



**Original Article:**

**Nutritional Status of Households of Rural Field Practice Area of a Tertiary Care Hospital in India**

**MK Sharma**, Professor & Head, Dept., of Community Medicine, College of Medicine & JNM Hospitals, Kalyani, West Bengal,  
**Neeraj Gour**, Assistant Professor, Dept., of Community Medicine, College of Medicine & JNM Hospitals, Kalyani, West Bengal,  
**Dinesh Kumar Walia**, Assistant Professor, Dept., of Community Medicine, Government Medical College, Sector -32, Chandigarh,  
**NK Goel**, Professor & Head, Dept., of Community Medicine, Government Medical College, Sector -32, Chandigarh,  
**Neeraj Agarwal**, Associate Professor, Dept., of Community Medicine, Government Medical College, Sector -32, Chandigarh.

**Address For Correspondence:**

**Neeraj Gour,**

R-14, Rishi Nagar

Hem Singh ki Pared,

Lashkar, Gwalior,

Madhya Pradesh - 474001, India.

**E-mail:** drneeraj\_g04@yahoo.com

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**Abstract:**

**Introduction:** In the world as a whole there appears to be a shift from under-nourishment towards over-nourishment making more and more children, adolescents, adults and even elderly to be overweight and obese. **Objectives:** Study aimed to find out the age and sex wise commonness of over-weight & obesity amongst the families of an overtly different socio-economic environment and its trend in the members of one type of families. **Materials & Methods:** The undergraduate medical students are supposed to maintain record of individual health (including height & weight) of their own family as well as that of the allotted family. The data collected (record maintained) by students was utilized to calculate Body Mass Index (BMI). **Results:** Out of total 291 subjects (males 168; females 123) in students own family 28.9% (28.0%; 30.1%) were overweight and 5.9% (6.0%; 5.7%) were obese. The similar figures for 262 subjects (males 143 & females 119) in the allotted families were 20.2% (18.5%; 20.2%) and 6.5% (4.2%; 8.4%) respectively. The respective percentages of under nourished individuals were 18.6 (17.9; 19.5) and 35.5 (37.8; 32.8). Thus over-nutrition was more common amongst the members of students own families (34.8% vs. 26.7%) and under-nutrition was more common amongst the members of allotted families (35.5% vs. 18.6%) For the years 2000-2003, BMI amongst individuals of students own families the under-nutrition in the age group of 15-24 years amongst males increased from 15.9% to 32.9% and over-nutrition from 13.6% to 20.5%. There was no case of overweight and obesity up to the age of 34 years in the previous analysis which was 2.6% in the present analysis Previous results demonstrated overweight to be more common in males (32.4% Vs. 24.4% in females) and obesity being more common females (6.3% Vs. 2.6% in females). **Conclusion:** Males are increasingly becoming prey of malnutrition (adolescents for under-nutrition and adults & elderly for over-nutrition. More studies covering larger samples are required to be conducted on a more frequent basis.

**Key Words:** Nutritional status; Underweight; Overweight; Obesity.

**Introduction:**

Nutritional status of the people in the entire world is becoming poorer and poorer- crippling the developed nations with over-weight and the developing nations with both under-weight & over-weight. Also the relationship between obesity and poverty is complex: being poor in one of the world's poorest countries (i.e. in countries with a per capita Gross National Product [GNP] of less than \$ 800 per year) is associated with under-weight and malnutrition, whereas being poor in a middle income country (with a per capita GNP of about \$ 3,000 per year) is associated with an increased risk of obesity. Some developing countries faced the paradox of families in which the children are underweight and the adults are overweight. Today more than 1.1 billion adults<sup>1</sup> (1.7 billion with revised definition<sup>2,3</sup>) worldwide are overweight. The obesity accounts for 16% of global disability –adjusted life-years (DALYs). Anti-obesity day is observed on 26<sup>th</sup> November each year. As per WHO the 10 fattest countries of last decade were -American Samoa-93.5%, Kiribati 81.5% USA 66.7%, Germany 66.5%, Egypt 66%, Bosnia-Herzegovina 62.9%, New Zealand 62.7%, Israel 61.9% and U.K. 61%. Taiwan is the first country to introduce Junk Food Tax, it is followed by Romania and then by Australia. The Health Secretary of Britain on 7<sup>th</sup> January 2010 commented, "We are really in danger of being known as the best in the world for watching sport but one the worst for getting out there and doing it for ourselves." Nationally representative surveys show recent increase in the prevalence of overweight and obesity among women of reproductive age in Bangladesh, Nepal and India.<sup>4</sup> The daily news 'The Hindu' in the year 2007 itself also mentioned that India is facing obesity epidemic. Due to large number, India has been requested to join the International Congress on obesity, making it the first nation of developing countries in Asia to be put on obesity map. In a letter to Asia Pacific International Herald Tribune, the then Health Minister Dr. Ramadoss described the nutritional situation in India as "A War with Two Fronts: Hunger and Obesity." In fact in India the double burden of underweight and overweight appears to be present even amongst the adolescents.<sup>5</sup> In a recently conducted nationally representative Indian

