

# Trends in Gross Body Measurements and Nutritional Status of Young Haryanvi Males and Females of India – A Comparative Anthropometric Assessment

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**Abstract:** Height and weight measurements are important factors relating to growth and development and nutritional status of children and adolescents. The young age period is nutritionally significant because this is the prime time to build.

**Aims and Objectives:** The prime objective of the present study is to estimate and compare the height, weight, body mass index (BMI) and nutritional status among Haryanvi males and females of 5.00- 20.99 years of age.

**Subjects:** This study is carried out on a total of 800 subjects i.e. 400 males and 400 females of age ranging from 5.00-20.99 years. Subjects are further subdivided into eight age groups ranging from 5.00-20.99 years.

**Methods:** Height and weight of the subjects is measured using standard anthropometric techniques given by Lohman et al 1988. BMI is computed for each individual. Further subjects are categorized under Normal, underweight and overweight according to International Classification of underweight, overweight and obesity according to body mass index (BMI) given by WHO(2002).

**Results:** It is found that females are lacking far behind in weight and height as compare to males. All the females from the age group 5.00-6.99 years categories underweight and severe thin (100%) whereas overweight females are present only in 19.00-20.99 age group i.e. 34% in pre-obese category. Results indicate only 2% of males from age group 17.00-18.99 years lie under the underweight category followed by the 32% subjects of the age group 5.00-6.99 years. Among all the age groups male subjects predominantly belong to either normal or overweight category.

**Conclusion:** Improper dietary habits and unawareness of balanced diet in young growing males and females leads to the various related metabolic syndromes. This suggests that there is need for nutrition and health awareness among the Haryanvi parents and their children.

**Keywords:** BMI, Underweight, Overweight, Haryanvi males and females, Anthropometry.

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## 1. INTRODUCTION

Anthropometry is a series of systematized measuring techniques that express quantitatively the dimensions of the human body and skeleton and is widely recognized as one of the useful techniques to assess the growth and nutritional status of individual or population (Krishan, 2007, Hussain, 2013).

Fat content of human beings has physiological and medical importance as it may influence morbidity and mortality. Body fat measurement provides useful information as it may alter effectiveness of drugs and anaesthetics. Body fat content can be obtained from height and weight. However, for more precise evaluation several methods are available which give a

reasonably accurate measure of body fat both in normal subjects and in individuals with unusual body builds (**Drinkwater and Ross, 1980**). Various anthropometric indices (body mass index and BMI) are available that play an important role in predicting the various health risks and show good correlation (**WHO 1995, 1999 and Singh et al., 2011**).

The growth of an individual may be defined in term of changes in its magnitude, gain in its mass or weight, increase in the size of organs or thickness of tissue and changes in size of individual as whole (**Garn,1952**).Growth in adolescent period faster than at any other time in life except the first year and adolescent gain up 50% weight of their adult weight, more than 20% of their adult height and 50% of their skeletal mass. Peak height velocities achieved during the growth spurt are 9 cm/ year and 10.5 cm / year for girls and boys, respectively. In both sexes weight gain is proportionally greater than height gain. In boys, height and weight gain occur together, but girls weight gain is lags behind the height gain by 3 -6 months (**Brasel, 1982**).Over 1/5 population in India comprise of children aged 5-14 years. The school age period is significant because this is the prime time to build up. (**Awasthi, 2000**). According to **UNICEF, 1997** in India, approximately 57 million children are underweight. The dynamics of physical growth and development including sexual maturation are important for their implications in health and disease. There are considerable variations for these patterns of growth within and between human populations. The varied underlying causes of these variations can be understood by conducting such growth studies under varied conditions. So there is a need to evaluate the growth patterns and nutritional status in males and females of Haryana, India.

Present study has been designed to generate additional base line data for growth patterns in male and female subjects of Haryana aged from 5.00 years to 20.99 years, and to compare them with National and International standards.

## 2. AIMS & OBJECTIVES

The present study was conducted with the following aims and objectives:-

- To estimate and compare the height, weight and body mass index (BMI) among Haryanvi males and females of 5.00-20.99 years of age.
- To assess the nutritional status using anthropometric parameters.

