International Journal of Academic Research and Development
ISSN: 2455-4197
Impact Factor: RJIF 5.22
www.academicsjournal.com
Volume 3; Issue 2; March 2018; Page No. 300-305

Prevalence of obesity among adults of Koraput district, Odisha: An anthropological study

[1] Chandan Kumar Das, [2] Jayanta Kumar Nayak
[1] Research Scholar, Department of Anthropology, Central University of Orissa, Koraput, Odisha, India
[2] Assistant Professor, Department of Anthropology, Central University of Orissa, Koraput, Odisha, India

Abstract
Introduction: Health of adult is the greatest challenge in the 21st century. People from rural as well as urban settings are now prone to more health risks which decreases the individual output, earning capacity, mental illness and quality of life due to overweight and obesity. Koraput is the southern district of Odisha comes under KBK region which is always a focal point for development and healthcare issues.
Objectives: The main objectives of the study were to quantify obesity among the adults of Koraput and to correlate the age with height, body weight, waist circumference, hip circumference, Body Mass Index, Rohrer Index, waist-hip ratio, and Conicity index.
Methods: A cross-sectional study was carried out in three different villages of Koraput district. Both adult males and females (18 years and above) were selected randomly. Revised Body Mass Index (BMI) cut off values for Asian Indians, waist-hip ratio, Rohrer Index, and Conicity Index were taken into consideration for quantifying obesity. Proper measurements like height, body weight, waist circumference, and hip circumference with standardised instruments were also taken with minimum clothing.
Results: According to BMI and Rohrer Index, males are more obese (21.73% and 42.03%) than females (11.39%, and 37.98%). But concerning the central obesity indices like waist-hip ratio, and Conicity Index, the prevalence of obesity is higher in females (46.84%, and 98.10%) than males (20.29%, and 86.96%).
Conclusion: Females are dominatingly obese than males as per central obesity indices. Larger family size, hand to mouth economy striving for more work burden leading to unbalanced and improper dietary pattern is being the root cause of obesity. Challenging socioeconomic factors as well as transforming life style has raised obesity among the adults of Koraput district.

Keywords: obesity, central obesity indices, unbalanced diet, socioeconomic factors

Introduction

Being a global epidemic, obesity has prevailed in all developed as well as developing countries since few decades. It is a key contributor to vital chronic diseases often co-existing with under nutrition in developing countries. Obesity is a multifaceted serious disorder influencing all age groups furnishing a double burden in developing counterparts where nutrition transition is going on [1].

According to WHO (Feb, 2016), 1.9 billion adults (18 years & above) were overweight globally where 650 million adults were obese from them. In Indian context, obesity has reached 10 million cases per year and is very common in teenage onwards. Changing mode of socio-economical factors as well as remarkably changing life style striving towards overweight and obesity [1, 2].

Causes and Consequences of Obesity

Genetics and environment are two pivotal forces for obesity epidemic. Scientists have discovered several genes of our body which can determine the susceptibility to weight gain. Changing socio-economic status of our surrounding by the virtue of rapid industrialization, modernization, urbanization, and economic growth motivated us to live with a sedentary lifestyle which reduces our physical activity. As a result of globalization, urban and semi-urban areas are providing foods which are rich in sugar, saturated fatty acids, high caloric content, and having poor nutritive values. Work burdens as well as unmet family income are giving way to intake unbalanced and inadequate diet in rural areas. However, people from urban settings are more susceptible towards low physical activity which is a root cause for obesity. Consumption of high calorie foods and a great shift from high working level to sedentary life, striving more towards obesity. Globally, obesity rate has risen to three times since 1975 [1].

Increased rate of consuming energy dense foods and reduced activity level give rise to obesity. The health consequence of obesity includes several diet related chronic diseases as well as metabolic imbalances. A number of serious body ailments include type-2 diabetes, cardio vascular disease (CVD), cardiac stroke, hypertension, musculoskeletal problems like osteoarthritis, skin problems, infertility, and certain forms of cancers in the body are being routed through obesity. Obesity has also some metabolic effects on blood pressure, cholesterol, triglycerides, and insulin resistance. Moreover, obesity is the driving force towards all types of chronic disorders that reduces our quality of life [1, 2].

