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Prevalence and Determinants of Obesity among Elderly in an Urban Area of Bengaluru

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ABSTRACT

Background: Obesity is a serious public health challenge all over the globe. Aging process increases the risk of obesity by bringing about changes in the body composition and innate environment. The present study was undertaken to find out the prevalence and determinants of obesity among elderly population in an urban area.

Methods: Data was collected from 247 elderly living in an urban area of Bengaluru, regarding socio-personal characteristics, dietary habits and physical exercise practices Anthropometric measurements such as height, weight for BMI, waist circumference and body fat percentage by using body fat monitor were taken.

Results: The prevalence of generalised obesity and central obesity was 62.3% and 56.7% respectively and female sex(*P*=0.03, *P*=0.02), family history of obesity [(*P*=0.0004, OR=3.6), (*P*=0.0002, OR=3.6)], presence of co-morbidity [(P=0.0002, OR=3.1), (*P*=0.0001, OR=3.7)] and eating three or more meals [(*P*=0.004, OR=3.5) (*P*=0.007, OR=7.1)] were significantly associated with both generalised and central obesity. Strong positive correlation of BMI with waist circumference and percentage body fat, and waist circumference with percentage body fat were also observed.

Conclusions: Around two third and more than half of the elderly subjects were having obesity. Female sex, family history of obesity, presence of co-morbidities and eating three or more meals were significantly associated with both the type of obesity and BMI, waist circumference and body fat percentage are suitable indicators of assessment of obesity among elderly subjects.

Key words: Elderly, generalized obesity, central obesity, prevalence, urban area, Bengaluru.

INTRODUCTION

Obesity is a serious public health challenge of 21st century all over the globe.Aging process brings about changes in the body composition which includes decrease in lean muscle mass, bone mass and increase in total body fat. Apart from aging process, faulty dietary habits and physical inactivity also promote obesity.[1]As people age, obesity exacerbates serious medical conditions such as hypertension, type 2 diabetes, dyslipidemia, degenerative joint disease, depression, malignancies and increases the risk of functional impairment and premature death. In India, few community based studies conducted in urban areas have shown that the prevalence of obesity among elderly varies between 40.5% - 54%.[2,3] The elderly population is fastest growing segment in India which constitute 8.2% according to 2011censusand expected to increase its share to 10.7% by 2021.[4,5]All these evidence suggests that the situation of obesity and its consequences in elderly is likely to get worse in the near future.

The researchers, dieticians and clinicians around the world have adopted the Body Mass Index (BMI) and Waist Circumference (WC) based on WHO classification for the assessment of obesity (generalised and central obesity). However the WHO classification for BMI is not suitable for assessment of obesity in Indians because of the following reasons; a) more body fat for a given BMI compared to other ethnic groups among Indiansand b) morbi-mortality is more with lower BMIs and smaller waist circumferences among Indians.[6,7]These evidences suggest that BMI and waist circumference cut offs should be reduced in Indians. Currently there is dearth of studies based on lower cut-offs for body mass index and waist circumference, and also which have done a comprehensive assessment of obesity using BMI, waist circumference and mean body fat percentage (BFP) among elderly from an urban part of India. The evidence derived from this study will be a guide for future studies and essential for formulating policies and undertaking future interventions to curb the menace of obesity among Indian elderly. In this background, the present study was undertaken to find out the prevalence and determinants of obesity among elderly population in an urban area of Bengaluru.

METHODS AND MATERIALS

The present cross-sectional study was carried out in the urban field practice area of Kempegowda Institute of Medical Sciences (Parvathipura) Bangalore from January 2010 to November 2011 after getting clearance from institutional ethics committee (IEC). Out of 2947 population in the locality, 258 were elderly people (60 years and above).Elderly residing in the area for a minimum period of six months and those willing to participate and cooperate in the study were included and those with serious illnesses were excluded. Finally 247 elderly were recruited into the study after applying the inclusion and exclusion criteria. The households of the elderly were visited by trained investigators and after obtaining informed consent, data regarding socio-personal characteristics, dietary habits and physical exercise practices were collected from the elderly by interview method using a pre-tested, semi-structured questionnaire.

