Original Article

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Metabolic Syndrome in Obese and Non-Obese Individuals Presented at A Tertiary Care Hospital of Hyderabad, Pakistan

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ABSTRACT

Metabolic Syndrome (MetS) has proved to be of enormous negative impact on health of humans, even in case of non-obese people. **Objective:** To determine the frequency of metabolic syndrome in obese and non-obese individuals at Liaquat University Hospital Hyderabad/Jamshoro. **Methods:** This Cross sectional comparative study was conducted on 122 persons, 61 obese and 61 non-obese persons, chosen through Non probability consecutive sampling technique. Patients of either gender, aged between 30 to 60 years, visited the OPD or hospitalized were selected. The patients with acute or chronic Ischemic heart disease or stroke, liver, lung or kidney or thyroid diseases or suffering from malignancy along with Pregnant ladies and lactating mothers were excluded. MetS was diagnosed via IDF and AHA classification. **Results:** Metabolic Syndrome (MetS) was significantly more prevalent in obese individuals (70.5%) than in non-obese individuals (19.7%) (p = 0.001). Obese participants had a higher BMI (29.24 kg/m^2 versus 20.70 kg/m^2, p = 0.001), greater prevalence of dyslipidemia (63.9% versus 16.4%, p = 0.001), and uncontrolled diabetes (41.0% versus 13.1%, p = 0.001). Blood pressure was significantly elevated in the obese group, with mean systolic and diastolic pressures of 143.52 mmHg and 93.11 mmHg, respectively (p = 0.001). **Conclusion:** MetS was present in 45.1% of the participant and was found to be strongly consistent with obesity although it was also detected in noteworthy portion of non-obese persons.

INTRODUCTION

Metabolic syndrome is a metabolic syndrome is an emerging global health concern. Enormous number of people being diagnosed with met s and the world is significantly suffering from its consequences. On one hand it's the reflection of increase in burden of associated risk factors, on the other hand resultant morbidity and subsequent mortality is increased. It enhances the risk of myocardial infarction 34 folds and of stroke 24 folds [1]. It execute very high chances of development of Type 2 diabetes as likelihood is increased by 5 times, not only this but multiplies the risk of overall mortality by 1.5 fold [2]. Prevalence of metabolic syndrome is ranging from 10% to 84% worldwide, in USA it is about 35% 2 and the pooled prevalence in South Asia is stretched from 14% to 32.5% [3,

4]. Met s showed geographical disparity which also suggest role of genetic and environmental factors [3]. Detection of amplified number of new case reveal it like a noninfectious epidemic [4]. Metabolic syndrome is diagnosed by the presence of three of the five chief contributors i.e. increased waist circumference or belly fat, high plasma triglycerides two major lipids include fasting triglyceridemia >150 mg/dL and HDL cholesterol concentration <40 mg/dL, elevated blood pressure and high blood sugar [2]. In Pakistan burden of disease is still largely undocumented even pooled surveys are not on note but as the risk factors are very abundant in this country possibility is that huge number of Pakistanis also being suffered from the perilous effects of MetS [4]. Newer

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research pointed out that MetS is also found in non-obese persons. An international health organization discovered metabolic syndrome was present in 5% of non-obese and 60% of obese people [1]. This highlighted that metabolic pathologies are accountable for the occurrence of diabetes and heart disease. Many researchers suggest that insulin resistance is the main culprit behind the pathogenesis of MetS [1, 2]. Many of the features of MetS are the result of insulin resistance, e.g., diabetes, dyslipidemia, hyperuricemia, increased inflammatory markers, endothelial dysfunction, and thrombosis, etc [5]. The research objective was to assess the existence of metabolic syndrome among obese and non-obese persons at a tertiary care hospital in Sindh, where patients come from both rural and urban areas, with the majority belonging to a low socioeconomic class. This study focused on a socioeconomically disadvantaged population, shedding light on the unique challenges and health disparities faced by these groups. As very scanty data are available from Pakistan, this study represented a snapshot of the situation among poor people from the interior of Sindh.

