period of nine months, aimed to assess the health status of children studying in various schools situated in a large military cantonment in North India in 2007-2008. The children were from various socio-economic, cultural, and ethnic backgrounds from all states of the country. A total of 2997 children were examined.

After obtaining informed consent from the parents, the children were examined with special emphasis on the evidence of malnutrition. The details of examination and anthropometric measurements (height, weight, skinfold thickness and mid-arm circumference) were recorded in a standard proforma. The results were tabulated and weight for age, height for age, BMI and BMI Z scores were calculated using EPI Info 6. The anthropometric indices (Height for age and weight/age) were compared against WHO/NCHS standards. BMI for age was compared with CDC Standards.

BMI was calculated on children who were healthy as per various anthropometric indices. Only children who were between +2 SD and -2 SD in weight for age Z scores, weight for height Z score and height for age Z scores were selected for calculation of BMI for age reference charts. A total of 2299 healthy children (z score within +/-2) were selected for calculating the reference values. For each age and sex group 95th, 75th, 50th, 5th and 3rd percentiles were calculated using Microsoft excel software. Smoothened lines were obtained using the Moving average technique. The smoothened percentile lines were compared with CDC percentile lines.

RESULTS

The anthropometric data was collected from 2997 children studying in various schools of the cantonment. The male (1786) to female (1211) ratio was 1.44:1. Maximum number of children were from age group 108 months [331 (11.0%)] and the least [17 (0.6%)] were in the age group 216. Within the age groups, the highest representation of females was in the age group of 84 months [127 (48.8%)] and age group 216 had the lowest representation of females [6 (35.3%)]. The population was also homogenously distributed (p = 0.1886).

Among the females mean weight increased from 60 months to 216 months, except at 204 months were there was a fall. Among the males the mean weight increased from 60 months to 216 months (Table 1). The child whose weight for age was lower than -2 SD were classified as underweight and those below -3 SD are severely underweight. Over all prevalence of underweight was 4.7% among females and 7% among males. Maximum number of underweight girls (6.9%) were in the age group 156 months and boys (22%) were in age group of 204 months. One boy and none of the girls were severely underweight.

The mean height increased among the females from 60 months to 216 months, except at 204 months where a drop in the mean height was noted. Among the males, the mean height increased from 60 months to 216 months, though after 180 months it remained fairly constant (Table 2). The children whose height for age was in the range of -2 to -3 Sd were labeled as stunted and those below -3 SD severely stunted. Over all prevalence of stunting was 4.3% among girls (out of which six (0.5%) were severely stunted) and 3% among boys (three (0.2 % severely stunted). Maximum prevalence of stunted girls (20.9%) and boys (8.3%) were in the age groups 204 months. The mean BMI increased from 60 months to 216 months among both sexes, except among the females where there was a drop at 204 and 216 months. From 132 months onwards the BMI among the females was higher than that of the males (Table 3).

Among the females the mean mid arm circumference increased from 60 months to 216 months, except at 204 months where there was a drop. Whereas among the males there was a constant increase (Table 4). The triceps skin fold thickness among the females increased from 60 months onwards to 216 months, except at 204 months there was a fall. Among the males, skin fold thickness showed a steady increase from 60 months to 216 months (Table 5). The biceps skin fold thickness among the females increased from 60 months onwards, except at 156, 192 and 216 months where there was a fall. Among the males there was a steady increase from 60 months to 216 months (Table 6). The sub scapular skin fold thickness among the females increased from 60 months to 216 months except at 84 and 156 months where there was a fall. Among the males there was a constant increase from 60 months to 216 months (Table 7). Among the females the supra iliac skin fold thickness increased from 60 months to 216 months, whereas among the males there was a fall at 204 months (Table 8).

DISCUSSION

The main objective of a nutritional survey is to obtain information on the prevalence and geographic distribution of the nutritional problems of the community. The methods of nutritional assessment include: (1) clinical examination (2) Anthropometry (3) Biochemical evaluation (4) Functional assessment (5) Assessment of dietary intake (6) Vital and health statistics (7) Ecological studies (1).

Body Mass Index (BMI): BMI is used as screening tool to identify possible weight problems among children. For children and teens, the age-and sex-specific percentiles of BMI are used because the amount of body fat changes with age and differs in girls and boys. Moreover, healthy weight ranges cannot be provided for children and teens as the healthy weight ranges changes every month as the age and height increase for each sex (7).