survey,<sup>6</sup> the overall prevalence of overweight and obesity combined for India was 13% and 9% in respect of females and males respectively. The same survey demonstrated that the state of Punjab ranks 1<sup>st</sup> in India for obesity. The Chandigarh being the capital of Punjab and also because it was not covered in the above-mentioned survey, the present study was conducted as a pilot project with the following objectives.

1. To find out the prevalence of under nutrition and over nutrition among the members of the families allotted to under graduate medical students.
2. To measure the burden of overweight and obesity among the members of students' own families.
3. To compare the results aimed as above (No.2) with the similar results obtained five years back to find out trend in nutritional status of families' individuals.
4. To compare the nutrition status of medical students families with the similar result of other workers in India and abroad.

#### Materials and Methods:

Chandigarh is the best planned city of India, having just 10% area earmarked as rural. A portion of this area is utilized by the department of community medicine of Government Medical College and Hospital, Chandigarh for the purpose of the field training to medical students. As a part of the curriculum, one family is allotted to each student (who is also supposed to look after his/ her own family). The allotted families are overtly quite different (having lower socio-economic status) from the students own families which are of higher socio-economic status. The undergraduate medical students (numbering 50 in each batch) are supposed to complete the manual provided by the department of Community Medicine. In doing so each student is supposed to be meticulous in ensuring the recording of height and weight of each individual in the family. The faculty members are supervising this process of data collection by accompanying the medical students in the field and also by checking the completeness of manuals at frequent intervals in the department. The medical students are briefed before proceeding to field with special emphasis on methods of height and weight recording. The present study was conducted between 26th Oct 2010 to 5th of Dec 2010. The height was measured in centimeters to the nearest 0.5 cm, and weight was measured in kilograms up to the nearest of 0.5 kg using a bathroom scale. The students were advised to ensure its validation on a daily basis with known weights. The height of the participants was measured by asking them to stand barefoot by facing the back adjacent to the wall and keeping a scale straight on the head. A point was marked by the pencil on the wall. The participants were then asked to move and the length was measured using measuring tape in meters. For calculation of the weight, the participants were asked to stand on the bathroom scale weighing machine, which was placed horizontally on a level surface and participants were asked to stand on it without any footwear and with minimum covered clothing. The data collected (records maintained by students) was utilized to calculate Body Mass Index (BMI) since its measurement has been considered as one of the easiest ways to determine the transition of a person from normal weight to obesity. BMI is simple to calculate and it categorizes a person as underweight, normal, overweight and obese with its stages. Among the study subjects, those who fall under underweight category, were taken as under nutrition, on the other hand those who fall under overweight and obese categories were taken as over nutrition respectively.

Thus, BMI not only identifies the obesity but also persons in pre-obese stages. So a screening Program me based on BMI

would be helpful not only in defining obese but also pre-obese persons so that timely measures would be taken for its correction, prevention and control in a person and in the community as a whole. BMI ranging from 20-24.9 kg /m<sup>2</sup> was considered as optimum, <20 kg/m<sup>2</sup> as underweight and 25-29.9 kg /m<sup>2</sup> as overweight and equal to as or more than 30 kg /m<sup>2</sup> as obese. The cut off point for overweight was taken as 25 and above because few workers<sup>7</sup> still feel that BMI cutoff points for obesity should not vary with ethnic groups. Similarly for underweight the cutoff points were taken as 20 or less as has been used by few workers.<sup>8</sup> Another reason to use the above mentioned cutoff points as 20 or less for underweight and 25 or more for overweight was aimed to compare the results presently obtained with the one obtained in the year 2000-2003 when same cutoff points were used. In fact it is stated that the universally accepted/suggested ideal BMI is 20-24.9 kilogram square-meter.<sup>9</sup>

#### Results:

Table-1 demonstrates that out of total 291 subjects in students own families, 28.9% were overweight, 5.9% were obese and 18.6% were under-nourished. The percent prevalence of under-nutrition decreased as the age advanced from 63.6% in the age group of 5-14 years to 2% in the age group of 45-54 years. There was no individual having under-nutrition from the age of 55 years onwards. The percentage proportion of overweight and obesity (over-nutrition) increased from 16.6% in the age group of 15-24 years to 58.6% in the age group of 45-54 years. After this it decreased to 40.7% in the age group of 55+ years. Obesity alone increased from 2.6% in the age group of 15-24 years to 12.1% in the age group of 45-54 years and then decreased to 7.4%. There was no individual having over nutrition in the age group of 5-14 years.