## 3. MATERIALS AND METHODS

Present cross-sectional study has been conducted on a total of 800 subjects of two distinct groups i.e. males (n=400) and females (n=400) ranging in age from 5.00 years to 20.99 years. Subjects were measured for anthropometrical measurements (height and weight) with a view to assess their nutritional status. Data is collected from various districts of Haryana state. Subjects were measured with their prior consent in their free hours of work. Present study has already been approved by institutional clinical ethical committee (ICEC), DeshBhagat University, MandiGobindgarh, Punjab, India.

### 1. Inclusion Criteria:-

- Subject should be born and resident of Haryana state of India.
- Age of the subjects should be from 5.00years to 20.99years.

### 2. Exclusion Criteria:-

- Subjects below 5.00 years and above 20.99 years of age.
- Subjects with congenital malformation, apparent anomalies, inflammation, trauma, deformities and surgery (if any) will be excluded as that may have affected their normal process of growth and development.
- Subjects migrated to Haryana India.

## METHODS

### Sampling:

- A total of 800 subjects examined on the simple random basis. Subjects further divided into eight distinct groups according to age (table 3.1).
- Prior informed consent was taken from the subjects (if adult) otherwise from their parents before their participation in the study. Date of birth of each subject was confirmed and noted from detailed mark sheets of previous classes or from birth certificates, identity proof whichever available for calculating the decimal age.
- Ethical approval was taken from the university ethical committee before the commencement of study.

Table 3.1 Age group wise distribution of subjects

Age Group (years)	Males (N=400)	Females (N=400)
5.00-6.99	50	50
7.00 - 8.99	50	50
9.00 - 10.99	50	50
11.00- 12.99	50	50
13.00-14.99	50	50
15.00-16.99	50	50
17.00-18.99	50	50
19.00-20.99	50	50
Total	400	400

\*N is total number of subjects

### Anthropometric Measurements

The following anthropometric measurements i.e. Height (cm), Weight (kg) were taken on each subject following the techniques given by **Lohman et al. (1988)**. Body mass index (BMI) computed for each individual. Body Mass Index is calculated as weight (in kg) divided by height (in m squared).

### ARMANTARIUM

- I. Anthropometric Rod
- II. Crown weighing Scale

### Body Mass Index (BMI)

It is also known as Quetlet's index and is calculated as follows:

$$\text{BMI} = \text{Weight (Kg)} / (\text{Height (m)})^2$$

Further classification of body mass index has been done using the criteria given by WHO (2002).

## 4. RESULTS

### Gross body measurements

Table 4.1 and Fig. 4.1, 4.2 describe the Mean and SD values of the height and weight of males and females of all the age groups. It has been observed that males are tallest (172.95 cm) in comparison to females at all the age groups.