Anthropometric Measurements: The anthropometric measurements such as standing height, body weight and waist circumference of elderly were measured by using appropriate standard equipments and procedures. The height was measured using a stadiometer capable of measuring to an accuracy of1mm and weight using a digital weighing scale (Omron) capable of measuring to an accuracy of 100g**.**The waist circumference was measured at the level of midpoint between the tip of the iliac crest and the lower margin of the last palpable rib in the mid-axillary line by using a stretch resistant tape. The proposed Asia-Pacific guidelines were used to classify BMI and International Diabetes Federation (IDF) cut-offs for waist circumference.[8,9]

Assessment of Body fat percentage (BFP): In this study, body fat percentage was assessed for 229 elderly in the age group of 60-80 years. The BFP was assessed by bioelectrical impedance method using the body fat monitor (Omron-HBF-306). The subjects were made to stand straight with feet slightly apart and hold the body fat monitor in such a way that the middle finger rests in the groove of the handle, palm is in contact with electrodes, thumbs up and resting on the top of the unit and arms held straight out and making 90° with the body.[10]All the measurements were taken during morning hours (09:00 – 12:00) and subjects were instructed not to have vigorous physical activity in preceding 12 hours. Repeated measurements were taken on a subsample of study subjects for reliability analysis.

Statistical Analysis: In this study, both descriptive (percentages, mean and standard deviation) and inferential statistics such as chi-square test was used to find out the association of generalised and central obesity with socio-personal characteristics, dietary habits and physical exercise practices. Student's t-test was used to test the differences of the BFP between the sexes. Odd's ratio was used to test the association of generalized and central obesity with various determinants. Correlation was used to find out the relationship between BMI, waist circumference and BFP. P-value of less than 0.05 was considered statistically significant. All the statistical analysis was performed using Statistical Packages for Social Sciences version 17.0.

RESULTS

In the current study, out of 247 elderly subjects, 154 (62.3%) were having generalised obesity, of which 33 (13.3%) were overweight (BMI$\geq$23 kg/m^2), 93 (37.7%) obese –category I (BMI$\geq$25 kg/m2)and 28 (11.3%) obese – category II (BMI$\geq$30 kg/m2), 26 (10.5%) underweight and 67 (27.1%) normal according to BMI. 140 (56.7%) were suffering from central obesity($\geq$90 cms for males and $\geq$80 cms for females).

Statistically significant association was found between generalized obesity and sex with females having more obesity (67.3%) than males (53.8%) [*P*=0.03]. Similarly, statistically significant association was also observed between central obesity and sex with females having more central obesity (62.2%) than males (47.3%) [*P*=0.02]. There was a

statistically significant association between generalised obesity and family history of obesity with the prevalence of obesity being higher in subjects having family history of obesity (82.5%) than those without a family history (56.3%); Odd's Ratio was 3.6 with *P*=0.0004, implying subjects with family history of obesity were at four times higher risk of developing generalised obesity compared to those without a family history. Similarly statistically significant association was noted between central obesity and family history of obesity with subjects having family history of obesity having a higher prevalence of central obesity (78.6%) when compared to those without a family history (50.3%). Odd's Ratio was 3.6 with *P*=0.0002, implying subjects with a family history of obesity were at four times higher risk of developing central obesity compared to those without a family history. With regards to the co-morbidity status, there was a statistically significant association between generalised obesity and co-morbidities, with subjects having generalised obesity having a higher prevalence of co-morbidities (68.8%) when compared to those without generalised obesity (41.4%). Odd's ratio was 3.1 with *P*=0.0002, implying subjects having generalised obesity were three times at higher risk of developing co-morbidities compared to those without generalised obesity. Similarly statistically significant association was observed between central obesity and co-morbidity with subjects having central obesity having a higher prevalence of co-morbidities (64%) compared to those without central obesity (32.8%); OR=3.7 and *P*=0.0001 implying subjects with central obesity were at four times higher risk of developing co-morbidities compared to those without central obesity. There was no statistically association of generalised obesity and central obesity with age (*P*=0.2, 0.4), literacy (*P*=0.07, 0.7) working status (*P*=0.4, 0.3) and standard of living index (SLI) (*P*= 0.09, 0.2) [table 1].