It is seen from Table-2 that amongst 262 subjects in the allotted families, 20.2% were over-weight, 6.1% were obese and 35.5% were under-nourished. The percent proportion of under-nutrition decreased as age advanced; from 92.3% in the age group of 5-14 years to 8.5% in the age group of 35-44 years and then increased to 14.3% in the age group of 55+years. Contrary to under-nutrition, the over-nutrition decreased with age, being 20% in the age group of 15-24 years to 55% in the age group of 45-54 years and then decreased to 42.9% in the age group of 55+years. Obesity alone increased from 2% in the age group of 15-24 years to 2.8% in the age group of 25-34 years, further to 17% in the age group of 35-44 years and eventually to 20% in the age group of 45-54 years after which the prevalence decreased to 4.8%.

As per the Table-3, for the block year 2000-2003 (previous analysis<sup>10</sup>, the percentage of individuals with optimum BMI was 51.7% and for present analysis (block Year 2004-2008) it was just 46.7%. There was no case of obesity up to the age of 34 years in previous analysis the proportion of which was 2.6% in the present analysis for the same age group. As per the previous analysis, amongst males aged 15-24 years, the under-nutrition and over-nutrition were 15.9% and 13.6% respectively. The similar figures for the present analysis were 32.9% and 23.2% respectively. This indicates an increase of abnormal BMI (both towards under-nutrition and towards over-nutrition) among males which is a point of concern. Previous results demonstrated overweight to be more common in males (32.4% Vs. 24.4% in females) and obesity being more common in females (6.3% Vs. 2.6% in males). The similar figures for present analysis were 28% Vs. 30.1% and 5.7% Vs. 6.0% indicating the blurring of gender difference in overweight and obesity over the time. According to present analysis, for student's own families, among individuals aged 15-24 years, the prevalence of overweight in males and females was 20.5% and 2.4% respectively. For the individuals belonging to the allotted families, similar figures were 30.4% & 7.4% respectively. After the age

of 24 years overweight were more common in females. This trend of overweight being more common among females continued in all age groups up to 54 years (21.9% v/s 17.5% in the age group 25-34 years, 33.3% v/s 30.8% in the age group 35-44 years and 36.4% v/s 33.3% in the age group of 45-54 years). In the age group of 55+ years the prevalence of overweight for

males was significantly more (46.2%) as compared to females (25%). For student's own families' similar trend could not be observed due probably to the small number of individuals in each age group. However, in the age group of 55+ years overweight in males was less (31.6%) as compared to females (37.5%).

**Table 1: Nutritional Status of Individuals of Students' Own Families**

Age (years)	Sex	BMI<20	20-24.9	25-29.9	30 or more	Total	P Value
5-14	Male	3(60.0)	2(40.0)	0	0	5	P= 0.81
	Female	4(67.7)	2(33.3)	0	0	6	
	<b>Total</b>	<b>7(63.6)</b>	<b>4(36.4)</b>	<b>0</b>	<b>0</b>	<b>11</b>	
15-24	Male	24(32.9)	32(43.8)	15(20.5)	2(2.7)	73	P= 0.93
	Female	16(39.0)	23(56.1)	1(2.4)	1(2.4)	41	
	<b>Total</b>	<b>40(35.1)</b>	<b>55(48.2)</b>	<b>16(14.0)</b>	<b>3(2.6)</b>	<b>114</b>	
25-34	Male	2(13.3)	10(66.7)	3(20.0)	0	15	P=0.71
	Female	1(25.0)	3(70.0)	0	0	4	
	<b>Total</b>	<b>3(15.8)</b>	<b>13(68.4)</b>	<b>3(15.8)</b>	<b>0</b>	<b>19</b>	
35-44	Male	0	0	1(100)	0	1	US
	Female	2(10)	9(45.0)	9(45.0)	0	20	
	<b>Total</b>	<b>2(9.5)</b>	<b>9(42.9)</b>	<b>10(47.6)</b>	<b>0</b>	<b>21</b>	
45-54	Male	1(1.8)	24(43.6)	22(40.0)	8(14.5)	55	P=0.33
	Female	1(2.3)	15(34.1)	24(54.5)	4(9.1)	44	
	<b>Total</b>	<b>2(2.0)</b>	<b>39(39.4)</b>	<b>46(46.5)</b>	<b>12(12.1)</b>	<b>99</b>	
55+	Male	0	13(68.4)	6(31.6)	0	19	P= 0.13
	Female	0	3(37.5)	3(37.5)	2(25.0)	8	
	<b>Total</b>	<b>0</b>	<b>16(59.3)</b>	<b>9(33.3)</b>	<b>2(7.4)</b>	<b>27</b>	
All ages	Male	30(17.9)	81(48.2)	47(28.0)	10(6.00)	168	P= 0.83
	Female	24(19.5)	55(44.7)	37(30.1)	7(5.7)	123	
	<b>Total</b>	<b>54(18.6)</b>	<b>136(46.7)</b>	<b>84(28.9)</b>	<b>17(5.9)</b>	<b>291</b>	

