Combined obesity among adult in-patients: A study in a tertiary care hospital

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Abstract

Introduction: Obesity is one of the major risk factors for number of preventable non-communicable diseases (NCD's). In adults, the combined measure of BMI and waist circumference provides better information on obesity in either sex. This gives good opportunity to predict the risk of development of NCD's better compared to the use of individual index. In this context, present study was undertaken.

Materials and Methods: Data was collected from 228 adult in-patients in a tertiary care hospital of Bengaluru, regarding socio-personal profile, dietary habits, physical exercise practices and co-morbidities. Anthropometric measurements such as height, weight and waist circumference were recorded and, BMI and waist circumference were combined as composite index.

Results: The proportion of combined obesity was 32.9% and family history of obesity (p=0.01), history of alcohol intake (p=0.02), presence of two or more co-morbidities (p=0.0005) and hypertension with type 2 diabetes mellitus (p=0.001) were significantly associated with combined obesity.

Conclusions: Around one third of the adult in-patients were having combine obesity and associated with family history of obesity, alcohol intake and co-morbidities. The combined use of BMI and waist circumference is a suitable and practical index for assessment of obesity in adult in-patients.

Keywords: Combined obesity, BMI, Waist circumference, adult in-patients, Tertiary care hospital.

Introduction

Obesity is considered as a major public health concern affecting all age and socioeconomic groups both in developed and developing countries, thus WHO refers obesity as escalating global epidemic.[1]

Obesity is one of the major risk factors responsible for number of preventable, non-communicable diseases (NCD's) such as hypertension, diabetes mellitus, ischemic heart diseases, cancer and stroke etc. The risk of non-communicable diseases increases with increase in BMI and waist circumference.[2]

All over the globe, obesity has doubled between 1980 and 2014. The WHO estimates that more than 1 billion people are overweight, with 300 million meeting the criteria of obesity.[3] In India, between NFHS 3 and 4, there was a stark rise in the prevalence of obesity among adult men from 10.4% to 18% and in women from 13.9% to 19.6%.[4]

In the Indian adults, many studies have shown good correlation between BMI and waist circumference and their proneness for obesity related morbidity and premature mortality.[5-6] In this regard, combining both BMI and waist circumference provides better information on the extent of generalized and abdominal obesity in either sex. This gives good opportunity to predict the risk of development of NCD's better compared to the use of either BMI or waist circumference alone. Extensive review of literature has shown that there is a scarcity of information on assessment of combined obesity among adults where both Body Mass Index (BMI) and waist circumference (WC) are considered.

The evidences derived from such studies provide required information to tackle generalized and central obesity simultaneously and helps to reduce the burden of obesity and related co-morbidity in near future. In this context, the present exploratory study was undertaken among adult in-patients to find out the proportion and factors associated with combined obesity based on BMI and WC in a tertiary care hospital at Bengaluru.

Materials and Methods

The present observational study was carried out in Kempegowda Institute of Medical Sciences Hospital and Research Center (KIMSH&RC), a tertiary care hospital at Bengaluru involving the adult in-patients (>18 years to 59 years) from September to November 2016. A total of 228 study subjects were enrolled in the study by using systematic random sampling technique where every 5th in-patient from the department of Medicine was included in the study after getting informed consent. The sample size was estimated using the formula n = 4 pq/L2. The prevalence of combined obesity, "p" among adults was taken as 17.17%. With precision of 5%, using the above mentioned statistical formula which considers 95% confidence limits; the sample size was estimated to be 228.[7]

At the beginning, institutional ethics committee clearance was taken. The data was collected by an interview method, using a pre-tested semi-structured questionnaire from study subjects regarding socio-personal profile, dietary habits, physical exercise practices and co-morbid conditions. In this study, subjects who were ambulatory and willing to participate

were included while those who were seriously ill and having severe abnormality in speech and hearing were excluded. Anthropometric measurements such as height, weight and waist circumference were measured by following standard procedures and guidelines by trained medical professional as an investigator. The height was measured to the nearest 0.5 cm with stadiometer. Weight was measured to the nearest 0.5 kg with weighing scale. The generalised obesity was assessed by using BMI based on WHO Asia-Pacific guidelines and an International Diabetes Federation (IDF) guideline was adopted to assess central obesity (>90 cm for males and >80 cm for females).[8] The combined obesity was derived by combining both generalized and central obesity based on BMI and WC and categorizing central obesity based on sex according to BMI classification.