Mid-arm Circumference and Skinfold Thickness: While Mid arm circumference is a good indicator of muscle bulk, skin fold thickness (measured at triceps, biceps, subscapular and suprailiac sites) is an indicator of body fat. Combined with mid arm circumference, the skin fold thickness may help determine the ratio of fat to the muscle (8). However, the skin fold thickness provides information on excess body fat among children and adolescents only if BMI for age lies between 85th and 95th percentiles (9).

Anthropometry The three most widely used indicators of child nutritional status are weight-for-age, height-for-age and weight-for-height. These three indices are used to identify three nutritional conditions: underweight, stunting and wasting respectively. These measurements do not give any indication of relative amount of body fat and muscle (10, 11). Anthropometry has been accepted as an important tool for assessment of nutritional status particularly of children. The four building blocks or measures used to undertake anthropometric measurements are age, sex, length/height and weight. This study attempted to assess the nutritional status of school children from all over the country in a large military station in north India.

Socio-demographic profile

The anthropometric data was collected from 2997 children; out of which 1786 (59.6%) were males and 1211 (40.4%) females. The maximum number of children was in the age group 108 months and the minimum were in the age group 216 months. The population was homogenously distributed (p= 0.1886). Most of the children belonged to low (2045, 68.2%) or middle (526, 17.6%) income groups. Only about 300 (10%) children were from higher income group.

The mean BMI in each age group was almost equal among both sexes up to the age of 108 months, thereafter the mean BMI among girls was higher than that of boys. This can be explained by the fact that there is increase in adipose tissue and the overall weight gain during the pubertal growth spurt. Stage of sexual maturation may be a confounder when interpreting BMI as an indicator of overweight and of the presence of overweight. On an average BMI increases with the stage of sexual maturation in girls but the estimates of relative body fat are variable especially in girls who have just attained menarche. To overcome the variable sensitivity in children and adolescents, BMI should be clubbed with actual measures of body fat rather than the use of BMI alone (3).

Prevalence of underweight among the girls in the study population was 4.7% as compared to 7.0% among the boys. The overall prevalence rate was 6%. The prevalence of underweight ranged from 4.6%, 32.3% and 51.7% in various studies conducted in Turkey, Pakistan and among children of tea plantation workers in Assam (12,13,14).

Prevalence of stunting among the females in the study population was 4.3% as compared to 3.0% among the males. The overall prevalence rate was 3.5%. The prevalence of underweight ranged from 5.7%, 19.8% and 33% in the studies from Turkey, Nigeria and Pakistan respectively. In developed countries like Malaysia the prevalence of stunting was 6.7% (15). Based on the data given above, the prevalence of underweight and stunting in the study population was very low as compared to most other developing countries of the world.

Prevalence of Overweight/ Obesity

Prevalence of overweight among the girls and boys in the study was 0.4% and none of them were obese. Studies conducted among affluent school children of metropolitan cities revealed that 22% overweight and 6% obese in Delhi and prevalence was 13.1% and 5% in Bengaluru (3, 16). Other study among school girls from West Bengal showed that 17.63% girls were overweight and 5.10% were obese (17). In Punjab the prevalence of overweight/obesity among boys and girls was

12.2/5.92% and 14.31/6.27% respectively (18). As compared to the above-mentioned studies the prevalence of overweight and obesity was much lower in our study population probably because the study was conducted in the schools of an army cantonment and the most of the children were the wards of defense personnel.

Percentile charts

The BMI values of the female children in study was at least two points lower than the mean BMI recorded in a study conducted by Anju Sood et al among affluent adolescent girls in Bengaluru city (3). This variation could probably be due to the wide variation in the socioeconomic status of the study population in the Bangalore study. Correlation between BMI and body weight was calculated and showed that the BMI correlated well with the body weight (R^2=0.72) and as expected the correlation between BMI and height showed that the BMI correlated poorly with the height (R^2=0.33).