Table – 1: Association between socio-personal characteristics and obesity

Variables	Generalized obesity		OR	95%CI	P value	Central obesity		OR	95% CI	P value
	Yes (%)	No (%)				Yes (%)	No (%)			
Age (years)										
60 – 69	102(64.2)	57(35.8)	1.2	0.7-2.1	0.2	91(57.2)	68(42.8)	1.1	0.6-1.8	0.4
70+	52(59.1)	36(40.9)				49(55.7)	39(44.3)			
Sex										
Female	105(67.3)	51(32.7)	**1.8**	**1.0-3.0**	**0.03***	97(62.2)	59(37.8)	**1.8**	**1.1 -3.1**	**0.02***
Male	49 (53.8)	42 (46.2)				43(47.3)	48(52.7)			
Literacy										
Illiterates	46(54.8)	38(45.2)	1.9	0.9-2.8	0.07	48(57.8)	35(42.2)	1.1	0.6-1.8	0.7
Literates	108 (66.3)	55 (33.7)				92(56.1)	72(43.9)			
Working status										
working	25(56.8)	19(43.2)	1.3	0.7-2.6	0.4	22(50)	22(50)	0.7	0.7-2.7	0.3
Not working	129(63.5)	74(36.5)				118(58.1)	85(41.9)			
SLI										
High	132(64.7)	72(35.3)	1.8	0.9-3.4	0.09	119(58.3)	85(41.7)	1.5	0.8 -2.8	0.2
Medium/low	22(51.2)	21(48.8)				21(48.8)	22(51.2)			
Family h/o obesity										
Present	47(82.5)	10(17.5)	**3.6**	**1.7-7.6**	**0.0004***	44(78.6)	12(21.4)	**3.6**	**1.3 -7.3**	**0.0002***
Absent	107(56.3)	83(43.7)				96(50.3)	95(49.7)			
Co-morbidity										
Present	130(68.8)	59(31.2)	**3.1**	**1.7-5.7**	**0.0002***	121(64)	68(36)	**3.7**	**2.0 -6.8**	**0.0001***
Absent	24(41.4)	34(58.6)				19(32.8)	39(61.2)			

* indicates statistically significant (p<0.05)

Table – 2: Association between dietary habits, physical exercise and obesity

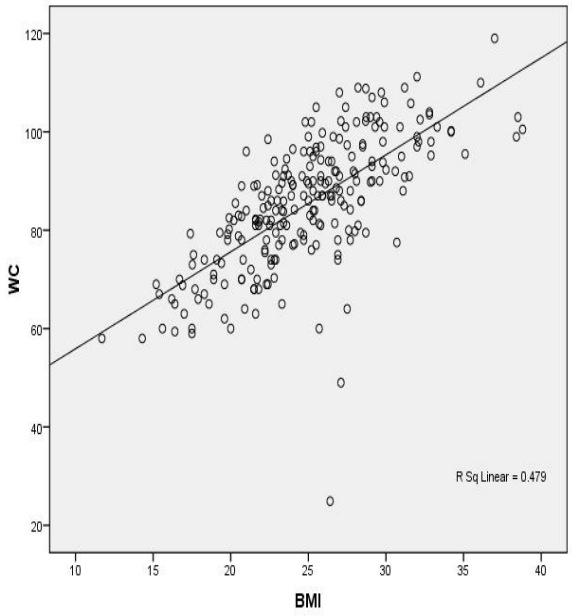
Variable	Generalized obesity		OR	95%CI	*P*	Central obesity		OR	95%CI	*P*
	Yes	No				Yes	No			
Type of diet										
Non-veg	120 (83.9)	23 (16.1)	1.2	0.6-2.1	0.6	111 (58.4)	79 (41.6)	1.0	0.7-2.5	0.3
Veg	34 (32.7)	70 (67.3)				29 (50.9)	28 (49.1)			
Meals/day										
≥3	146 (90.7)	15 (9.3)	**3.5**	**1.4-8.6**	**0.004**	133 (59.4)	91 (40.6)	**7.1**	**1.3-8.4**	**0.007**
<3	8 (9.3)	78 (90.7)				7 (30.4)	16 (69.6)			
Physical exercise										
Yes	57 (67.9)	27 (32.1)	1.4	0.8-2.5	0.2	49 (58.3)	35 (41.7)	0.1	0.7-1.9	0.7
No	97 (59.5)	66 (40.5)				91 (55.8)	72 (44.2)			

Figures in parenthesis indicates percentage, * indicates statistically significant (p<0.05)