The results would help in understanding the disease burden, and life-threatening consequences of MetS could be prevented by taking proper actions. This awareness would also be beneficial in the prevention of MetS in society.

METHODS

After approval from Ethical Review Committee, this comparative cross sectional study was conducted at Department of Medicine Liaquat University Hospital, Hyderabad for the period of six months from October 2022 to March 2023. The sample size of 122 patients was calculated via taking the average prevalence of metabolic syndrome as 19.1%, with d=7% and CI of 95%. Patients were divided into 2 groups; 61 obese and 61 non –obese persons were enrolled, through [8]. Non probability consecutive sampling technique was used due to the feasibility of accessing patients in a tertiary care hospital setting where significant issues of time constraints, and resource limitations were there. Subject to informed consent patients of either gender, aged between 30 to 60 years, visited the OPD or hospitalized fulfilling the exclusion criteria, were selected. The study was approved from Ethical Review Committee of Liaquat University of Medical and Health Sciences, Jamshoro vide letter no. NO. LUMHS/REC/-148; dated: 29/09/2022. The patients with acute or chronic Ischemic heart disease or stroke, liver, lung or kidney or thyroid diseases or suffering from malignancy were excluded. Patients using following substances were not included in the research; Alcohol, corticosteroids, betablockers, hormone replacement therapy, selective estrogen receptor modulators, anabolic

or anti-obesity medication. Pregnant ladies and lactating mothers were also omitted from the study. Metabolic syndrome was diagnosed when a patient has at least ≥3 of the following five parameters: fasting glucose ≥100 mg/dL, blood pressure ≥130/85 mm Hg, triglycerides ≥150 mg/dL, HDLC < 40 mg/dL in men or < 50 mg/dL in women and waist circumference ≥90 cm (35 in) in men or ≥80 cm (32 in) in women. These parameters were assessed as part of usual standard hospital protocols. Both groups were compared for these parameters. Non-Obese were defined as those individuals with BMI of 18.522.9 kg/m2 and BMI ≥25 kg/m was defined as obese as per Asia Pacific guidelines [3, 4]. The data were analyzed by using SPSS version 26.0. The association of prevalence of metabolic syndrome and other categorical variables (Dyslipidemia, Uncontrolled Diabetes, Smoking, Hyperuricemia and Hypomagnesemia) were measured via Chi-square test while the difference of quantitative variables (Mean BMI, Mean Systolic BP and Mean Diastolic BP) between the groups was measured via independent T test. A p-value of ≤0.05 considered statistically significant while a p-value of ≤0.001 was considered as highly statistically significant.

RESULTS

The mean age of obese participants was 46.23 ± 9.30 years, while that of non-obese participants was slightly higher at 49.76 ± 5.50 years. In terms of gender distribution, males constituted a majority in both groups, accounting for 62.3% of obese participants and 52.5% of non-obese participants, while females comprised 37.7% and 47.5%, respectively. Smoking status showed that 32.8% of obese individuals were smokers compared to 45.9% among the non-obese group.

Table 1: Demographic Variables of Study Participants (n=122)

Demographic Variables		Obese Mean ± SD / N (%)	Non-Obese Mean ± SD / N (%)
Mean Age		46.23 ± 9.30 Years	49.76 ± 5.50 Years
Gender	Male	38 (62.3%)	32 (52.5%)
	Female	23 (37.7%)	29 (47.5%)
Smoking Status	Present	20 (32.8%)	28 (45.9%)
	Absent	41 (67.2%)	33 (54.1%)
Catchment	Urban	42 (68.9%)	30 (49.2%)
	Rural	19 (31.1%)	31 (50.8%)

Regarding the catchment area, the majority of obese participants (68.9%) were from urban areas, whereas non-obese participants were more evenly distributed, with 49.2% from urban and 50.8% from rural areas. (Table 1) Patient`s symptoms were shown in Figure 1.

