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Age variations in obesity, adiposity and central body fat distribution among Bengalee urban adult male of North 24 Parganas, West Bengal, India

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Abstract

The prevalence of obesity is increasing in most populations of world, affecting the children, adolescents and adult. Aim of the present cross-sectional study is to find out age variation in adiposity, obesity and central body fat distribution among the adult Bengalee Hindu men aged between 20-50 years and also the prevalence of obesity and overweight among them. The studied men population was divided into three groups: Group I (20-29 years), Group II (30-39 years) and, Group III (40+ years). Result shows that aging has some significant effect on adiposity, obesity and central body fat distribution among the study population. Men in Group III had higher means in compared with the rest of the groups. The individuals in Group II had the intermediate values. When considering the generalized obesity the results revealed that more number of men in Group III were obese and overweight and the prevalence of obesity less in Group I and intermediate in Group II. In case of central obesity the result is same Group III has high frequency. One of the important outcomes of this study is that over all occurrence of central obesity is higher than the generalized obesity.

Keywords: Adiposity, android, Bengalee, conicity index, gynoid, obesity.

Introduction

Distribution of fat and the amount of fat in human body is very important to calculate the risk factor of various diseases. Abnormal fat distribution is strongly associated with various diseases. When excess body fat is accumulated in the body a condition developed which is known as obesity. Obesity is worldwide public health problem; in last few decades, prevalence of obesity has increased at alarming rate all over the world not only in western hemisphere, but also in the developing countries (WHO, 1998). It arises when intake of the food is in excess of physical needs that means when the energy balance is not correct. Kopelman (2000) suggests that obesity is now so common in the world's population that it is beginning to replace under nutrition and infectious disease as the most significant contributor to ill health. The prevalence of obesity recently increased in

Asia as well as western countries (Ohzeki et al., 1990).

Obesity has also been defined as a condition in which excess accumulation of fat in adipose tissue. In normal man percentage of body fat is 15-18percent. In normal individual 65-70percent of adipose tissue is fat and 15-30percent of total body weight constitutes with adipose tissue. Distribution of fat is very important in the study of obesity. Vague in 1956 was the first to point out that there may be two type of human obesity (android and gynoid), depending upon bodily distribution of fat. Furthermore he emphasized that individuals with android obesity (upper body obesity) had more risk of developing health problems than the gynoid (lower body obesity).

BMI can be considered to provide the most useful for estimation of the prevalence generalized obesity within the population and the risk associated with it. It is more highly correlated with body fat than other indices. In the present study BMI is used to understand the prevalence of obesity in different age group and the variation within them. A graded classification of overweight and obesity using BMI value provide valuable information about increased body fatness. It allows meaningful comparison of weight status within and between populations. For meaningful comparison between or within populations, WHO (2000) advised to use the single BMI cut-off points. A BMI of 30 or more is widely accepted as obese. It allows firm basis for evaluating intervention.

Obese individual with excess fat in the intra-abdominal depots are at particular risk of the adverse health consequences of obesity. Waist circumference is a good indicator of deep adipose tissue and it is related to fat mass and when it used in a ratio with hip circumference is also a good indicator of masculine distribution of adipose tissue. Waist circumference is a convenient and simple measurement that is unrelated to height, but correlates closely with BMI and WHR and is an approximate index of intra abdominal fat mass and total body fat (Lean et al., 1996).

The conicity index (CI) implies that abdominal obesity is modeled as progression of a body from a cylindrical shape towards the shape of a double cone, i.e., two cones with a common base at waist level. Unlike WHR, it takes into account the overall adiposity of the individual and is also independent of hip circumference. Theoretically, the predicted range of CI is between 1.00 (perfect cylindrical) and 1.73 (perfect double cone) (Valdez, 1991). Conicity index has been reported to be associated with various CHD factors to a similar extent as WHR (Valdez, Seidell, Ahn and Weiss, 1993).