The data was analysed using SPSS version 21.0. The descriptive statistics such as mean and proportions and Inferential statistics such as chi-square test was used to find out the association between combined obesity and factors such as socio-personal profile, dietary habits, physical exercise practices and co-morbid conditions.

Results

Out of 228 study subjects, 130 (57%) were males and 98 (43%) were females. The mean age of the study population was 36.9±13 years, mean age of male was 37.4±13.2 years and of female 36.1±12.7 years. Majority belonged to age group of 41-59 years (39.5%), most of them were Hindu by religion (74.1%), from urban area (61.4%), educated up to high school (31.1%) and belonged to class-3 (according to modified B G Prasad classification) socio-economic status (53.1%). (Table 1).

Table 1: Socio-personal profile of study subjects

Variable	Category	Frequency (%) (n=228)
Age	41 - 59 yrs	90 (39.5)
Sex	Male	130 (57)
Religion	Hindu	169 (74.1)
Locality	Urban	140 (61.4)
Education	High School	71 (31.1)
Socioeconomic Status*	Class – 3	121 (53.1)

*****Modified BG Prasad's classification

The proportion of combined obesity among the subjects (BMI >23kg/m^2 and central obesity >90 cms for men and >80 cms for women) was 75 (32.9%) and proportion of combined obesity among males was 49(65.3%) and females 26(34.7%) respectively. According to BMI, 33 (14.5%) were underweight, 89 (39.4%) were normal and 23 (10.1%) were considered as overweight and 83 (36.4%) were obese and totally 106(46.5%) were overweight/obese. The measurement of waist circumference shown that 99 (43.4%) were considered to be centrally obese and proportion of central obesity among males were 59 (59.6%) and 40 (40.4%) among females respectingly.

The distribution of central obesity according to BMI has shown that 24 (24.2%) of the study subjects under normal and below normal BMI category were having central obesity compare to only 13 (13.1%) from overweight category and 43 (43.5%) of the subjects having central obesity under obesity class - 1 compare to 19 (19.2%) from obesity class – II. (Table 2)

Table 2: Distribution of central obesity according to BMI classification (n=99)

BMI classification	Central obesity		
	Male (%)	Female (%)	Total (%)
Underweight (18.5 kg/m^2)	-	2(5.0)	2(2)
Normal (18.5-22.9 kg/m^2)	10(16.9)	12(30.0)	22(22.2)
Overweight (23-24.9 kg/m^2)	8(13.6)	5(12.5)	13(13.1)
Obesity – class – I(25- 29.9 kg/m^2)	30(50.8)	13(32.5)	43(43.5)
Obesity –class – II(>30 kg/m^2)	11(18.7)	8(20.0)	19(19.2)
Total	59(100.0)	40(100.0)	99(100)

Regarding, socio-personal profile of study subjects, statistically significant association was found between combined obesity and family history of obesity, with proportion of combined obesity being higher among subjects having family history of obesity (40.3%) than those without family history (25.4%) (p=0.01). With regards to alcohol intake, there was a statistically significant association between combined obesity and history of alcohol intake, with proportion of combined obesity being higher among subjects having history of alcohol intake (42.3%) than those without alcohol intake (28%). According to co-morbidity status, there

was a statistically significant association between combined obesity and number of co-morbidity, with proportion of combined obesity was higher among subjects having ≥2 co-morbidities (46.1%) compared to those with <2 co-morbidity (24%), implying subjects with combined obesity were three times higher risk for developing ≥2 co-morbidities compare to those without combined obesity (OR= 2.7, p=0.0005). There was no statistically significant association of combined obesity and age, sex, religion, locality, education, occupation, socio-economic status, type of family and history of smoking (Table 3).