US = Unspecified, parenthesis indicate percentages

**Table 2: Nutritional Status of Individuals of Families Allotted to Students**

Age (years)	Sex	BMI<20	20-24.9	25-29.9	30 or more	Total	P Value
5-14	Male	30(93.8)	2(6.2)	0	0	32	P= 0.62
	Female	18(90.0)	2(10.0)	0	0	20	
	<b>Total</b>	<b>48(92.3)</b>	<b>4(7.7)</b>	<b>0</b>	<b>0</b>	<b>52</b>	
15-24	Male	9(37.5)	7(29.2)	7(29.2)	1(4.2)	24	P= 0.12
	Female	13(48.1)	11(40.0)	2(7.4)	1(2.0)	27	
	<b>Total</b>	<b>22(43.1)</b>	<b>18(35.3)</b>	<b>9(17.6)</b>	<b>2(2.0)</b>	<b>51</b>	
25-34	Male	9(21.4)	24(57.1)	7(16.7)	2(4.8)	42	P= 0.88
	Female	5(15.6)	18(56.3)	7(21.9)	2(2.8)	32	
	<b>Total</b>	<b>14(18.9)</b>	<b>42(56.8)</b>	<b>14(18.9)</b>	<b>4(5.4)</b>	<b>74</b>	
35-44	Male	3(11.5)	10(38.5)	8(30.8)	3(14.3)	24	P= 0.40
	Female	1(4.8)	10(47.6)	7(33.3)	8(17.0)	26	
	<b>Total</b>	<b>4(8.0)</b>	<b>20(40.0)</b>	<b>15(30.0)</b>	<b>11(34.0)</b>	<b>50</b>	
45-54	Male	0	5(55.6)	3(27.2)	3(27.2)	11	P= 0.46
	Female	2(18.2)	2(18.2)	4(36.4)	4(36.4)	12	
	<b>Total</b>	<b>2(8.7)</b>	<b>7(30.4)</b>	<b>7(30.4)</b>	<b>7(30.4)</b>	<b>23</b>	
55+	Male	3(13.1)	4(30.8)	6(46.2)	1(12.5)	14	P= 0.28
	Female	0	5(62.5)	2(25.0)	1(4.8)	8	
	<b>Total</b>	<b>3(13.6)</b>	<b>9(40.9)</b>	<b>8(36.4)</b>	<b>2(9.1)</b>	<b>22</b>	
All ages	Male	54(36.7)	52(35.4)	31(21.1)	10(6.8)	147	P= 0.21
	Female	39(31.2)	48(38.4)	22(17.6)	16(12.8)	125	
	<b>Total</b>	<b>93(34.2)</b>	<b>100(36.8)</b>	<b>53(19.5)</b>	<b>26(9.6)</b>	<b>262</b>	