Several studies from India have dealt with age changes in adiposity obesity and body fat distribution. A few studies have been conducted in the Bengalee population. A cross-sectional study of 279 older (50+ years) urban Bengalee Hindu Women was undertaken to find out the age variation in adiposity and central body fat distribution by Bose and Das Chaudhuri (2000 a). Another study is age trends in anthropometric characteristic among elderly population of Bengalee Hindu men in Calcutta, India (Bose et al., 2000b). A study on age and sex variation in adiposity and central body fat distribution was conducted by Gosh, Bose and Das Chaudhuri in 2001. Bhadra, Mukhopadhyay and Bose conducted a study on prevalence of overweight and obesity among adult Bengalee Hindu women of Kolkata, India in 2003. No study on obesity, adiposity, and central body fat distribution among adult men aged between 20 to 50 years has been reported from the Bengalee population. Aim of the present study is to find out age variation in adiposity, obesity and central body fat distribution among the adult Bengalee Hindu men aged between 20-50 years and also the prevalence of obesity and overweight among them.

Materials and Methods

Present study was conducted among adult Bengalee Hindu males residing at Barasat area within the jurisdiction of Kolkata Metropolitan Development Authority (KMDA) in the district of North 24 parganas, West Bengal, India. The study population of present investigation consisted of 300 males aged 20 to 50 years. The mean age of the population is 36.82 (sd +/- 9.25).

Requisite information on socio-demographic profile was collected by interview schedule method. A total four anthropometric measurements were taken for each subject. These antropometric measurements include height, weight and two circumferences - minimum waist circumference and maximum hip circumference. Body mass index (BMI), conicity index (CI) and waist-hip ratio (WHR) were calculated using the measurements mentioned above. Body mass index and waist hip ratio were computed using standard equation of (WHO, 2000).

All the anthropometric measurements were made by investigator using standard anthropometric technique (Lohman et al., 1988). Height was measured to the nearest 0.1 cm using Martin's anthropometer and the body weight of the subject was recorded to nearest 0.5 Kg on weighing scale. Both for height and weight the subject were requested to remove their shoe and wearing minimum cloth. Circumference measurements were made to the nearest 0.1 cm, using a steel tape. Minimum waist circumference was measured at the smallest circumference of the torso, which is the level of natural waist. Maximum hip circumference measurement was made horizontally at the level of maximum extension of the buttocks.

From the four anthropometric measurements– height, weight, minimum waist circumference and maximum hip circumference, body mass index (BMI), conicity index (CI), and waist-hip ratio (WHR) are calculated. BMI is the ratio between body weight in kg and square of height in meter, expressed as BMI= weight/height (kg/m^2). CI is the index for measuring the central adiposity. It was derived from the equation proposed by Valdez et al., (1993), where the waist circumference or abdominal girth is in meter, weight in kg, and height in meter. The value 0.109 is a constant that result from conversion of units of volume and mass into units of length. CI = waist circumference in m / 0.109√(weight in kg / height in m). WHR it is the ratio of minimum waist circumference and the maximum hip circumference. It is the indicator of abdominal adiposity. WHR = waist circumference (cm) /Hip circumference (cm).

Data were collected on a pre-designated pro-forma and finally these data were transferred in to tabular form. The descriptive statistics like mean, standard deviation, were calculated using the specific statistical formulae. Variation within the age group individuals and between age group individuals of adiposity, obesity and central body fat distribution was examined using analysis of variance (ANOVA).

Results and Discussion

The mean and standard deviation (SD) of seven anthropometric variables, height, weight, minimum waist circumference, maximum hip circumference, body mass index, waist-hip ratio and conicity index of study population consisting of 300 Bengalee adult males were presented in the Table 1. The mean weight of

Table 1. Anthropometric characteristics of study population (n=300).

Variables	Mean	SD
Height (cm)	165.09	6.77
Weight (kg)	63.21	12.32
Body mass index (Kg/m^2)	23.11	3.87
Minimum Waist circumference (cm)	81.95	10.47
Maximum Hip circumference (cm)	90.75	8.26
Waist-hip ratio	0.90	0.08
Conicity index	1.22	0.09

Table 2. Anthropometric characters and derived indices by age group of study population.