SUMMARY AND CONCLUSION

Malnutrition is a major public health problem occurring as a silent epidemic in developing countries like India. Obesity is also emerging as a problem among children especially among the affluent society. The prevalence of underweight among the children in the present study was 4.7% among the females and 7% among the males and that of stunting among the children was 4.3% among the females and 3.0% among the males. The prevalence of overweight was 0.4% among the females and 0.4% among the males. The mean BMI was much lower in the study population as compared to most other studies conducted on Indian children. Percentile charts for BMI for age was prepared on healthy children and the values were found to be lower than the CDC values. These charts may be used as local reference standards for children of the Armed Forces personnel.

RECOMMENDATIONS

The mothers and healthcare personnel at peripheral health facilities should be sensitized to the problem of malnutrition so that they can identify these cases and timely intervention can be started. A multi-centric study needs to be carried out amongst healthy children to set reference standards for children of various ethnic groups and geographic locations in the country. Nutritional and lifestyle education must be included in the school curriculum of all children.

TABLE 1: MEAN WEIGHT AND HEIGHT

Age	FEMALES					MALES				
	No.	MEAN WT	SD	MEAN HT	SD	No.	MEAN WT	SD	MEAN HT	SD
60	26	**18.17**	2.91	**112.04**	5.14	45	**18.40**	2.59	**113.70**	5.93
72	95	**18.96**	2.63	**115.30**	5.75	124	**19.44**	2.67	**115.55**	5.06
84	127	**20.61**	3.45	**119.70**	5.77	133	**21.57**	4.01	**121.52**	6.07
96	125	**22.84**	4.26	**125.43**	6.66	202	**34.00**	4.74	**125.24**	5.31
108	132	**25.54**	4.57	**131.46**	5.68	199	**25.99**	4.62	**131.84**	6.11
120	111	**29.24**	5.65	**138.10**	6.54	172	**29.52**	6.05	**136.44**	7.01
132	109	**33.65**	5.79	**144.52**	6.90	183	**32.84**	6.44	**148.15**	7.34
144	112	**39.66**	7.84	**148.72**	14.67	165	**37.87**	7.51	**149.41**	7.69
156	131	**42.00**	8.21	**152.38**	6.04	187	**42.67**	8.29	**156.31**	8.97
168	104	**45.82**	8.54	**155.44**	4.93	176	**49.64**	9.32	**163.85**	8.34
180	66	**49.82**	7.16	**157.22**	6.01	95	**52.41**	8.92	**166.95**	6.60
192	43	**54.31**	8.89	**159.88**	6.50	58	**55.62**	9.34	**169.80**	8.04
204	24	**50.05**	9.48	**156.23**	5.81	36	**55.91**	9.28	**169.17**	9.20
216	6	**54.95**	7.43	**162.15**	9.66	11	**58.37**	11.78	**169.16**	7.32

Age is given in Months; WT- wight, HT- Height, SD- Standard Deviation

TABLE 2: MEAN BMI AND MID ARM CIRCUMFERENCE

Age			Females					Males		
	N	Mean BMI	SD	Mean MAC	SD	N	Mean BMI	SD	Mean MAC	SD
60	26	**18.17**	2.01	**15.92**	1.74	45	**18.40**	1.74	**15.71**	1.74
72	95	**18.96**	1.38	**16.04**	1.62	124	**19.44**	1.71	**16.10**	1.79
84	127	**20.61**	1.81	**16.05**	1.97	133	**21.57**	1.98	**16.55**	1.73
96	125	**22.84**	1.85	**16.50**	1.68	202	**34.00**	2.02	**16.72**	2.52
108	132	**25.54**	1.99	**17.31**	1.93	199	**25.99**	2.22	**17.54**	2.50
120	111	**29.24**	2.03	**17.79**	2.34	172	**29.52**	2.19	**18.29**	2.76
132	109	**33.65**	2.30	**18.66**	2.44	183	**32.84**	2.24	**18.92**	3.14
144	112	**39.66**	2.77	**19.79**	2.32	165	**37.87**	2.92	**19.94**	2.79
156	131	**42.00**	2.83	**20.50**	2.27	187	**42.67**	2.97	**20.75**	3.20
168	104	**45.82**	3.32	**21.42**	2.68	176	**49.64**	3.29	**21.77**	2.73
180	66	**49.82**	2.97	**22.53**	2.56	95	**52.41**	2.79	**22.49**	2.69
192	43	**54.31**	3.34	**23.06**	2.34	58	**55.62**	2.61	**23.67**	3.07
204	24	**50.05**	3.37	**22.64**	2.61	36	**55.91**	2.68	**23.46**	2.02
216	6	**54.95**	2.01	**23.25**	3.72	11	**58.37**	2.96	**23.40**	2.78