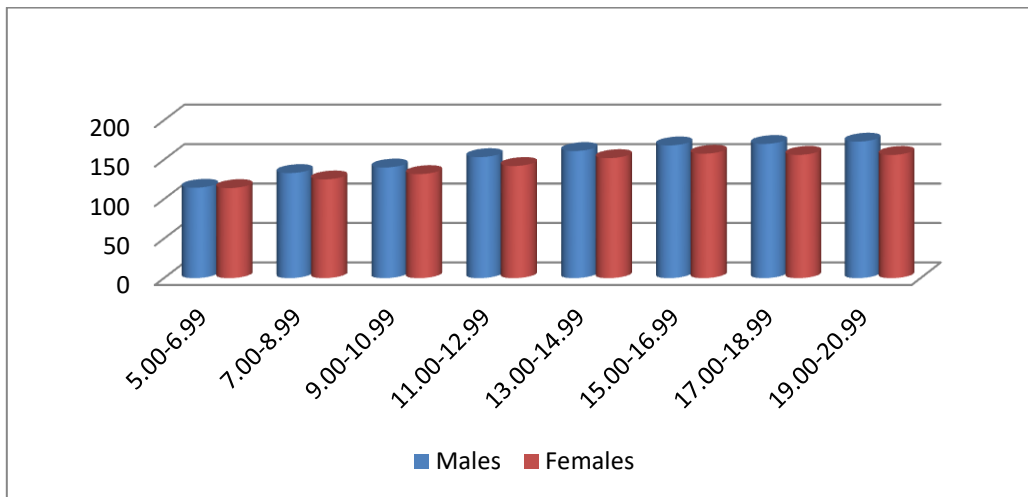
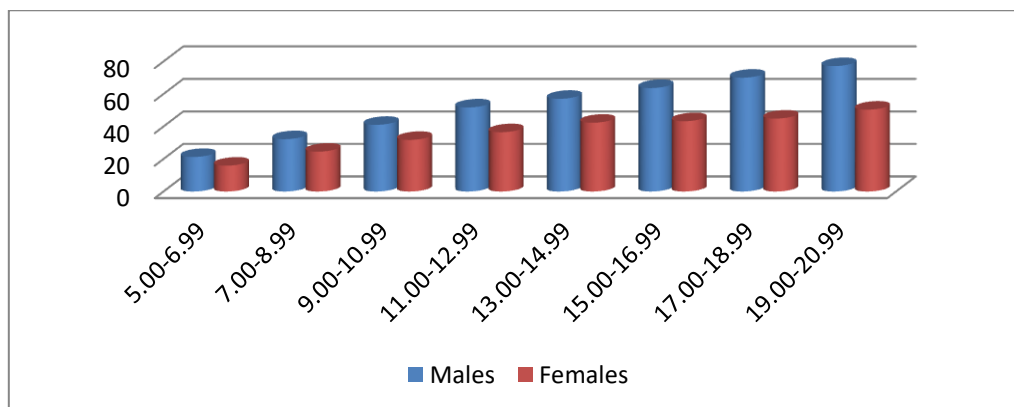
It is observed that the trends in mean height and mean weight are increasing over the ages in all the groups. The maximum increment in height (19cm) for males has been observed between the age group of 5.00-6.99 years and the trend has been found to be decreasing from 13.00 onwards. It is found that the mean weight is also increasing with advancing age. Maximum increment in weight has been observed between the age group of 5.00-6.99 years (11kg.). It has been observed that the mean height and mean weight is increases with the ages up to 15.00-16.99 years. The maximum increment in height for females has been observed between the age group of 5.00-6.99 and 7.00-8.99 years (10.96cm) followed by (10.28cm) between the age groups 9.00-10.99 and 11.00-12.99 years. Same as the trend of height, mean weight is also increases with advancing age. Maximum increment in weight (8.61kg) for females has been observed between the age group of 5.00-6.99 and 7.00-8.99 years.

In terms of statistics (**Table 4.1**), differences for weight are statistically highly significant among male and female subjects. Male subjects are significantly heavier than the female subjects among all the age groups. Female subjects are significantly shorter than male counterparts among all the age groups except for the first age group i.e. 5.00-6.99 who are similar to each other for height i.e. 114.53 for males and 114.13 for females.

**Table 4.1: Mean and Standard Deviation of Gross Body Measurements of males and females of Haryana.**

Age Group (in years)	N (number of Subjects)	Height (cms.)		t value	Weight (Kgm.)		t value
		Males	Females		Males	Females	
		Mean $\pm$ SD	Mean $\pm$ SD		Mean $\pm$ SD	Mean $\pm$ SD	
5.00-6.99	50	114.53 $\pm$ 2.04	114.13 $\pm$ 3.15	<b>0.763</b>	21.27 $\pm$ 2.46	15.93 $\pm$ 1.79	<b>12.39***</b>
7.00-8.99	50	133.17 $\pm$ 1.75	125.09 $\pm$ 2.45	<b>18.91***</b>	32.21 $\pm$ 2.86	24.54 $\pm$ 2.13	<b>15.18***</b>
9.00-10.99	50	140.15 $\pm$ 1.96	131.82 $\pm$ 2.07	<b>20.61***</b>	41.04 $\pm$ 2.89	31.76 $\pm$ 3.96	<b>13.36***</b>
11.00-12.99	50	153.33 $\pm$ 1.62	142.10 $\pm$ 3.36	<b>21.22***</b>	51.74 $\pm$ 2.06	36.5 $\pm$ 2.25	<b>35.38***</b>
13.00-14.99	50	161.04 $\pm$ 3.24	152.11 $\pm$ 0.84	<b>18.83***</b>	57.07 $\pm$ 4.89	42.34 $\pm$ 1.02	<b>20.84***</b>
15.00-16.99	50	168.18 $\pm$ 2.08	157.62 $\pm$ 5.00	<b>13.76***</b>	63.67 $\pm$ 2.76	43.24 $\pm$ 3.83	<b>30.57***</b>
17.00-18.99	50	170.02 $\pm$ 2.15	156.20 $\pm$ 3.48	<b>23.85***</b>	70.05 $\pm$ 3.66	44.87 $\pm$ 4.08	<b>32.41***</b>
19.00-20.99	50	172.95 $\pm$ 5.29	156.08 $\pm$ 4.48	<b>17.18***</b>	77.18 $\pm$ 7.01	50.39 $\pm$ 8.92	<b>16.68***</b>