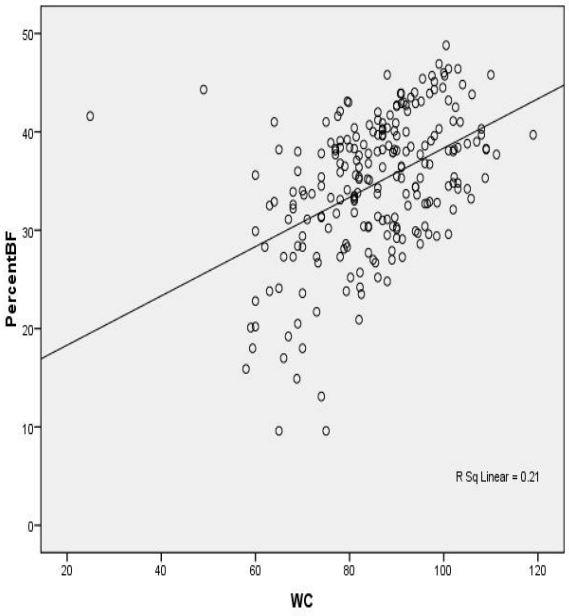
Table - 3: Comparison of body fat percentage (BFP) of individuals with generalized and central obesity across sexes

Variable	Male (n=83)				Female (n-146)			
	n	Mean±SD	t-value	p-value	n	Mean±SD	t-value	p-value
Generalized obesity								
Present	48	34.3±4.5	7.6	0.0001*	101	40.4±4.4	9.9	0.0001*
Absent	35	24.9±6.3			45	30.0 +6.3		
Central obesity								
Present	42	34.2±3. 6	7.3	0.0001*	91	39.9±4.3	6.7	0.0001*
Absent	41	26.4±6.4			55	32.7±7.2		

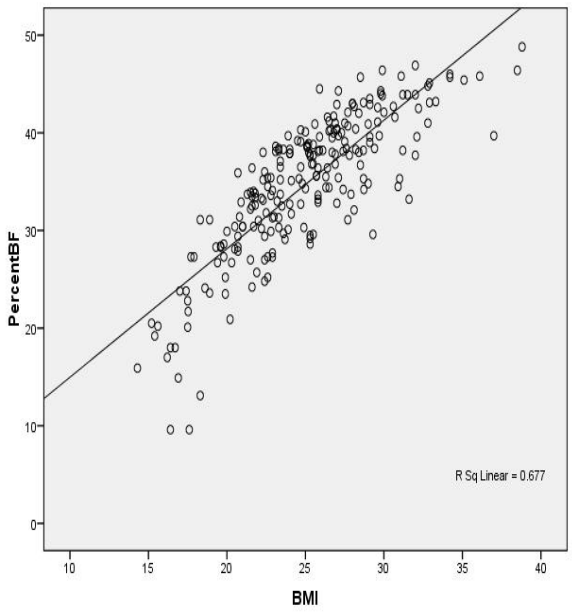
* indicates statistically significant (<0.05)



Graph 1: Correlation between BMI and Waist circumference



Graph 3: Correlation between Waist circumference and Body Fat percentage



Graph 2: Correlation between BMI and Body Fat percentage

There was a statistically significant association between generalised obesity and number of meals per day with subjects subsisting on ≥3 meals per day having a higher prevalence of obesity (90.7%) compared to those having <3 meals per day (9.3%). OR was 3.5 and *P*=0.004, implying subjects having ≥3 meals/day were at four times higher risk of developing generalised obesity compared to those having <3 meals per day. Similarly there was a statistically significant association between central obesity and number of meals per day with subjects subsisting on ≥3 meals having a higher prevalence of central obesity (59.4%) when compared to those having <3 meals (30.4%). OR was 7.1 and *P*=0.007, implying subjects having ≥3 meals were at seven times higher risk of developing central obesity compared to those having <3 meals per day. There was no statistically significant association of generalised obesity and central obesity with type of meals and practice of physical exercise (*P*= 0.6, 0.2) (p= 0.3, 0.7 respectively) [table 2].

In this study, the percentage body fat (PBF) was significantly higher among subjects with general-

ised obesity compared to those without generalised obesity among both males (t=7.6, *P*=0.0001) and females (t=9.9, *P*=0.0001). Similarly, PBF was significantly higher among subjects with central obesity compared to those without central obesity among both males (t=7.3, *P*=0.0001) and females (t=6.7, *P*=0.0001) [table 3].