Variables	Age Group					
	Group-I 20-29years		Group-II 30-39 years		Group-III 40+ years	
	n=89		n=88		n=123	
	Mean	SD	Mean	SD	Mean	SD
Height (cm)	166.40	6.82	165.00	6.57	164.13	6.77
Weight (kg)	61.55	11.65	63.80	13.20	64.00	12.10
Body mass index (Kg/m^2)	22.15	3.48	23.27	4.02	23.69	3.93
Minimum waist circumference (cm)	78.87	10.04	81.20	10.50	84.70	10.09
Maximum hip circumference (cm)	89.25	8.25	90.70	8.16	91.80	8.23
Waist-hip ratio	0.88	0.06	0.89	0.06	0.93	0.01
Conicity index	1.19	0.09	1.20	0.08	1.25	0.10

Table 3. Analysis of variance (ANOVA) of anthropometric variables.

Anthropometric Variables	Square of Variance	df	Sum of square	Mean sum of square	F ratio	Remarks
Height (cm)	Between the age groups	2	131.870	65.935	1.44	Not significant (P>0.05)
	Within the age group	297	13560.587	45.659		
	TOTAL	299	13692.457			
Weight (kg)	Between the age groups	2	399.839	199.920	1.32	Not significant (P>0.05)
	Within the age group	297	44981.072	151.451		
	Total	299	45380.912			

WC (cm)	Between the age groups	2	1783.407	891.704	6.07	Significant (P< 0.05)
	Within the age group	297	43597.504	146.793		
	Total	299	45380.912			
HC (cm)	Between the age groups	2	398.718	199.359	2.96	Not significant (P>0.05)
	Within the age group	297	20004.146	67.354		
	Total	299	20402.864			
WHR	Between the age groups	2	0.099	0.050	7.55	Significant (P< 0.05)
	Within the age group	297	1.949	0.007		
	Total	299	2.048			
BMI (kg/m^2)	Between the age groups	2	109.335	54.667	3.72	Significant (P<0.05)
	Within the age group	297	4366.428	14.702		
	Total	299	4475.763			
CI	Between the age groups	2	0.289	0.144	18.48	Significant (P<0.05)
	Within the age group	297	2.318	0.008		
	Total	299	2.607			

Table 4. Prevalence of underweight and obesity by age group categories.

Categories	**Group I (20-29 yrs)**		**Group II (30-39 yrs)**		**Group III (40+ yrs)**	
	Number of Individuals	**%**	**Number of Individuals**	**%**	**Number of Individuals**	**%**
Underweight	17	19.10	13	14.77	13	10.57
Normal	49	55.06	45	51.14	65	52.85
Over weight	21	23.60	27	30.68	40	32.52
Obese-I	2	2.25	2	2.27	4	3.25
Obese-II	0	0.00	1	1.14	1	0.81
Obese-III	0	0.00	0	0.00	0	0.00
TOTAL	89	100.00	88	100.00	123	100.00

Table 5. Prevalence of overweight and obesity among study population.

Age Group	Sample size	Overweight (BMI 25.0-29.99)	Obese (BMI >29.99)
Group I (20-29 yrs)	89	21 (23.6)	2 (2.25)
Group II (30-39 yrs)	88	27 (30.68)	3 (3.41)
Group III (40+ yrs)	123	40 (32.52)	5 (4.07)
All ages combined	300	88 (29.33)	10 (3.33)
Percentages are presented in parentheses			

Table 6. Obesity based on waist circumference in study population.

Age Group	Sample size	Normal	Centrally obese
Group I (20-29yrs)	89	48 (53.93)	41 (46.07)
Group II (30-39yrs)	88	43 (48.86)	45 (51.14)
Group III (40+ yrs)	123	33 (26.83)	90 (73.17)
All age combine	300	124 (41.33)	176 (58.67)
Percentages are presented in parentheses			

Table 7. Obesity based on waist-hip ratio in study population.