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

**Fig. 1 Trends in Height (cm) among males and females of Haryana.****Fig. 2 Trends in Weight (kg) among males and females of Haryana****Body Mass Index (BMI)**

It has been observed that males (25.84 kg) and females (20.75 kg) of age group 19.00-20.99 years possess maximum mean body weight for given height followed by the males (24.24 kg) and females (18.04 kg) of age group 17.00-18.99 years, whereas males (16.18kg) and females (12.29kg) of age group 5.00-6.99 years respectively has relatively small body mass for a given height than that of other age groups (table 4.2).

Among females highest mean value for BMI i.e. 20.75 & 18.40 is observed in the subjects of age groups 19.00-20.99 & 17.00-18.99 years respectively, whereas females of age group 5.00-6.99 years respectively has (12.29) relatively small body mass for a given height than that of other age groups.

In terms of statistics, differences for body mass index (BMI) are found to be statistically highly significant for males vs. Females, for all the age groups.

**Table 4.2: Body Mass Index (BMI) of males and females with age**

Age Group (in years)	N (number of Subjects)	Body Mass Index(Kg/m <sup>2</sup> )				t value
		Males		Females		
		Mean	SD	Mean	SD	
5.00-6.99	50	16.18	1.50	12.29	0.96	15.75***
7.00-8.99	50	18.13	1.20	15.66	0.98	11.21***
9.00-10.99	50	20.87	1.00	18.27	2.18	7.63***
11.00-12.99	50	21.99	0.48	18.12	1.37	18.77***
13.00-14.99	50	22.00	1.73	18.29	0.41	14.67***
15.00-16.99	50	22.52	1.13	17.42	1.53	18.83***
17.00-18.99	50	24.24	1.35	18.40	1.76	18.57***
19.00-20.99	50	25.84	2.59	20.75	3.95	7.62***

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

### Males

Further using the WHO (2002) criteria of BMI classification for 5.00-18.99 years male cases from the present study has been categorized into different grades of body mass index (table 4.3). It has been observed that maximum numbers of individuals that lie in the normal range of BMI are of 15.00-16.99 years age group (92%) followed by age group 17.00-18.99 years (64%) and then subjects of age group 13.00-14.99 years (52%). Only 36% of subjects belonging to age group 7.00-8.99 years lie in the normal range of BMI, which is minimum among all the age groups.

Results indicate 100% of the males of the age group 11.00-12.99 years lie in the overweight followed by the males of age groups 9.00-10.99 years (72%), 7.00-8.99 years (52%), 13.00-14.99 years (46%) and 17.00-18.99 (34%) years. Age groups 5.00-6.99 years and 15.00-16.99 years possess least males i.e. 10% & 18% respectively in the overweight category. Maximum of 28% of individuals lie in the obese category belongs to the age group 9.00-10.99 years followed by 5.00-6.99 (18%) 7.00-8.99 (12%) years and 2% of the males from the age group 13.00-14.99 years (table 4.3). From age group 19.00-20.99 years 28% of the subjects lie in the normal range of BMI whereas 64% lie in pre obese and only 8% are present in class I obese (table 4.5). Only of 2% of individuals from age group 17.00-18.99 years lie in underweight category followed by the 32% subjects of the age group 5.00-6.99 years.