Table 3: Association between Socio-personal profile of study subjects and combined obesity

Variable		Subjects (n=228)	Combined Obesity		OR	95% CI	P-value
			Yes	No			
Age (years)	≤40yr	138	45(32.6)	93(67.4)	0.9	0.5-1.7	0.9
	>40yr	90	30(33.3)	60(66.7)			
Sex	Men	130	49(37.7)	81(62.3)	1.7	0.9-2.9	0.07
	Women	98	26(26.5)	72(73.5)			
Religion	Hindu	169	52(30.7)	117(69.3)	0.7	0.4-1.3	0.2
	Non Hindu	59	23(39.0)	36(61.0)			
Locality	Urban	140	46(32.8)	94(67.2)	1.0	0.5-1.8	0.9
	Rural	88	29(33.0)	59(67.0)			
Education	Up to High school	153	48(31.3)	105(68.7)	0.8	0.4-1.5	0.5
	High school & above	75	27(36.0)	48(64)			
Occupation	Heavy & moderate	95	34(35.8)	61(64.2)	0.8	0.4-1.4	0.4
	Sedentary	133	41(30.8)	92(69.2)			
SES	Class 1-3	196	64(32.6)	132(67.4)	0.9	0.4-2.3	0.8
	Class 4-5	32	11(34.3)	21(65.7)			
Type of Family	Nuclear	127	47(37.0)	80(63.0)	1.1	0.5-2.5	0.08
	Non-Nuclear	101	28(27.7)	73(72.3)			
Family h/o obesity	Present	114	46(40.3)	68(59.7)	1.9	1.1-3.4	0.01
	Absent	114	29(25.4)	85(74.6)			
h/o Alcohol intake	Present	78	33(42.3)	45(57.7)	1.8	1.0-3.3	0.02
	Absent	150	42(28.0)	108(72.0)			
Smoking	Present	53	20(37.7)	33(62.3)	0.8	0.4-1.3	0.4
	Absent	175	55(31.4)	120(68.6)			
Co morbidity	≥2	91	42(46.1)	49(53.9)	2.7	1.5-4.7	0.0005
	<2	137	33(24.0)	104(76.0)			

There was no statistically significant association observed between combined obesity and type of the diet (p=0.5) and physical exercise practices (p=0.4) (Table 4).

Table 4: Association between dietary habits, physical exercise with co-morbid obesity

Variable		Subjects (n=228)	Combined Obesity		OR	95% CI	P value
			Yes	No			
Type of diet	Vegetarian	58	21(36.2)	37(63.8)	1.1	0.6-2.3	0.5
	Non Vegetarian	170	54(31.7)	116(68.3)			
Physical exercise	Yes	62	18(29.0)	44(71.0)	0.8	0.4-1.5	0.4
	No	166	57(34.3)	109(65.7)			

The type of co-morbidities has shown that there was a statistically significant association between combined obesity and subjects suffering from both hypertension and type 2 diabetes mellitus, with proportion of combined obesity higher in subjects with both hypertension and diabetes mellitus (32.4%) compared with subjects not having both the disorders (21%), implying subjects with combined obesity were four times higher risk for hypertension and type 2 diabetes mellitus compared to those without combined obesity (OR=3.9, p=0.001). There was no statistically significant association of combined obesity with subjects with only hypertension, only type 2 diabetes, coronary heart disease, gastro entireties, anemia, dengue and bronchial asthma (Table 5).