Assessment of Obesity

Obesity can easily be measured through Body Mass Index (BMI). BMI is a very popular tool for Anthropological researchers defined as a person's body weight is divided by square of the height in meters (Kg/m^2). Again the values of

BMI have some cut off points through which we can assess obesity. A BMI value <18.5 is termed as 'Underweight', 18.5-24.9 is 'Normal', ≥25.0 is 'Overweight', and ≥30.0 is 'Obese'. However this cut-off varies across the geographical regions of world. For instance people from Asia having BMI value ≥23.0 are Overweight and ≥25.0 are Obese [3]. Similarly the BMI value above 25 is regarded as Overweight and above 27 is Obese for natives of North America, Europe, and Latin America. Recent studies also configured that people having underweight status in early life tends to overweight and obese in later period with several health complications like hypertension, diabetes, and risk towards Cardio Vascular Diseases (CVDs). Prior to Body Mass Index, other anthropometric indices like Waist-Hip Ratio (WHR), Waist-Height Ratio (WHtR), Conicity Index (CI), Rohrer Index (RI), Abdominal Volume Index (AVI), and Body Adiposity Index (BAI) are worth mentioning for the assessment of obesity.

Obesity Prevention

A long term strategy should be employ including weight maintenance and weight loss for the individuals or groups who are at risk towards developing obesity. Both community and individual level, initiative should implement for the prevention of obesity epidemic. In community level, we can create a healthy and active environment promoting availability and accessibility of low fat and fibre rich foods as well as provide opportunities for physical activity in public places. At individual level we can transform our life styles and dietary pattern. Daily exercise with consumption of vegetables, nuts, and fruits with a balanced diet according to physical status can decrease the risk of developing obesity. Foods which are rich in carbohydrates, fatty acids (animal based fats), oily and junk foods, should be avoided largely. A healthy lifestyle comprising of healthy nutritive balanced diet with regular physical exercise can be the key to succeeding obesity epidemic [1, 2, 3].

Objectives of the Study

The main objectives of the Study are to:

- Quantify obesity among the adults of Koraput.
- Correlate age with height, body weight, waist circumference, hip circumference, Body Mass Index, Rohrer Index, waist-hip ratio, and Conicity index.

Methodology

The proposed study was cross-sectional in nature. Three villages (Padmapur, Kakigan, and Janiguda) of Koraput district were conveniently selected for the study. These three villages were adjacent to the Koraput district headquarter as well as to Semiliguda market. The study has been carried out in 161 households (19 from Padmapur, 129 from Kakigan, and 13 from Janiguda). Adults (Male, and Female) having aged 18 years and above were selected randomly for the assessment of obesity. A total 227 adults (69 Males, and 158 Females) free from pregnancy and severe diseases were taken for quantification of Obesity. Informed consent as well as field ethics was followed during the course of data collection.

Prior to household census, anthropometric measurements like height, and body weight, were taken from each subject for the assessment of obesity. Standardized anthropometry rod and weighing machine has been used for the measurement. Subjects were allowed to stand straight in a plain surface during height measurement and minimum clothing was checked during weight measurement. Both waist and hip circumferences were taken by measuring tape. All the measurements were taken early in the morning and in empty stomach. For Body Mass Index (BMI) analysis, revised WHO cut off (2004) has been applied (<18.5 'Underweight', 18.5-22.9 'Normal', 23.0-24.9 'overweight', and ≥25.0 'obese'). Rohrer Index (RI) category was also followed to measure obesity. The values for Rohrer Index category are '≤1.12' for 'very low', '1.13-1.1.19' for 'low', '1.20-1.25' for 'medium', '1.26-1.32' for 'upper medium', '1.33-1.39' for 'high', and ≥'1.40' for 'very high'. Prior to RI, and BMI, two other central obesity indices were taken into consideration for the assessment of obesity i.e. waist-hip ratio (WHR), and Conicity Index (CI). The cut off ranges for waist-hip ratio categories are '<0.85' for 'excellent', '0.85-0.89' for 'good', '0.90-0.95' for 'average', and '>0.95' for 'at risk' category in males whereas '<0.75' for 'excellent', '0.75-0.79' for 'good', '0.80-0.86' for 'average', and '>0.86' for 'at risk' category in females. Similarly the cut off ranges for Conicity Index categories are '≤1.12' for 'normal', and '>1.12' for 'obese' in males and '≤1.06' for 'normal', and '>1.06' for 'obese' in females. Correlation was also calculated through SPSS 20 version. Dietary pattern was assessed by 24 hour recall method. The formulas for different anthropometric indices are as follows:

Body Mass Index [BMI = (Weight in Kg/ Height in m^2)]

Waist-Hip Ratio [WHR = (Waist Circumference/Hip Circumference)]

Rohrer Index [RI = (Body Weight in gm. / Stature in cm^3) x 100]

$$\text{Conicity Index } [CI = \frac{\text{waist (m)}}{0.109 \times \sqrt{\frac{(\text{Weight(kg)})}{\text{Height (m)}}}}]$$

Socioeconomic Status of Studied Households

For Socioeconomic status, household census was filled up by the researcher. Socioeconomic status was evaluated keeping on view of primary occupation of family members, family income, family size, educational status, housing pattern, knowledge about good health, and balanced diet etc. It was found that most of the adults are daily wage contract labourers followed by some were working at factory and stone mills. It was also found that female adults were more ambitious for income than male adults. Family income ranges between 3500-22000 rupees per month. Remarkably family size is also big, i.e., single member family (10.56%), two members' family (16.15%), three members' family (26.09%), four members' family (26.09%), and more than four members' family (21.11%), has reported in household census. Out of 161 households, 62.73% houses are mud and thatched and/or tiles, 21.74% houses are asbestos with mud floor and rest 15.53% are RCC building. People of the study area were educationally poor and having very little knowledge towards health and sanitation. As per data, 48.29% female were non-literate whereas 51.71% were literate. Similarly 74.08% males were literate whereas only 25.92% males were non-literate.

Results

Table 1: Distribution of Demographic and Anthropometric Indices among Adults

Demographic and Anthropometric Indices	Male (n=69) Mean ±SD	Female (n=158) Mean ±SD	Total (n=227) Mean ±SD	p-Value
Age (Years)	33.29 ± 10.63	34.15 ± 11.72	33.89 ± 11.38	0.604
Height (cm)	160.94 ± 5.72	150.00 ± 5.46	153.33 ± 7.48	<0.001**
Body Weight (Kg)	57.87 ± 11.06	46.41 ± 8.33	49.89 ± 10.62	<0.001**
Waist Circumference (cm)	80.01 ± 10.37	75.00 ± 10.08	76.53 ± 10.40	<0.001**
Hip Circumference (cm)	87.36 ± 8.98	86.53 ± 8.53	86.79 ± 8.66	<0.001**
BMI (Kg/m^2)	22.19 ± 2.83	20.81 ± 5.10	21.50 ± 3.44	0.001**
WHR	0.90 ± 0.11	0.86 ± 0.06	0.88 ± 0.08	0.002**
Rohrer Index	1.38 ± 0.23	1.37 ± 0.23	1.38 ± 0.23	0.776
Conicity Index	1.21 ± 0.14	1.23 ± 0.09	1.23 ± 0.11	0.120

**Correlation is statistically significant at the 0.01 Level (2 tailed)

Table-1 highlights the demographic and anthropometric indices among adults of Koraput district. Of total 227 adults, mean age is 33.89 years followed by mean height, and weight is 153.33 cm and 49.89 Kg respectively. In case of males the mean age is 33.29 whereas in female, the mean age is 34.15 years. Compared to female, mean height, and weight is higher in males (160.94 cm, and 57.87 Kg). Females are having mean height, and weight of 150.00 cm, and 46.41 Kg. The mean waist, and hip circumferences of adults are 76.53 cm, and 86.79 cm followed by higher in males (80.01 cm, and 87.36cm) than females (75.00 cm, and 86.53 cm). The mean BMI and waist-hip ratio (WHR) among all adults are 21.50, and 0.88. Incidence of mean BMI and WHR are also higher in males (22.19, and 0.90) than females (20.81, and 0.86). Similarly the mean values of Rohrer Index (RI) and Conicity Index (CI) are 1.38, and 1.23 respectively. Rohrer Index is higher in males (1.38) followed by females (1.37) but Conicity Index is lower in males (1.21) than females (1.23). Correlation is also statistically significant at the 0.01 level (2 tailed) with height, weight, waist circumference, hip circumference, BMI, and WHR.