**Table 4.3: WHO Classification of underweight, overweight and obesity according to body mass index (BMI) of males ranging in age from 5.00-18.99.**

WHO Classification	Z-SCORES SD	Age Group (in years)						
		5.00- 6.99	7.00-8.99	9.00- 10.99	11.00- 12.99	13.00- 14.99	15.00- 16.99	17.00-18.99
		N (50)	N (50)	N (50)	N (50)	N (50)	N (50)	N (50)
Underweight		32%	-	-	-	-	-	2%
Thinness	<-2SD	-	-	-	-	-	-	-
Severe thinness	<-3SD	-	-	-	-	-	-	-
NORMAL		40%	36%	-	-	52%	92%	64%
Over weight	>+1SD	10%	52%	72%	100%	46%	18%	34%
Obese	>+2SD	18%	12%	28%	-	2%	-	-

**Females**

All the females from the age group 5.00-6.99 years are underweight, among them 40% females of the 5.00-6.99 years group are severe thin and 28% are thin, whereas in 7.00-8.99 years age group 50% of the subjects are underweight and 50% are normal. No normal subject is found in 5.00-6.99 years age group whereas maximum of normal females lies under 7.00-8.99 years age group i.e. 50%. Overweight females are present among two age groups i.e. 9.00-10.99, 11.00-12.99 years (table 4.4). No subject is found in obese category of any age group. Females of 19.00-20.99 years age group are classified according to the WHO classification for adult subjects. Among these subjects 2% were severe thin 14% moderate thin 38% mild thin and 34% females fall in pre obese category (table 4.5).

**Table 4.4: WHO Classification of underweight, overweight and obesity according to body mass index (BMI) of females ranging in age from 5.00-18.99.**

WHO Classification	Z-SCORES SD	Age Groups (in years)						
		5.00-6.99	7.00-8.99	9.00-10.99	11.00-12.99	13.00-14.99	15.00-16.99	17.00-18.99
		N (50)	N (50)	N (50)	N (50)	N (50)	N (50)	N (50)
Underweight		32%	48%	32%	48%	90%	72%	84%
Thinness	<-2SD	28%	2%	-	-	-	20%	2%
Severe thinness	<-3SD	40%	-	-	-	-	-	-
NORMAL	-	-	50%	38%	38%	10%	8%	14%
Over weight	>+1SD	-	-	30%	14%	-	-	-
Obese	>+2SD	-	-	-	-	-	-	-

**Table 4.5: International Classification of underweight, overweight and obesity according to body mass index (BMI) of Males and Females of subjects age ranging from 19.00-20.99.**

WHO Classification	Body Mass Index (BMI) range value	Age Group (in Years) 19.00-20.99	
		Males (N=50)	Females (N=50)
Underweight	<18.50	-	-
Severe thinness	<16.00	-	2%
Moderate thinness	16.00-16.99	-	14%
Mild thinness	17.00-18.49	-	38%
NORMAL	18.50-24.99	28%	12%
Over weight	≥25.00	-	-
Pre-obese	25.00-29.99	64%	34%
Obese	≥30.00	-	-
Obese class I	30.00-34.99	8%	-
Obese class II	35.00-39.99	-	-
Obese class III	≥40.00	-	-

## 5. DISCUSSION

Gross body measurements such that height and weight are the most important indicators of growth, obesity, effect of various stresses and diseases & give an important indication about health status of children and are also good indicator of nation's progress in socio economic-terms.

Present study indicates that the Haryanvi males are taller and heavier as compared to the female subjects among all the age groups. It is observed that the trends in mean height and mean weight are increasing with advancing age. The height of Haryanvi females and males doesn't differ much only for the age group 5.00-6.99 years, however females are significantly shorter than male counterparts among rest of the age groups.

Comparing the present study with the population of central India (Thakur &Gautam 2015, Thakur &Gautam 2016) similar trend of increasing height and weight with advancing age has been observed but males and females of Haryana are found to be taller and heavier than males and females of central India.



Further comparing the body weight and height of present studied females with national center for health statistics (2005) similar trend of increasing gross body parameters with advancing age has been observed, however Haryanvi females are found to be shorter in stature and lighter than NCHS reference population.

Comparing the results with the ICMR, 1996 standards it has been found that males and females of present study are taller and heavier than that of reference population with advancing age groups.

Remarkable increase in both height and weight parameters for both boys and girls of present study has been observed between nine to fourteen years indicating the pubertal or adolescent growth spurt which is characterized by more intense development and considered to be an important feature of human growth (**Ravanshad et al., Stefancic&Tomazo-Runil, 1998**).

The mean values of BMI ranged from 16.18 kg/m<sup>2</sup> to 25.84 kg/m<sup>2</sup> in boys and 12.29 kg/m<sup>2</sup> to 20.75 kg/m<sup>2</sup> in girls. When BMI for age was used maximum number of boys with healthy weight (92%) is found at the age group of 15.00-16.99 years and maximum healthy weight (50%) girls are found at the age group of 7.00-8.99 years.