Parenthesis indicate percentages

Age (years)	Sex	2000 - 2003		2004-2008		2004 - 2008	
		BMI<20 (Own family)	BMI > 25 (Own family)	BMI<20 (Own family)	BMI > 25 (Own family)	BMI<20 (allotted family)	BMI > 25 (allotted family)
5-14	Male	9(50.0)	2(11.1)	3(60.0)	0	30(93.8)	8(34.8)
	Female	7(77.8)	2(22.2)	4(67.7)	0	18(90.0)	3(11.1)
	<b>Total</b>	<b>16(59.3)</b>	<b>4(14.8)</b>	<b>7(63.6)</b>	<b>0</b>	<b>48(92.3)</b>	<b>11(22.4)</b>
15-24	Male	34(15.9)	29(13.6)	24(32.9)	17(23.3)	9(37.5)	9(22.5)
	Female	77(39.3)	16(8.2)	16(39.0)	2(4.9)	13(48.1)	9(28.1)
	<b>Total</b>	<b>111(27.1)</b>	<b>45(11.0)</b>	<b>40(35.1)</b>	<b>19(16.6)</b>	<b>22(43.1)</b>	<b>18(25.0)</b>
25-34	Male	4(9.1)	26(59.0)	2(13.3)	3(20.0)	9(21.4)	11(42.3)
	Female	6(27.3)	6(27.3)	1(25.0)	0	5(15.6)	15(71.4)
	<b>Total</b>	<b>10(15.2)</b>	<b>32(48.5)</b>	<b>3(15.8)</b>	<b>3(15.8)</b>	<b>14(18.9)</b>	<b>26(55.3)</b>
35-44	Male	0	2(66.7)	0	1(100)	3(11.5)	6(16.7)
	Female	2(5.0)	90(47.5)	2(10.0)	9(45.0)	1(4.8)	8(72.7)
	<b>Total</b>	<b>2(4.7)</b>	<b>21(48.8)</b>	<b>2(9.5)</b>	<b>10(47.6)</b>	<b>4(8.0)</b>	<b>14(70.0)</b>
45-54	Male	5(2.9)	92(53.5)	1(1.8)	30(54.5)	0	7(53.8)
	Female	2(1.2)	85(50.0)	1(2.3)	28(63.6)	2(18.2)	3(37.5)
	<b>Total</b>	<b>7(2.1)</b>	<b>177(51.8)</b>	<b>2(2.0)</b>	<b>58(58.6)</b>	<b>2(8.7)</b>	<b>10(47.6)</b>
55+	Male	2(3.6)	26(47.3)	0	6(31.6)	3(13.1)	0
	Female	2(7.4)	14(51.9)	0	5(62.5)	0	0
	<b>Total</b>	<b>4(4.9)</b>	<b>40(48.8)</b>	<b>0</b>	<b>11(40.7)</b>	<b>3(13.6)</b>	<b>0(00)</b>
All ages	Male	54(10.7)	177(35.0)	30(17.9)	57(33.9)	54(36.7)	41(28.7)
	Female	96(21.7)	142(30.6)	24(19.5)	44(35.8)	39(31.2)	38(31.9)
	<b>Total</b>	<b>150(15.5)</b>	<b>319(32.9)</b>	<b>54(18.6)</b>	<b>101(37.1)</b>	<b>93(34.2)</b>	<b>79(30.2)</b>
		<b>P&lt; 0.001; X<sup>2</sup>=14.73</b>		<b>P = 0.94; X<sup>2</sup>=0.01</b>		<b>P = 0.51; X<sup>2</sup>=0.43</b>	

Parenthesis indicate percentages

#### Discussion:

The present study demonstrated that the prevalence of over-nutrition (obesity and overweight) was 36.1% in own families and 33.3% in allotted families in the age group of 15+ years. A nationally representative Indian survey<sup>6</sup> has observed that the national average prevalence of it is 11%. The reason for the higher prevalence of over-nutrition in our study might be the overall higher socio-economic status of Chandigarh population as a similar positive correlation of obesity with higher education and wealth index has been by the same survey. The other workers<sup>11,12</sup> have also demonstrated a higher prevalence of obesity amounting to 42.2% & 61.8% respectively using BMI cutoff points of 25 or above and 22.2% and 26% respectively<sup>12,13</sup> using BMI cutoff points of 23 or above amongst north Indian population. The prevalence of obesity has also been observed higher amounting to 45.9% amongst south Indian urban population<sup>14</sup>, 16.4% in South Indian rural population<sup>15</sup>, 32.8% among the population of Madhya Pradesh<sup>16</sup> and 63.9% in Turkey's population.<sup>17</sup> In an Assam based study<sup>18</sup> covering 510 laborers aged 20- 59 years the prevalence of overweight was just 5.7% whereas the prevalence of underweight was 14.3%. In our study for allotted families, in the age group of 15+ years, under nutrition was just 21.4% but over nutrition was 33% indicating a strong point of research as there appears to be something inherent in the environment of Chandigarh which is responsible for higher chances of overweight amongst its residents. Higher prevalence of overweight was observed even for adolescents by other workers e.g. 5.8% in Karnataka amongst affluent school children aged 10-15 years<sup>19</sup>, 9.8% in the age group of 7-12 years in Kerala<sup>20</sup>, 14.5% in children of Gujrat<sup>21</sup>. However, in another Karnataka based study<sup>22</sup> covering 250 adolescent girls aged 13-19 years; none was found to suffer from overweight or obesity whereas 27.6% were under-nourished. In our study for allotted families we observed that in the age group of 15-24 among females, 48.1% were under-nourished in addition to 11.1% being overweight. Regarding the association of overweight with age, in our study for allotted families we observed an increase in overweight as the age advanced, from 18% in the age group of 15-24 years to 38.1% in the age group of 55 years and older. A nationally representative Indian survey<sup>6</sup> demonstrated an increase of overweight from 1.4% in the age group of 15-19 years to 12.9% in the age group of 40-49 years among