Table 2: Age Group Wise Distribution of Body Mass Index (BMI) among the Adults

Age Groups (Years)	Body Mass Index Male		Body Mass Index Female		Body Mass Index Total	
	Number (n)	Mean ±SD	Number (n)	Mean ±SD	Number (n)	Mean ±SD
18-30	35	21.60 ± 3.26	72	20.05 ± 9.25	107	20.85 ± 3.13
31-40	18	25.02 ± 4.45	41	21.07 ± 3.43	59	23.04 ± 4.16
41-50	11	19.88 ± 1.73	31	21.13 ± 4.43	42	20.50 ± 3.92
51 & Above	5	22.20 ± 1.87	14	21.00 ± 3.27	19	21.60 ± 0.17
Total	69	22.19 ± 2.83	158	20.81 ± 5.10	227	21.50 ± 3.44

Table-2 depicts about age group wise distribution of all adults (males, and females) into mean BMI values. Adults are categorized into four age groups, i.e. 18-30, 31-40, 41-50, and 51 & above. Mean BMI among adults is 21.50. Comparatively, mean BMI is higher in males (22.19) than females (20.81). Again, the mean values of BMI among adults are higher in 31-40 age group (23.04) followed by 21.60 in 51 & above age group, 20.85 in 18-30 age groups, and least in 41-50 age group (20.50). The mean BMI values of male adults are higher than female adults in all age groups except in 41-50. In male adults, the maximum mean BMI value is 25.02 (31-40 age group) and minimum is 19.88 (41-50 age group). Similarly, in female adults the maximum mean BMI is 21.13 (41-50 age groups) while minimum mean BMI is 20.05 (18-30 age group). A fluctuation of mean BMI witnessed among all age groups of male adults than female adults. As compared to female adults, male adults are having higher mean BMI value (22.19) than female adults (20.81).

Table 3: Category Wise BMI Status of Adults

BMI Categories (WHO,2004)	Male		Female		Total	
	Number (n)	Percent (%)	Number (n)	Percent (%)	Number (n)	Percent (%)
Underweight (<18.5)	09	13.04	43	27.22	52	22.90
Normal (18.5-22.9)	33	47.83	79	50.00	112	49.34
Overweight (23.0-24.9)	12	17.39	18	11.39	30	13.22
Obese (≥25.0)	15	21.74	18	11.39	33	14.54
Total	69	100	158	100	227	100

Table-3 represents the classification of Adults (Males, and Females) into different BMI categories according to WHO (2004). The prevalence of obesity among adults is 14.54%, followed by overweight is 13.22%, normal is 49.34%, and underweight is 22.90%. Again percent prevalence of underweight, normal, overweight, and obese in male adults is 13.04, 47.83, 17.39, and 21.74 respectively. Similarly the percent prevalence of underweight, normal, overweight, and

obese in female adults is 27.22, 50.00, 11.39, and 11.39 respectively. Compared to male adults, female adults are excess (27.22%) in underweight category. In overweight category, male adults are having higher prevalence (17.39%) than female adults (11.39%). Concerning the obese category, prevalence of male adults are also higher (21.74%) than female adults (11.39%). Male adults have higher percent prevalence of overweight and obesity than female adults.

Table 4: Category Wise Distribution of Rhorer Index among Adults

Rohrer Index Category	Male		Female		Total	
	Number (n)	Percent (%)	Number (n)	Percent (%)	Number (n)	Percent (%)
Very Low (≤1.12)	07	10.14	23	14.56	30	13.22
Low (1.13-1.19)	06	8.70	14	8.86	20	8.81
Medium (1.20-1.25)	12	17.39	18	11.39	30	13.22
Upper Medium (1.26-1.32)	08	11.59	22	13.92	30	13.22
High (1.33-1.39)	07	10.15	21	13.29	28	12.33
Very High (≥1.40)	29	42.03	60	37.98	89	39.20
Total	69	100	158	100	227	100

Table-4 represents the category wise distribution of Rohrer Index among adults. Rohrer index is categorise into six categories i.e. very low (≤1.12), low (1.13-1.19), medium (1.20-1.25), upper medium (1.26-1.32), high (1.33-1.39), and very high (≥ 1.40), and obviously the last category is consideration for obesity. According to the Rohrer Index, 39.20% adults are in 'very high' category followed by higher in males (42.03%) than females (37.98%). The percent prevalence of adults in 'very low', 'low', 'medium', 'upper medium', and 'high' category are 13.22%, 8.81%, 13.22%, 13.22%, and 12.33% respectively. In 'very low', and 'low' category females are in higher prevalence (14.56%, and 8.86%) than males (10.14%, and 8.70%). Percent prevalence medium category of male adults is higher (17.39%) than females (11.39%). Similarly in 'upper medium', and 'high' category, percent prevalence of male and female adults are 11.59%, 10.15%, and 13.92%, and 13.29% respectively. In ''very high' category, the prevalence of male adults is higher (42.03%) than females (37.98%).