Prevalence of overweight and obese is higher in case of boys as compare to the girls. Nutritional status reflects the health status, in the present study female subjects has been observed chronically underweight, thin and severe thin which indicates acute under nutrition of females as compare to males.

Another studies supporting the results of present study from Haryana state reported with maximum stunting prevalence i.e. 54% has been observed among the children of Hisar whereas Maximum percentage of underweight children i.e. 63.9% found in Fatehabad district of Haryana. Nutrient intake was found to be more in boys as compare to girls of Hisar district of Haryana (**Sati &Dahiya 2012, Kumar et. al. 2014**).

Unfortunately malnutrition continues to be a major health problem in most developing countries and nutritional deficiency disease account for considerable diseased proportion of hospital admissions and the underline state of mal nutrition modifies adversely the course of many nutritional diseases (**ICMR 1984, Gopalan 1994**).

In present study maximum number of subjects from males is found to be overweight/obese and from females they are in underweight/ thinnest categories. The most important factor that influences the nutritional status of girls is wide discrimination on the basis of caste and sex. There is strong son preference. There is discrimination in nurturing and education of boys and girls. Since very beginning the discrimination started. As they grow, extent of discrimination further widens. Female feticide and infanticide was widely prevalent in different Indian societies, which has resulted in the declining population of women folk around the globe (**Thakur and Gautam 2015**).

Studies from Raichur of Karnataka and Punjab report the similar results supporting the present study. In these studies it has been observed that the girls again found to be shorter and lighter than boys. Higher percentage of boys was found to have normal nutritional status than girls reflecting gender discrimination in providing nutrition in terms of food (**Bharati et al. 2005, Singh &Sekhon 2015**).

Another study on females at Sri Lanka also reveals more percentage of under nutrition females than over nutrition. It has been observed that 52.7% females were normal, 20.7% underweight, 19.8% stunt, 19.1% were under wasting nutritional status, however 9.1% were overweight and 0.9% were found under obese category (**Adikari and weerathunga 2015**). Similar study by **Jayathissa and Ranbanda (2006)** on Sri Lankan girls age between 10-19 years revealed the prevalence of underweight 47.2%, stunting 28.5% and overweight 2.2% suggesting more underweight nutritional status than over weight.

As prevalence of overweight and childhood obesity is also observed in the males of present study. Now a day's children are very much fond of eating of junk foods and playing computer or mobile oriented games or watching television etc. The sedentary life style decreased the sports participation and other physical activities which play a big role in raising the graph of obesity in childhood and makes them physically inactive which prove to be fatal for their health in later years such that the development of heart disease and other chronic diseases including hyperlipidemia, hyperinsulinaemia, hypertension and elderly atherosclerosis (**Klesges et al., 1993; Saraswathi et al., 2011; cole et al., 2000**).

## 6. CONCLUSION

Sedentary lifestyle, lack of balanced diet and improper dietary habits in young growing males and females leads to the malnutrition and various related metabolic syndromes that shows its impact later in life. This suggests that there is need for nutrition and health awareness among the Haryanvi parents and their children. Further mother's literacy can play important role to reduce under nutrition.