Age Group	Sample size	Normal	Centrally obese
Group I (20-29yrs)	89	55 (61.80)	34 (38.20)
Group II (30-39yrs)	88	44 (50.00)	44 (50.00)
Group III (40+ yrs)	123	43 (34.96)	80 (65.04)
All age combine	300	142 (47.33)	158 (52.67)
Percentages are presented in parentheses			

the study population is 165.09 +/- 6.77 cm and the mean weight is 63.2 +/- 12.32 kg. In case of waist circumference and hip circumference means are found to be 81.95 +/- 10.47 cm and 90.75 +/- 8.26 cm respectively. Whereas mean waist-hip ratio, derived from waist and hip circumferences, is calculated and found to be 0.90 +/- 0.06. Using the measurements height and weight an index derived, known as body mass index. BMI, which is a good indicator of obesity, possesses the mean of 23.11 +/- 3.87 kg/m^2 in the study. The mean value of conicity index of Bengalee adult male of present study is 1.22 +/- 0.09.

In the present study of 300 male individuals aged between 20 to 50 years are classified in to three age groups, Group I (20-30 years), Group II (30-39 years) and Group III (40 years and above). The mean height of the subject of the group I is 166.40 +/- 6.82 cm whereas in group II and group III it is 165.0 +/- 6.57 cm and 164.13 +/- 6.77 cm respectively. The mean weight of the group I is 61.55 +/- 11.65 kg and in-group II it is 63.80 +/- 13.20 kg and in case of group III mean weight is 64.00 +/- 12.10 kg. A gradual increase in mean weight is observed among the individuals of group I to group III. Whereas mean height of the individuals of group I is greater than the group II and group III. Using the two measurements height and weight, an index is calculated which is known as body mass index. The individual of group I possesses mean BMI 22.15 +/- 3.84 kg/m^2 and in group II and group III the mean values are 23.27 +/- 4.02 and 23.69 +/- 3.93 respectively. Here an increase in mean BMI is observed gradually from individuals of group I to group III. This indicates a gradual increase in fat accumulation from group I to group III.

Waist circumference, which is an indicator of deep adipose tissue and, it is related to fat mass. Mean minimum waist circumference of group I is 78.87 +/- 10.04 cm and in group II it is 81.20 +/- 10.50 cm and in group III it is 91.80 +/- 8.23 cm. Mean waist circumference which is an indicator of central obesity is increased with the increasing age from age group I to age group III gradually. Maximum hip circumference of group II have the mean value of 89.25 +/- 8.25 cm, and among the individuals of group II the mean value is 90.70 +/- 8.16 cm and group III possesses the mean 91.80 +/- 8.23 cm.

Waist circumference when used in a ratio with hip circumference, waist-hip ratio, is a good indicator of central body fat distribution. High waist-hip indicates central obesity. Mean waist-hip ratio of group I is 0.88 +/- 0.06, group II shows the mean of 0.89 +/- 0.06 and group III shows a little higher mean than the previous two age groups, 0.93 +/- 0.01. This result suggests that abdominal fat deposition is increased gradually from group I tom group III as age progresses.

Conicity index is another measure of central adiposity. The conicity index is derived from the measurements waist circumference, weight and height. The mean coniocity index of group I is 1.19 +/- 0.09, in-group II it is 1.20 +/- 0.08 and finally in group II the mean is 1.25 +/- 0.10. Group III has the higher mean than the group I and group II. This indicates that the deviation from the circumference of an imaginary cylindrical shape to a double cone shape.