Table 5: Age Group Wise Distribution of Waist-Hip Ratio among Adults

Age Groups (Years)	Waist-Hip Ratio Male		Waist-Hip Ratio Female		Waist-Hip Ratio Total	
	Number (n)	Mean ±SD	Number (n)	Mean ±SD	Number (n)	Mean ±SD
18-30	35	0.91 ± 0.17	72	0.86 ± 0.06	107	0.88 ± 0.10
31-40	18	0.92 ± 0.18	41	0.87 ± 0.06	59	0.89 ± 0.09
41-50	11	0.88 ± 0.05	31	0.87 ± 0.06	42	0.87 ± 0.05
51 & Above	5	0.89 ± 0.06	14	0.86 ± 0.05	19	0.87 ± 0.05
Total	69	0.90 ± 0.11	158	0.86 ± 0.06	227	0.88 ± 0.08

Table-5 shows age group wise distribution of waist-hip ratio (WHR) among adults. The mean waist-hip ratio among adults in all age groups is 0.88, followed by highest in 31-40 age group (0.89), and lowest in 41-50, and 51 & above age groups (0.87, and 0.87). Mean WHR of adults in 18-30 age group is 0.88. Compared to females, males have higher waist-hip ratio (0.91, 0.92, 0.88, and 0.89 in 18-30, 31-40, 41-50, and 51 & above age groups respectively) than females (0.86, 0.87, 0.87, and 0.86 in 18-30, 31-40, 41-50, and 51 & above category). The mean WHR is comparatively higher in males (0.90) than females (0.86).

Table 6: Category Wise Distribution of Waist-Hip Ratio among Adults

Waste-Hip Ratio Category	Male		Female		Total	
	Number (n)	Percent (%)	Number (n)	Percent (%)	Number (n)	Percent (%)
Excellent	14	20.29	1	0.63	15	6.61
Good	18	26.09	17	10.76	35	15.41
Average	23	33.33	66	41.77	89	39.21
At Risk	14	20.29	74	46.84	88	38.77
Total	69	100	158	100	227	100

Table -6 depicts about the distribution of adults into various waist-hip categories like 'excellent', 'good', 'average', and 'at risk'. Of total 227 adults (males, and females), 38.77% adults are in 'at risk' category who are in obese condition. In 'average' category 39.21% adults are found whereas the percent prevalence of WHR in 'excellent' and 'good' category is 6.61%, and 15.41% respectively. Compared to males, females are having higher percent prevalence of 'average', and 'at risk' condition (46.84%, and 41.77%) than males (33.33%, and 20.29%). However in 'excellent', and 'good' category the percent prevalence of males is higher (26.09%, and 20.29%) than females (0.63%, and 10.76%).

Table 7: Category Wise Distribution of Conicity Index among Adults

Conicity Index Category	Male		Female		Total	
	Number (n)	Percent (%)	Number (n)	Percent (%)	Number (n)	Percent (%)
Normal	09	13.04	03	1.90	12	5.29
Obese	60	86.96	155	98.10	215	94.71
Total	69	100	158	100	227	100

Table-7 represents the prevalence of obesity among adults according to the Conicity index. Of total adults, the percent prevalence of obesity is extremely high i.e. 94.71% followed by 5.29% of adults are in normal condition. The prevalence of obesity among females is highest i.e. 98.10% followed by 86.96% in males. Again males are higher in normal condition (13.04%) than females (1.90%).