PRESENTING COMPLAINTS
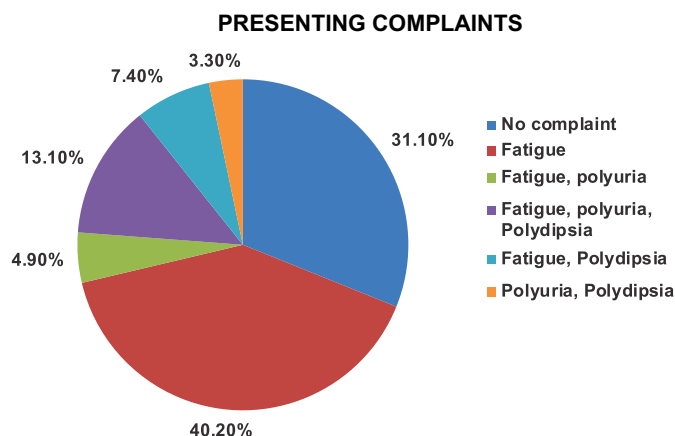
Figure 1: Presenting Complaints among study Patients

Metabolic Syndrome (MetS) was significantly more prevalent among obese patients (70.5%) compared to non-obese patients (19.7%) (p = 0.001). Obese individuals had a higher mean BMI (29.24 kg/m^2 versus 20.70 kg/m^2, p = 0.001) and showed greater prevalence of dyslipidemia (63.9% versus 16.4%, p = 0.001) and uncontrolled diabetes (41.0% versus 13.1%, p = 0.001). Additionally, mean systolic blood pressure (143.52 mmHg versus 120.81 mmHg) and mean diastolic blood pressure (93.11 mmHg versus 82.06 mmHg) were significantly higher in obese patients (p = 0.001). Hyperuricemia was also more common in obese individuals (24.6% versus 9.8%, p = 0.031), while hypomagnesemia did not differ significantly between the groups (11.5% versus 3.3%, p = 0.083) as shown in Table 2.

Table 2: Frequency of Metabolic Syndrome and Its Features among study participants

Mets Features	Present N (%)	Absent N (%)	Obese Patients N (%)/%	Non-Obese Patients N (%)/%	p-value
Metabolic Syndrome	55 (45.1%)	67 (54.9%)	43 (70.5%) / 18 (29.5%)	12 (19.7%) / 49 (80.3%)	0.001
Mean BMI Kg/m^2			29.24%	20.70%	0.001
Mean Systolic BP (mmHg)			143.52%	120.81%	0.001
Mean Diastolic BP (mmHg)			93.11%	82.06%	0.001
Dyslipidemia			63.9%	16.4%	0.001
Uncontrolled Diabetes			41.0%	13.1%	0.001
Smoking			32.8%	45.9%	0.138
Hyperuricemia			24.6%	9.8%	0.031
Hypomagnesemia			11.5%	3.3%	0.083

DISCUSSION

The concept of metabolic syndrome was dated back to 1970's, discovered particularly in relation with CVS diseases [6]. Many hypothesis being proposed but exact mechanism was still not clear for occurrence of MetS. It`s presence was a red alert sign for increase mortality and morbidity. Related to modern life style, physical inactivity and dietary habits metabolic syndrome was speedily growing set of interlinked diseases which has disastrous effect on life of people [7]. Overall, metabolic syndrome was present in 45.1% of these samples. This was a very alarming percentage, to make result generalized further trials were needed. In USA meta-analysis reported prevalence of METS as 37.6% [8]. In a South African study, authors detect the presence of MetS in 35% of obese as compare to 5% in normal weight subjects (P<0.01). Like this study they also noticed statistically suggestive relationship between obesity and presence of characteristic parameters of the condition [9]. In this study it was found that elderly people were more prone to develop MetS as compare to younger age group. This was noticed by other researchers as well [10]. It was found that often women were the victim of set of metabolic abnormalities in this community as compare to men; again this was also checked by other authors including researchers from neighbor country [3, 6]. 48.1% of female from these sample found to effect from this syndrome, majority of them were obese. In this study two groups were made of individuals; obese and non-obese, each consisting of 61 persons. Both groups were compared for the presence of MetS and its associated risk factors. This study demonstrated statistically noteworthy association of obesity with metabolic syndrome as analysis showed a p-value of 0.001. Their connection was a highlighted phenomenon and also found true in the people of lower socioeconomic class of interior of Sindh [11]. 70.5% of obese individuals were found to have MetS, while 29.5% did not exhibit this condition. In contrast, among non-obese participants, 19.7% were diagnosed with metabolic syndrome, leaving 80.3% without the condition. Pakistan belongs from third world countries but it stands on 9th position in obesity among 188 countries .Obesity was high in urban areas as compared to the rural area [12]. Presence of MetS in about 20% of non-obese individuals in this study was somewhat lesser than identified in a local meta-analysis, where the pooled prevalence was 28.8%. In South Asian countries, where dietary habits and habitat were much similar with this country pooled prevalence of the disease in non-obese persons was, 30% [13]. This dissimilarity may be because of different study design. In a research study, by using data from the Continuous NHANES, authors identified that non-obese MetS patients were more prone for cardiovascular mortality. Presence of this syndrome in non-obese person syndrome suggest that visceral fat deposition was more pathological, which was thought to take part in endocrine and inflammatory process [14]. It was documented that majority of these MetS patients were residents of urban areas. This demographic factor was noticed by others as well [15]. In this research Hypertension, dyslipidemia and diabetes were immensely accompanying with obesity 63.9% of obese persons found to be dyslipidemic as compared to