Table 3 represents the analysis of variance of the anthropometric variables. Analysis of variance (ANOVA) was performed to test the age variation in the level of adiposity, obesity and central body fat distribution among the Bengalee adult men aged 20 to 50 years. The result reveals that there was no significant difference in mean height ($p>0.05$) of male adult individuals belonging to three different age groups mentioned earlier. This is because all the subjects under study belong to the Bengalee adult population. After18 years of age growth in height is generally ceased so there is no further increase in height. Among aged persons after attainment of 55 years or above the height may decrease due to the effect of aging. A slight increase of mean weight is observed among males belonging to three age groups. But the result of ANOVA indicates that there is no age group variation in weight ($p>0.05$). That means age has no influence on body weight in the present study. HC (hip circumference) also shows similar result. WC (waist circumference), WHR (waist-hip ratio), BMI (body mass index), show significant value of F test ($P<0.05$) among the males belonging to the three age groups under study. It is established and also mentioned earlier that the BMI gives generalized obesity–adiposity of an individual's where as WC, WHR, and CI provide the condition of central obesity of an individual. In the present study significant values of F-test ($P<0.05$) in case of above three measurements among the Bengalee adult males of three suggest that aging has some effect on this variables. The significant positive correlations of age with these variables have been studied in the Bengalee population (Ghosh et al., 2001, Ghosh, 2002).

The frequency of underweight and, overweight and obese individual is presented in the Table 4. The frequency of underweight (BMI<18.5) is gradually decreasing with the increase of age. Group I has highest frequency of underweight individuals (19.10%) and in group III it is lowest (10.57). the frequency of obese individuals in different age groups are slightly different from each other. Obese III

(BMI>40.00) was not found among studied population. Obese II (BMI>35.00) was also not found in age group I.

Table 5 represents the frequency of obese and overweight subjects on the basis of body mass index. The frequency overweight is quite higher in the studied samples (29.33%). the number of overweight individuals are more in group III, the frequency is 30.68% and the frequency of overweight is low (23.60%) in group I. In group II the frequency is 30.68% that is closer to the frequency of group III. This indicates that the amount of excess fat deposition in the body increased with increasing age. The overall prevalence of obesity in the studied population is 3.33%. The frequencies of obese individuals are not far differed among the three age groups; however, group III has slightly higher frequency (4.07%). The most important fact that derived from the result is that the frequency of overweight among the studied Bengalee population is at an alarming stage. It may be noted that the estimation is based on indirect technique, i.e. Anthropometry and international classification of adult overweight and obesity (WHO, 2000) cut-off points were utilized.

Table 6 and Table7 show the presence of centrally obese individual in respect of waist circumference and waist-hip ratio .the Table 6 presents the prevalence of obesity and based on waist circumference among the males under study. The overall frequency of centrally obese individuals is 58.67%. More than 50% of the population is centrally obese in respect of waist circumference, has extensively used as an independent indicator to identify the central body fat distribution. The distribution of centrally obese persons among the three age groups show that the group III has the highest frequency 73.17% and group I possesses the lowest frequency below the 50% that is 46.07% and the group I just cross the 50%, the frequency is 51.14%. It may be suggested from the result that the excess fat deposition in the abdominal area is increased with the increasing age.

In Table 7 revealed the occurrence of centrally obese persons among the studied population on the basis of waist-hip ratio. The cut-off point of the waist-hip ratio were adopted as recommended by JNC for WHR >0.95(male). The overall frequency of centrally obese persons in respect of waist-hip ratio is 52.67%. But the distribution shows the higher frequency of centrally obese persons in age group III, 65.04%; relatively low frequency (38.20%) is observed in age group I and the half of the total sample size of group II is centrally obese in respect of WHR in the present study.

Considering the variables of waist circumference and waist-hip ratio it was found that more than half of the surveyed population Bengalee adult male of Kolkata were centrally obese. But in case of waist circumference the frequency is higher (58.67%) than the waist-hip ratio (52.67%). In both cases, it is noted that the occurrence of obesity is increased through increasing age. Three age groups also show the difference in the frequency of centrally obese individuals. On the other hand the frequency of obese individual on based on BMI is 3.33%. This means occurrence of generalized obesity is 3.33%. It may be concluded that the prevalence of central obesity measured as waist circumference (58.67%) and waist-hip ratio (52.67%) is higher than the generalized obesity. The result also pointed to the fact that in all the three age groups the occurrence of central obesity is higher than the as compared with generalized obesity among the Bengalee adult males.

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