Discussion

Among adults the prevalence of obesity is 14.54%, 39.20%, 38.77%, and 94.71% according to BMI, Rohrer Index, WHR, and Conicity Index respectively. As per the results of different anthropometric indices, the prevalence of obesity is higher in male adults [(21.74% in BMI), and (42.03% in 'very high' category of Rohrer Index)] than female adults [(11.39% in BMI), and 37.98% in 'very high' of Rohrer Index)]. But concerning the central obesity indices, prevalence of obesity among females is higher [(46.84% in 'at risk' category of WHR), and (98.10% in Conicity Index)] than males [(20.29% in 'at risk' category of WHR), and 86.98% in Conicity Index)]. There is also a correlation (0.01 level, 2 tailed) found between age with height, body weight, waist circumference, hip circumference, BMI, WHR, Rohrer Index, and with Conicity Index. Females are at a great risk towards obesity and more prone to developing chronic diseases than males. The probable reasons for incidence of obesity among adults are the changing life style as well as improper dietary habit. All the working adults inhabits near to the urban centre (Semiliguda market & Koraput market). The contractors are taking the labourers to the urban centres for road construction, building constructions, stone mills, and brick factories. Working adults are habituated with the market foods which are rich in calories. Improper dietary habits like consuming only two times, postponed lunch after targeted work, consuming more food as required at a particular time, bring about imbalances in dietary habits. Though people are residing in a nuclear family, their family size is relatively large. Simultaneously low family income is major cause to work burden as well as physical stress. Female adults are involving in daily waged contract work with household works leads to more energy expenditure and minimum consumption nutritive food due to hand to mouth economy, is a root cause towards higher prevalence of obesity. It is also observed that females are consuming more carbohydrates and sugar oriented foods in their diet. Most often females are taking foods in hotels rich in fatty acids and excess oil, may be the reason for develop risk towards obesity. It is also seen that while returning towards home, both male and female adults are taking road side fancy foods like chawmin, burger, rolls, manchurian, egg puffs, and varieties of pastries, may be the cause towards developing obesity. Male adults are relatively passive than female adults. Rapid urbanization may be the factor which is responsible for the changing life style from active to nearly sedentary level leading to higher prevalence of obesity among adults. Dominating mentality as well as imbibing with modern life style is the root cause towards obesity. Other supplementary reasons for developing obesity are comparatively low temperature along the year, passiveness towards physical exercise, very poor knowledge towards health and nutrition. If the current trends going on, the situation can be very worse within a decade.

Conclusion

Obesity, being a root towards many serious chronic diseases, is a fact of concern now days. A long term strategy should be inculcated in our daily life towards the eradication of obesity epidemic. Awareness toward healthy life style and balanced diet is required for the adults of Koraput who are presently in a state of developing obesity. Community as well as individual level initiative may be more fruitful towards prevention of obesity. An epidemiological research is needed in this area for assessment of obesity as well as the factors behind the development of obesity. Then only we can able to find out the proper remedies of obesity epidemic.

Acknowledgement

The authors are highly acknowledged & would like to give thanks to the adults of Koraput for their active participation in the study.

References

1. WHO (World Health Organization). Obesity and Overweight. Global Strategy on Diet, Physical Activity and Health, 2003.
2. http://www.who.int/dietphysicalactivity/media/en/gsfs_obesity.pdf Dated: 20.02.2018.
3. Sidhu S, Kumari K. Incidence of Overweight and Obesity among Urban and Rural Males of Amritsar. Journal of Exercise Science and Physiotherapy, 2006; 2:79-83.
4. Sidhu S, Sandhu HK. Assessment of overweight and obesity among urban adult males of Amritsar (Panjab). Journal of Exercise Science and Physiotherapy. 2005; 1:89-91.
5. Aziz N, Kallur SD, Nirmalan PK. Implication of the Revises Consensus Body Mass Indices for Asian Indians on Clinical Obstetric Practice. Journal of Clinical & Diagnostic Research. 2014; 8(5): 01-03.
6. Gopalan C. Obesity in the Indian urban middle class. NFI Bulletin, 1998; 6:175-179.
7. Gopalan C. Rising Incidence of obesity, coronary heart disease and diabetes in the Indian urban middle class, possible role of genetic and environmental factors. World

Review of Nutrition and Diet, 2001; 90:127-143.
8. Reddy KS, Pravakara D, Shah P. *et al*. Differences in body mass index and waist-hip ratio in North Indian rural and urban populations. Obesity Review, 2002; 3:197-202.
9. Flegal KM, Carroll MD, Ogden CL. *et Al*. Prevalence and trends in obesity among US adults,1999-2000. Journal of American Medical Association. 2002; 288:1723-1727.
10. Zargara AH, Masoodi SR, Laway BA. *et al*. Prevalence of obesity in adults: an epidemiological study from Kashmir valleys of the Indian subcontinent. J Assoc. Physicians India. 2000; 48(12):1170-1174.
11. Visweswar Rao K., Balakrishna N, Shatrugna V. Variation in forms of malnutrition in well-to-do adults and the associated factors. Man in India, 1995; 75:241-249.