males and 2.1% to 17.4% among females. The similar figures for obesity were 0.2%, 2.3% and 0.2%, 6.4% respectively. For students' own families the prevalence of overweight increased from 14% in the age group of 15-24 years to 46% in the age group of 45-54 years and then declined to 33.3% in the age group of 55+ years. In the same way the prevalence of obesity also increased from 2% in the age group of 15-24 years to 20% in the age group of 45-54 years for allotted families and from 2.6% to 12.1% for students' own families. However in the age group of 55+ years, the prevalence went down to 4.8% for allotted families and to 7.4% for students own families. An exactly similar relationship of overweight and obesity with the age has been observed by other workers<sup>16</sup> who observed an increase of overweight from 18.1% in the age group of 21-30 years to 44.5% in the age group of 51-59 years and the increase of obesity from zero per cent in the sage group of 21-30 years to 4% in the age group of 41-50 years and a decrease of obesity to 3.8% as age advanced to 51-59 years. A Turkey based study<sup>17</sup> has also observed a decrease in the prevalence of overweight after 60 years of age. In Madhya Pradesh based study<sup>16</sup> the prevalence of overweight was 36.7% in the age group of 40-50 years and 31.3% in the age group of 70+years. The sex-wise distribution of overweight and obesity was variable and inconsistently directed. The prevalence of extreme obesity (BMI more than 40 kg /sq.m) among males was 6.4 % which gradually decreased to 0% in the age group of 60+ years. In females there was none with extreme obesity in the age group of 30-40 years while in the age group of 40-50 years its prevalence was 1% which gradually decreased to 0% in the age group of 60+ years. In our study in the age group of 15 years and above, the prevalence of overweight was more in females (35.8%) compared to its lower prevalence of 33.9% in males. Similar observations of obesity being more common in females has been observed by different workers in various states/provinces e.g. at National level in India<sup>6</sup> (11% in females v/s 9% in males), 47.4% v/s 43.2% in urban South India<sup>14</sup>, 18.2% v/s 14.5% in rural South India.<sup>15</sup> However a study<sup>16</sup> conducted among individuals of high income group in Madhya Pradesh demonstrated that over-nutrition was more (34.4%) in males as compared its lower prevalence of 31.3% in females. In our study among students own families in the individuals aged 25+ years these similar figures were 44.4% and 55.3% indicat-

ing higher proneness (of this area) for overweight and obesity. The prevalence of overweight in females is higher also among elderly e.g. in a Delhi based study<sup>23</sup> it was 40.3% v/s 34.0%. In fact most studies<sup>24</sup> demonstrate a higher prevalence of overweight among females as compared to males. A study on Greek children and adolescents<sup>25</sup> has demonstrated an almost equal prevalence (20.7 in males; 20.9 in females) of over nutrition amongst males and females. However in the age group of 15-24 years as per our study overweight and obesity was more in males (23.2% vs.4.8% in females) in own family and 4.8% & 11.1% for allotted families. A similar observation of overweight being more common in males has been made by others in a study<sup>21</sup> covering 5664 children (3231 boys; 2433 girls) aged 12 -18 years demonstrating 17.2% of boys and 10.8% of girls as overweight and obese. Prevalence of overweight was high in children belonging to middle socio-economic status as compared to children of higher socio-economic status as per this study and our study. The prevalence of under-nutrition however was almost same in both sexes (70% females; 70.8% males) as per this study.<sup>21</sup> However, an important study<sup>26</sup> has demonstrated that over nutrition was more in females (16.6%) compared to the lower prevalence of 12.5% in males. In our study higher prevalence of under-nutrition among females was observed. A Karnataka based study<sup>19</sup> also observed a higher prevalence of obesity in females (8.8% in females and 4.4% in males). Among allotted families, (one with poor socio-economic status) the children are malnourished and adults are obese. Similar observations have been made by other workers.<sup>27</sup> In a North India based study<sup>28</sup> higher prevalence of over-weight (13.3% in males and 15.6% in females) has been observed even in slums. In our study the observation of lesser prevalence of overweight in the females aged 15-24 years belonging to allotted families may very well be due to the fact that in such poor families majority of the females remain unmarried girls by then and they try to keep themselves fit to get married as they do not have much say in such families. After marriage they get relax and rapidly start gaining weight surpassing their counterpart males. Regarding the trends of overweight and obesity, a nationally representative survey<sup>4</sup> covering 161755 women of reproductive age (15-49 years) demonstrated an increase in obesity during a decade from 10.6% to 14.8%. This increase was both in rural and urban area but more in rural area. It was positively related with age, increase socio-economic status and urban residents. Amongst US population aged 20-74 years<sup>29</sup>, the prevalence of obesity in males increased from 10.7% for the year 1960-1962 to 28.1% for the year 1999 – 2002 and in females from 15.7% to 34.0% for same years. Also extreme obesity is increasing more than over-weight. The trend of more obesity amongst females as compared to male was continuous throughout the years from 1960-2002. NNMB in a study<sup>30</sup> covering nine states demonstrated that the under nutrition among adult males decreased from 56% in the year 1975- 1989 to 37% in the year 2000-2001 and then a slow decline to 33% in the year 2004-2005. Among adult females the similar figures were 52%, 39% and 36% respectively. In our study we observed that there was no decline of under nutrition among males aged 25-44 years; on the contrary it was increased from 8.5% in the years 2000-2003 to 12.5% in the year 2004-2008. However in females there was slight decrease from 12.9% to 11.3% for the same years. An important study<sup>31</sup> on a cohort of 75868 subjects aged 35years and above from the year 1995-2004 demonstrated that the lower BMI was a predictor of mortality, while high BMI was not. A Malaysia based study<sup>32</sup> demonstrated a small increase (from 20.7% in the year 1996 to 26.7% in the year 2003 and 29.1% in the year 2006) in overweight and a larger increase (from 5.5% in the year 1996 to 12.2% in the year 2003 and 14% in the year 2006) in the obesity among adults over the years 1996 to 2009. We in our study did not observe any increase in overweight; instead a decrease was observed (from 32.4% in the year 2000-2003 to