## REFERENCES

- [1] Adikari A.M.N.T. and Weerathunga S.C. (2015) Nutritional Status of Adolescent School Girls in a Rural Area in Sri Lanka; Anthropometric Assessment. *Human Biology Review*, 4 (2): 175-185.
- [2] Awasthi CP, Kumar S, Tiwari PP and Singh AB. 2000 .Nutritional status of pre-school and school children in rural area of Sultanpur district. *Journal of Dairying, Foods and Home Sciences* **19** 16-21.
- [3] Bharti P, Itagi S, Megeri S.N. (2005). Anthropometric measurements of school children of Raichur, (Karnataka). *J. Hum. Ecol.*, 18(3): 177-179.
- [4] Brasel, J. A. (1982). Changes in body composition during adolescence. *Curr Concepts Nutr.*, 11:13-18.
- [5] Cole TJ, Bellizzi MC, Flegal KM, dietz WH, (2000). Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ*, 320(7244):1240-1243.
- [6] Drinkwater, DT and Ross, WD (1980).The anthropometric Fractionation of body mass. In: M.Ostyn, G.Beunen and J.Simmons (eds.). *Kinanthropometry II*.pp.179-189.University Park Press, Baltimore.
- [7] Gopalan C. (1994). Micronutrient deficiencies: public health implications. *Nutrition Foundation of India Bulletin*, 15(3):1-6.
- [8] Garn, SM (1952).Physical growth and development. *Amer J Phys Anthropol.*,10:169-192.
- [9] Hussain, I, Ahmad, A, Mohammad, A, Ali, Z (2013).Anthropometric profile of school children belonging to different regions of Himachal Pradesh. *European Academic Research*.4(1).
- [10] ICMR Standards (1984).Growth and physical development of Indian infants and children. Indian Council of Medical Research, New Delhi.
- [11] Indian Council of Medical Research (ICMR) (1996). Longitudinal study on growth of Indian Children during adolescence. An ICMR task force study. New Delhi: Indian Council of Medical Research.
- [12] Jayatissa, R, Ranbanda, RM. (2006). Prevalence of challenging problems among adolescent in Sri Lanka. *Food and Nutrition Bulletin*; 27(2).
- [13] Klesges, RC, Shelton ML, Kleges LM. (1993). Effects of television on metabolic rate: Potential implications for childhood obesity. *Pediatr*, 91: 281-286.
- [14] Krishan, K (2007). Anthropometry in forensic medicine and forensic science- forensic anthropometry. *Int J Forensic Sci.* 2(1).
- [15] Kumar R, Sangwan L, Peter R. Malik L. (2014). Anthropometric characteristics and nutritional status of rural primary school children in Fatehabad District of Haryana. *Int J Appl Basic MedRes*.4(1): 322-326.
- [16] Lohman, TG, Roche, AF and Marforell, ER (1988).Anthropometric Standardization Reference Manual. Human Kinetics: Campaign, IL.
- [17] NCHS (2005). Anthropometric Reference data for children and adults: U.S. Population, 199-2002.
- [18] Ravanshad S, Setoudeh-Maram E, Tabatabaee SHR. (1998). Physical growth of 6-18 years old school children in relation to the national center for health statistics standard in Shiraz, Iran. *Irn J Med Sci.* 23(3&4):85-88.
- [19] Saraswathi Y, S, , M, Najafi, Gangadhar, M,R, Malini, S,S (2011). Prevalence of childhood obesity in school children from Rural and urban areas in Mysore, Karnataka, India. *J Life Sci*, 3(1):51-55.



- [20] Sati., V. and Dahiya S.,(2012). Nutritional assessment of Rural School Going Children (7-9 Years) of Hisar District, Haryana.Scientific reports. 1(363):1-4.
- [21] Singh, A, Singh, SP and Kaur, A (2011).Assessment of Health Status by BMI and BP among Adult Men from Punjab, India. J Life Sci, 3(1): 65-67.
- [22] Singh, AP, Sekhon, J, (2015). Anthropometric estimates of nutritional status of school going children of Sri Muktsar Sahib (Punjab) India. Human Biology Review, 4(1), 74-83.
- [23] Stefancic, M.andTomazo-Ravnik T. (1998). A longitudinal observation of growth and body composition in a sample of 10-14 years old children from Ljubljana, Slovenia.*ActaMed.Auxol.*,30(3):161-167.
- [24] Thakur R. and Gautam R.K., (2015).Assessment of nutritional status among girls of 5-18 years of age of a central Indian city (Sagar). Human Biology Review, 4(4):325-336.
- [25] Thakur R. and Gautam R.K., (2016).Differential metabolic rates among the school going boys of a central Indian Town (Sagar). Human Biology Review, 5(2):146-160.
- [26] UNICEF(1997). Nutritional anaemia in South Asia.Malnutrition in South Asia-A Regional Profile.Rosa Publications.75-83.
- [27] World Health Organization. 1995. Physical status: the use and interpretation of anthropometry. Report of the WHO Expert Committee, Technical Report Series, No. 854. Geneva: World Health Organization.
- [28] WHO (1999).Programming for Adolescent Health and Development. WHO Tech Rep Series No.886.Geneva:WHO.
- [29] World Health Organization. (2002). World Health Report 2002: Reducing risks, Promoting Healthy Life. Geneva: World Health Organization.