Table 5: Association of co-morbidities with combined obesity

Variable		Subject	Combined Obesity		OR	95% CI	P-value
			Yes	No			
Hypertension only (without DM)	Yes	13	6(46.1)	7(53.9)	2.4	0.73-7.7	0.1
	No	215	56(26.0)	159(74.0)			
Diabetes (without HTN)	Yes	38	7(18.4)	31(81.6)	0.6	0.21-1.2	0.2
	No	190	55(29.0)	135(71.0)			
HTN and DM	Yes	47	24(32.4)	23(67.6)	3.9	1.9-7.7	0.001
	No	181	38(21.0)	143(79.0)			
Coronary heart disease	Yes	18	4(22.2)	14(77.8)	0.7	0.2-2.2	0.8#
	No	210	58(31.0)	152(69.0)			
Gastro-entireties	Yes	27	10(37.0)	17(63.0)	1.7	0.6-3.9	0.2
	No	201	52(25.8)	149(74.2)			
Anemia	Yes	22	5(22.7)	17(77.3)	0.8	0.2-2.1	0.6
	No	206	57(27.7)	149(72.3)			
Dengue	Yes	28	8(28.5)	20(71.5)	1.1	0.4-2.6	0.9
	No	200	54(27.0)	146(73.0)			
Bronchial asthma	Yes	12	03(25.0)	09(75.0)	0.9	0.1-3.6	0.9#
	No	216	59(27.3)	157(72.7)			

#Yates Chi Square

Discussion

The primary results of the study indicated that around one third (32.9%) of the study subjects had combined obesity. Similar observation was made by Zhang M et al in China shown that 32.5% of the subjects had combined obesity.[9] Contrary to these finding, ICMR – INDIAB – 3 study observed that burden of combined obesity was 26.6%, 19.3%, 13% and 9.8% respectively in Chandīgarh, Tamil nadu, Maharashtra and Jharkhand.[7] The disagreement between these results could be due to differences in set up, study design, geography, socio-economic and socio-cultural background of the subjects.

In the present study, proportion of combined obesity was high among males compare to females. Similarly, in a study conducted by Hou X et al has found that both BMI and WC were high among males compared to females.[10] Contrary to these findings, a study found that combined obesity is high among females compare to males.[7] These evidences support that combined use of BMI and WC as a better index to differentiate obesity based on sex because BMI alone cannot differentiate total body fat mass according to sex as a major limitation.

This study recorded 24% of the subjects were found to have high central obesity among normal and below normal BMI category. This finding clearly shows that 24% of the centrally obese subjects will be missed if BMI alone is considered, because Asian Indians have greater predisposition to central obesity and accumulation of visceral fat. These findings were supported and strengthened by studies conducted elsewhere.[11-12] These findings indicate that abdominal obesity varies dramatically with in the narrow range of BMI categories and these evidences confirm that combination of BMI and WC are practical measure of obesity.

The combined obesity is associated with family history of obesity and history of alcohol intake. Hence, these factors can be used as a tool of screening to detect adults at-risk of developing obesity. Subsequently, further probe is needed to find out the influence of these factors on combined obesity.

In the current study, combined obesity is associated with presence of two or more co-morbidities. This finding is consistent with study conducted by Cho YG on Korean adults, where combination of BMI and WC predicted high obesity related co-morbidities.[13] These observations add to the growing body of evidence that WC provides additional information on risk of co-morbidities when used along with BMI.

In this study, combined obesity is associated with both hypertension and type 2 diabetes mellitus. Similarly, many studies on Asians observed that hypertension was strongly associated with BMI and Type 2 diabetes mellitus with WC because WC reflects abdominal obesity which is closely associated with impaired glucose metabolism and BMI reflects body fluid volume which is closely associated with hypertension, therefore both indexes in combination is considered as superior and improves the predictive power of finding cardio-metabolic and cardio-vascular diseases. All these facts appreciate the utility of combined obesity based on BMI and WC.[10,14]

Conclusion

In this study, 32.9% of the study subjects had combined obesity and associated with family history of obesity, history of alcohol intake, presence of two or more co-morbidities and hypertension with type 2

diabetes mellitus. The combined obesity based on BMI and WC is a better index of obesity.

Limitations: The current study is limited by cross-sectional nature of study design and included only in-patients from medical wards.

Recommendations: This study appreciate the utility of combined obesity based on BMI and WC in hospital set-up and recommends that there is a need for such studies in hospital and population settings to find out the extent of the problem, cut-off values and associated risk factors for formulating prevention and control programme against combined obesity, which definitely help in reducing morbidity, premature mortality and health care cost related to obesity among Indian adults in future.

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