21.7% in the year 2004-2005 in males and from 24.4% to 18.5% in females). However, an increase in obesity from 2.6% to 8.4% in males and from 6.3% to 6.5% in females for the corresponding years was observed paralleling the trends in US<sup>29</sup> where increase in obesity has been found more than overweight increase. An important study<sup>33</sup> covering north Indian adolescents of both sexes conducted over the last five years (2003-2008) had demonstrated a significant BMI increase in both sexes (more so in females).

Small sample size, uni centric and small scale study were some of limitations of study which somehow makes these results less generalizable and applicable .nevertheless it gives an idea and starting point to the researchers to explore it more and more by planning a multicentric ,large scale if possible a longitudinal study in a bid to make these results more valid and implicable.

#### Conclusion:

People are continuously getting succumbed by this creeping and emerging health problem of Malnutrition and dissemination of this problem is not confined with one group, one sex or one race of society, everybody is becoming prey of it. So that it appeals from both at governmental and individual level to make a strategic and effective plan to curtail this rapidly rising malady at earliest.

#### References:

1. Haslam DW, James WP. Obesity. *Lancet*. 2005;366:1197-1209.
2. Steering Committee of the Western Pacific Region of the World Health Organization, the International Association for the Study of Obesity, and the International Obesity Task Force. The Asia –Pacific: Redefining obesity and its treatment. Melbourne, Australia: Health Communications Australia: 2000.
3. WHO expert consultation. Appropriate body-mass index for Asian populations and its-implications for policy and intervention strategies. *Lancet* 2004;363:157-163.
4. Balrajan Y, Villamor E. Nationally representative surveys show recent increase in the prevalence of over-weight and obesity among women of reproductive age in Bangladesh, Nepal and India. *J Nutr* Nov 1, 2009;139(11):2139-2144
5. Jeemon P, Prabhakaran D, Mohan V, Thankappan KR, Joshi PP, Ahmed F et al. Double burden of underweight and overweight among children (10-19 years of age) of employees working in Indian Industrial Units *Natl Med J India*. 2009;22:172-176.
6. National Family Health Survey 2005-2006. International Institute of Population Sciences, Ministry of Health and Family Welfare, 2007.
7. Stevens J. BMI cutoff points for obesity should not vary by ethnic group. In: Medeiros-Neto G, Halpern A, Bouchard C. Progress in Obesity Research: 9. Johan Libbey Eurotext Ltd pp554-557.
8. Gupta R, Rastogi P, Sarna M, Gupta VP, Sharma SK, Kothari R. Body Mass Index, Waist size, Waist Hip Ratio and Cardiovascular Risk Factors in Urban subjects. *JAPI*. Sep 2007;55:621-7.
9. Murthy NS, Agarwal U, Nandakumar BS, Prutvish S, Chaudhary K. Obesity and Colorectal Cancer. *ICMR Bulletin*. Jul-Sep 2009;39(7-9):33-40. Available at [http://icmr.nic.in/bulletin/english/2009/Bul\\_July\\_Sept.pdf](http://icmr.nic.in/bulletin/english/2009/Bul_July_Sept.pdf)
10. Sharma MK, Goel NK, Swami HM, Kaur G .An Epidemiological Study of Non-communicable Diseases amongst the Families of Medical Undergraduates. *Indian Medical Gazette*. 2006;9:400-405.