BMI- Body Mass Index, MAC- Mid Arm Circumference, SD- Standard Deviation

TABLE 3: MEAN SKINFOLD THICKNESS AMONG GIRLS

AGE	N	Biceps	SD	Triceps	SD	Sub-Scaular	SD	Supra-Iliac	SD
60	26	**12.23**	3.60	**16.57**	4.38	**10.07**	2.41	**12.61**	6.80
72	95	**13.44**	3.68	**17.6**	3.77	**11.38**	3.59	**14.20**	6.67
84	127	**13.60**	3.73	**17.45**	3.83	**09.57**	3.73	**14.84**	6.01
96	125	**14.88**	3.88	**19.4**	4.27	**11.32**	3.93	**20.22**	7.92
108	132	**15.89**	4.52	**20.45**	5.04	**11.89**	4.47	**22.64**	8.51
120	111	**16.27**	3.74	**21.40**	4.21	**12.63**	4.85	**23.98**	10.13
132	109	**17.50**	5.05	**22.16**	4.54	**15.03**	6.06	**26.81**	9.85
144	112	**18.73**	5.81	**23.45**	5.88	**17.01**	6.87	**29.96**	7.59
156	131	**17.91**	5.88	**21.85**	5.16	**15.82**	7.24	**27.43**	7.45
168	104	**18.91**	5.66	**22.01**	4.12	**19.16**	6.95	**30.03**	7.53
180	66	**20.18**	6.93	**23.28**	5.21	**20.04**	7.58	**31.86**	5.89
192	43	**19.97**	4.06	**25.00**	4.74	**20.62**	7.17	**32.61**	6.76
204	24	**20.45**	4.97	**24.4583**	5.61	**20.95**	7.10	**34.30**	5.33
216	6	**19.33**	5.71	**25**	4.98	**21.33**	7.08	**36.66**	5.46

TABLE 4: MEAN SKINFOLD THICKNESS AMONG BOYS

Age	N	Biceps	SD	Triceps	SD	Sub-Scapular	SD	Supra-Iliac	SD
60	45	**12.00**	3.72	**16.64**	2.89	**10.24**	3.78	**12.23**	5.65
72	124	**13.41**	3.15	**17.70**	3.59	**11.24**	3.34	**14.53**	5.36
84	133	**13.60**	4.12	**18.28**	4.38	**10.74**	3.65	**16.16**	6.99
96	202	**15.20**	3.40	**19.46**	3.19	**11.31**	3.69	**20.03**	5.37
108	199	**15.89**	4.59	**21.10**	5.19	**11.82**	4.46	**22.42**	8.84
120	172	**17.33**	5.80	**22.70**	5.52	**13.25**	6.03	**23.96**	10.43
132	183	**17.49**	4.99	**22.55**	5.11	**14.22**	7.01	**26.63**	8.94
144	165	**18.53**	5.71	**23.36**	6.05	**15.60**	6.78	**28.50**	7.01
156	187	**18.02**	5.18	**22.87**	5.35	**15.83**	7.34	**28.10**	6.98
168	176	**18.90**	4.80	**23.26**	4.80	**16.95**	6.54	**29.56**	6.67
180	95	**19.10**	4.57	**23.62**	4.34	**17.50**	6.59	**30.70**	6.31
192	58	**19.94**	6.17	**22.98**	6.31	**19.63**	6.69	**31.32**	5.68
204	36	**20.72**	4.52	**24.91**	4.16	**18.33**	5.85	**29.51**	5.59
216	11	**21.63**	3.95	**26.63**	3.90	**17.82**	6.24	**32.81**	6.66