16.4% of non-obese. In a meta-analysis conducted by Adil SO et al., authors found 29.5% of hypertensive persons, 20.6% of diabetic persons and 35.8% of patients with hypertriglyceridemia were offended by the particular syndrome. Highest prevalence was seen in persons with low HDL level, which was 48.2% [4]. In another Pakistani research author estimate MetS prevalence in diabetics was 65.6% according to latest criteria by IDF [16]. Mitochondrial oxidative stress and involvement of various signaling pathways like NFkB, PKC, MAPK, polyol, JNK, ERK, and NOX were postulated to play fundamental role in production of metabolic syndrome and it`s consequence morbidity [17]. Individuals were enlisted mainly from the OPD with no or minor illnesses and exclude the patients with stroke or MI and other major disease, it was found that a large number of patients felt lethargic or fatigued, comprising 40.2%. The high occurrence of fatigue as the presenting complaint emphasizes the workup for the set of metabolic abnormalities in such persons. A smaller percentage of individuals experienced varied combination of symptoms of fatigue, polyuria, and polydipsia. In the study published in 2020 authors found significant link between the two conditions. They calculated that chronic fatigue was 2 fold more common in patients of metabolic syndrome than controls, as the number of risk factors increases chances of chronic fatigue increases by 30% [18]. In this study it was observed that obese persons were more troubled from Hyperuricemia as compare to non-obese person and it was statically proved in this study. A recent study from China give supporting evidence that Hyperuricemia was positively linked with MetS and most of its component diseases [19]. Further research is necessary to investigate the correlation between magnesium levels and Metabolic Syndrome (MetS). Magnesium's role in MetS is of particular interest due to its involvement in various bodily reactions and inflammatory processes. While previous studies have suggested a link between magnesium and parameters like obesity and diabetes [20], our research found no significant difference in magnesium levels between obese and non-obese individuals (p-value = 0.083). This suggests that magnesium levels may not be a distinguishing factor between obese and non-obese populations, warranting further exploration of its role in MetS. In this research it was spotted that there was no significant difference between magnesium levels of obese and non-obese persons with p value of 0.083. The use of non-probability sampling technique was a major limitation of the study as it poses the selection bias and the risk that broader population may not be adequately represented in the sample.

CONCLUSIONS

Frequency of MetS was found to be 45.1% in this study. Metabolic syndrome and its associated risk factors, including dyslipidemia, uncontrolled diabetes, hypertension, and hyperuricemia, were significantly more prevalent in obese individuals compared to non-obese individuals. These findings highlight the urgent need for targeted interventions to address obesity-related metabolic disturbances, particularly in populations with high prevalence rates, to reduce the burden of cardiovascular and metabolic diseases.

Authors Contribution

Conceptualization: JT
Methodology: JT, MH, AA, AM, NM, MS
Formal analysis: JT
Writing, review and editing: JT, MH, AA, AM, NM, MS

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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