11. Gupta R, Sarna M, Thanvi J, Sharma V, Gupta VP. Fasting glucose and cardiovascular risk factors in an urban population. *JAPI*. 2007;55:705-709.
12. Gupta R, Thanvi J, Rastogi P, Kaul V, Gupta VP. High prevalence of multiple coronary risk factors in Punjabi Bhatia Community: Jaipur Health Watch-3. *Indian Heart Journal*. 2004;56:646-652.
13. Mishra A, Wasir J, Pandey RM. An evaluation of candidate definitions of the metabolic syndrome in adult Asian Indians. *Diabetes Care*, 2005;28:398-403.
14. Deepa M, Farooq S, Deepa R, Manjula D, Mohan V. Prevalence and significance of generalized and central body obesity in an urban Asian Indian population in Chennai, India. *Eur J Clin Nutr* 2009;63(2):259-267.
15. Kokiwar PR, Gopal Rao J, Shafee MD. Prevalence of coronary risk factors in a rural community of Andhra Pradesh. *Indian J Public Health*. 2009;53:52-54
16. Tiwari R, Shrivastav D, Gour N. A cross-sectional Study to Determine Prevalence of Obesity in High Income Group Colonies of Gwalior City. *Indian J community Medicine*. 2009;34:218-222.
17. Birgul O, Ferhat C, Saime S, Sevet O, Ali I B. Obesity Prevalence in Gaziantep, Turkey. *Indian Journal of Community Medicine*. 2009;34:29-34.
18. Mahanta TG, Ahamd FU, Mahanta BN, Barua A. Prevalence of Hypertension and its Risk Factors in a Tea Garden Community of Dibrugarh District, Assam. *Indian J Public Health*, 2008;52(1):45-47.
19. Kumar S, Mahapalaraju DK, Anuroopa MS. Prevalence of obesity and its influencing factors among affluent school children of Davangere. *Indian Journal of Community Medicine*. 2007;32:15-17.
20. Punjikanan ST, Kumari KS. Augmenting BMI and Waist Hip Ratio for establishing more efficient obesity percentiles among school going children. *Indian Journal of Community Medicine*. 2007;32:135-139.
21. Goyal RK, Shah VN, Saboo VB, Pathak S, Shah NN. Prevalence of overweight and obesity in Indian adolescent school going children; its relationship with socio-economic status and associated life styles. *JAPI*. 2010;58:151-157.
22. Indupalli AS. Health status of adolescent girls in an urban community of Gulbargah district, Karnataka. *Indian J Public Health*. 2009;53:232-234
23. Ingle GK, Nath A. Geriatric Health in India: concerns and solutions. *Indian Journal of Community Medicine*. 2006;33:214-218.
24. Misra A, Khurana L. Obesity and Metabolic Syndrome in developing countries. *J Clin Endocrin Metab*. 2008;93(11):s9-s30.
25. Geordiario GG, Nassis GP. Prevalence of overweight and obesity in a National representative sample of Greek children and adolescents. *Eur J Clin Nutr*. 2007;61:1072-1074.
26. Shah C, Diwan J, Rao P, Bhabhor M, Gokhola P, Mehta H. Assessment of obesity in school children. *Calicut Medical Journal* 2008;6(3):e2.
27. Hossain P, Kawar B, El Nahas M. Obesity and Diabetes in the developing World—A Growing Challenge. *New J Eng Med* 2007;356:213215.
28. Mishra A, Wasir J, Pandey RM, Devi JR, Sharma R, Vikram NK. High prevalence of diabetes, obesity and dislipidemia in an urban slum population in northern India. *Int J Obes Relat Metab Disord*. 2001;25:1722-1729
29. Maxcy-Rosaneau . Preventive Medicine and Public Health Oxford University 2009 page 1077
30. National Nutrition Monitoring Bureau (NNMB) (1989, 2002 and 2006).
31. Sauraget C, Ramadas K, Thomas G, Vinoda J, Thara S, Sankarnarayanan R. Body mass index, weight change and mortality risk in a prospective study in India. *Int J Epidemiol* 2008;37(5):990-1004.
32. Khambalia AZ, Seen LS. Trends in over weight and obesity among adults in Malaysia (1996-2009): A systemic review. *Obesity Reviews*, 2010;11(6):403-412.
33. Singhal N, Mishra A, Saha P, Rastogi K, Vikram NK. Secular Trends in Obesity, Regional Adiposity and Metabolic parameters among Asian Indian Adolescents in Northern India: A comparative data analysis of two selective samples 5 years apart 2003-2008 *Ann Nutr Metab*. 2010;56:176-181.