REFERENCES

1. Indian Institute for Population Sciences (IIPS) and MoHFW. National Family Health Survey -4. 2017. Available from: http://rchiips.org/nfhs/pdf/ NFHS4/India.pdf. Accessed 12 Dec, 2019.
2. Sunder Lal, Combating Malnutrition in India Through Community Efforts, Indian Journal of community Medicine, 2003; 28(3):99-106.
3. Anju Sood, Pushpa Sundararaj, Sushma Sharma, *Anura V. Kurpad and Sumithra Muthayya. BMI and Body Fat Percent: Affluent Adolescent Girls in Banglore City. Indian Pediatrics 2007; 44:587-591.
4. Tarozzi, Alessandro, "The Indian Public Distribution System as provider of food security: Evidence from child nutrition in Andhra Pradesh," European Economic Review, Elsevier, 2005; 49(5):1305-1330. https://ideas.repec.org/a/eee/eecrev/v49y2005i5p1305-1330.html.
5. Vaman khadilkar and Anuradha Khadilkar, Growth charts: A diagnostic tool, Indian J Endocrinol Metab. 2011 Sep;15(Suppl3):S166–S171. PMID: 22029020, PMCID: PMC3183514, doi:10.4103/2230-8210.84854.
6. Mercedes de Onis, Monika Blössner. The World Health Organization Global Database on Child Growth and Malnutrition: methodology and applications, International Journal of Epidemiology, 2003;32(4):518–526, DOI- https://doi.org/10.1093/ije/dyg099.
7. Edwin A Mitchell and Alistair W Stewart et al. Factors associated with body mass index in children and adolescents: An international cross-sectional study. PLoS One. 2018; 13(5):e0196221 PMCID :PMC5931641 PMID:29718950. DOI: 10.1371/journal.pone.0196221
8. Marie Rolland, Paolo Brambilla, Paola Manzoni et al. Body composition assessed on the basis of arm circumference and triceps skinfold thickness: A new index validated in children by magnetic resonance imaging. American Journal of Clinical Nutrition, 1997;65(6):1709-13. DOI: 10.1093/ajcn/65.6.1709
9. Zuguo Mei, Laurence M, Grummer strawn et al. Do Skin Fold Measurements Provide Additional Information to BMI in the Assessment of Body Fatness Among Children and Adolescents? Paediatrics 2007; 119(6): e1306-e1313.
10. Bruce Cogill. Anthropometric Indicators Measurement Guide. Food and Nutrition Technical Assistance Project, Academy for education Development, Washington DC. www.researchgate.net/publication/237442266.
11. Vijayaraghavan K, Singh D, Swaminathan M C, Arm Circumference and Fat Fold at Triceps in Well Nourished Indian School Children. Indian J Medical Research, 1994;62(7): 994-1001. PMID: 4435925
12. Emel Gür, Günay Can, Semra AkkusIs et al. Is Undernutrition a Problem among Turkish School Children? Which Factors have an Influence on It? Journal of Tropical Pediatrics, 2007; 52(6):421-6. DOI 10.1093/tropej/fml031
13. Anwer I, Awan JA 2003.Nutritional status comparison of rural with urban school children in Faisalabad District, Pakistan. Rural Remote Health. 2003 Jan-Jun;3(1):130. Epub 2003 May 30 PMID: 15877486
14. G.K. Medhi, A. Barua & J. Mahanta (2006) Growth and Nutritional Status of School Age Children (6-14 Years) of Tea Garden Worker of Assam, Journal of Human Ecology, 2006 ;19(2):83- 85. DOI: 10.1080/09709274.2006.11905860
15. Esiong Tee, Swan-Choo Khor, Hoon-Eng Ooi et al Regional Study of Nutritional Status of Urban Primary Schoolchildren. 3. Kuala Lumpur, Malaysia, Food and nutrition bulletin 2002;23(1):41-7. DOI: 10.1177/156482650202300106.

16. Sharma A, Sharma K, Mathur KP. Growth Pattern and Prevalence of Obesity in Affluent School Children in Delhi. Public Health Nutrition, 2007;101(5):485-91. DOI: https://doi.org/10.1017/S1368980007223894
17. Bose K, Bisai S, Mukhopadhyay A, Bhadra M. Overweight and obesity among affluent Bengalee school girls of Lake Town, Kolkata, India. Maternal and Child Nutrition2007; 3(2):141-5. DOI: https://doi.org/10.1111/j.1740-8709.2007.00085.
18. Sidhu S, Kaur N, Kaur R. Overweight and Obesity in Affluent School Children of Punjab. Annals of Human Biol! Mar 2006; 33(2): 255-259. DOI: 10.1080/03014460600578631.