The study also observed strong positive correlation of BMI with waist circumference (r=0.7, *P*=0.0001), and percentage body fat (r=0.8, *P*=0.0001) and waist circumference with percentage body fat(r=0.5, *P*=0.0001). All these were found to be statistically highly significant (graph 1, 2 and 3).

DISCUSSION

There is a high prevalence of both generalised and central obesity among South-East Asians including Indians. This fact is supported and strengthened by the present cross-sectional study, which revealed that the prevalence of generalised obesity as 62.3% and central obesity as 56.7% among the elderly subjects. Similar findings were reported by Aatif Qureshi et al, where the prevalence of generalised obesity and central obesity was 72% each and Arlagappa et al where the prevalence of generalised obesity and central obesity were 73% and 66% respectively.[3,11]This high prevalence of generalised and central obesity in elderly in all these studies despite variations in geography, socio-economic background and socio-cultural practices could be a fallout of nutritional and demographic transition and increased sedentariness.

This study found that elderly females were having higher prevalence of generalised and central obesity compared to their male counterparts. A study by Pereira P et al has also shown similar findings and the possible explanation for the association could be the presence of more body fat in females and increased restriction of females due to socio-cultural and security reasons.[12] There is a dearth of information regarding the association of female gender with central obesity, which needs to be probed further in future studies.

This study has observed that the generalised and central obesity is significantly associated with family history of obesity. This is supported by the recent detection of association between Myostatin gene and obesity among Indians.[13]Hence family history of obesity may be used as a screening tool for identification of elderly who are at risk of developing generalised and central obesity.

In this study, generalised and central obesity were found to be significantly associated with co-morbidities. Similar findings were reported by Sujin Kimi et al(i.e., association between generalised obesity and co morbidities) and Kuo-Chin Huang et al (i.e., association between central obesity and co morbidities).[14, 15]This association could be attributed to insulin resistance mediated metabolic syndrome in obesity which if left untreated, can increase the morbi-mortality due to coronary heart disease and stroke.[16]

In the current study, eating three or more meals per day was associated with the higher prevalence of both generalised and central obesity. This observation is supported by known fact that increases in the number of meals/day increases the amount of calories which in turn leads to both types of obesity. In this context, as age increases there are a need to decrease the size and number of meals in order to reduce the amount of calories and thereby prevent obesity.

Body fat percentage was significantly higher in subjects with generalised and central obesity compared to the normal subjects in both sexes and there was a positive correlation between BMI and waist circumference, BMI and body fat percentage, and waist circumference and body fat percentage. A study conducted by Dutra MC et al found positive association between BMI and waist circumference.[17]A study conducted by Ranasinghe C et al observed positive correlation between BMI and body fat percentage.[18]A study by Flegal KM et al shows significant correlation of BMI and waist circumference with body fat percentage.[19]These findings suggests that BMI, waist circumference and body fat percentage are suitable and comprehensive indicators of obesity among elderly subjects, which needs to be probed by conducting further studies by employing similar guidelines.

The strength of this study are inclusion of body fat percentage measurement to enhance the validity in measurement of generalised and central obesity in addition to using BMI and waist circumference and also all the anthropometric measurements were conducted by a single trained investigator which eliminated measurement bias. The limitation of this study is that it included elderly subjects from a particular locality, which curtails extrapolation of the results. Measurement of body fat percentage by Bio-electrical Impedance Analysis (BIA) is an easy and a cost-effective method and involves only minimal need for personnel training but is considered as an indirect method in the measurement of Body fat percentage (BFP).

The current study documented that around two third and more than half of the elderly subjects were having generalised and central obesity. In this regards, study recommends that there is a need to create awareness among elderly and their caregivers regarding adverse consequences of obesity. Due to scarcity of information on geriatric

obesity in the Indian context, there is a need for similar studies on Indian elderly to confirm the results and help to generate required information needed by policy makers to tackle the menace of geriatric obesity in near future.

CONCLUSIONS

The present study revealed that, the prevalence of generalized and central obesity was 62.3% and 56.7% respectively. Female gender, family history of obesity, presence of co-morbidity and eating three or more meals were significantly associated with both generalised and central obesity.BMI, waist circumference and body fat percentage are suitable indicators of assessment of obesity among elderly subjects.

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