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METABOLIC SYNDROME: PREVALENCE (IDF & NCEP-ATP III) IN UDHAMPUR, JAMMU CITY

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ABSTRACT: Aim: To determine the prevalence of metabolic syndrome in Udhampur, J & K population according to two different criteria's (IDF & NCEP-ATP III). **Methods:** A cross-sectional survey was conducted for the prevalence of metabolic syndrome among 210 participants. A pre-designed questionnaire was used to collect data, including demographic information; physical activity and biochemical parameters form their medical reports. **Results:** The study participants with a mean age of 55.79 yr consisted of 51.9% males and 48.09% females. Metabolic syndrome was seen in 46.67% and 35.24% subjects according to IDF and NCEP-ATP III criteria, respectively. The age-specific prevalence of metabolic syndrome was observed higher in the older group. **Conclusion:** It can be improved by encouraging the patients to adopt a healthy lifestyle with the intervention of regular physical activity and dietary modifications.

INTRODUCTION: The metabolic syndrome is a leading and escalating public health and clinical challenge worldwide due to urbanization, excessive energy intake, increasing obesity, and sedentary life habits [1]. It is defined as a constellation of an interconnected physiological, biochemical, clinical, and metabolic factors that directly raises the risk of atherosclerotic cardiovascular disease, T2DM causing mortality [2]. Metabolic syndrome is a lifestyle disease contributed by different factors and individuals with MetS have probability (30-40%) of developing diabetes and cardiovascular disorders within 20 years [3].

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There have been several definitions of MetS, but the most commonly used standards for definition at present are from the World Health Organization (WHO), the European Group for the study of Insulin Resistance, the National Cholesterol Education Programme Adult Treatment Panel III (NCEP-ATP III), American Association of Clinical Endocrinologists and the International Diabetes Federation (IDF).

The prevalence of MetS globally ranged from 10% to 84%, determined by gender, age, race, ethnicity and area of residence (urban and rural) of the population examined as well as the definition used [4, 5]. Generally, the International Diabetes Federation estimates that one-quarter of the world's adult population has the MetS. Sedentary lifestyle, higher socioeconomic standing, and high body mass index were related to MetS. Cameron *et al.*, [5] have reasoned that the differences in genetic background, diet, amounts of physical activity,

smoking, family history of diabetes, all influence the prevalence of the MetS. Misra and Khurana [6] and Ramachandran *et al*., [7] states that one-third of the urban population in India's major cities have metabolic syndrome. The prevalence of metabolic syndrome in Indian adults is ranged from 11% to 56% as reported by Sinha *et al*. [8] There are many studies reporting the prevalence of metabolic syndrome in Indian populations [9, 10, 11, 12, 13], reporting the increasing prevalence but till date this (Jammu) geographical part of India has never been covered by government as well as by any epidemiologist. Therefore, keeping in mind the present status, the study was conducted in Udhampur, Jammu city with the aim to study the prevalence of metabolic syndrome.

MATERIALS AND METHODS:

Study Participants and Data Collection: The current cross-sectional study was conducted in the Udhampur, Jammu city. A total of 210 subjects (101 females and 109 males) who were above 18 years of age and those without any critical illness participated in the study. Pregnant women, lactating women and were excluded from the study. The information about socio-demographic, anthropometric profile (height, weight, and waist circumference), physical activity and biochemical (plasma glucose, triglyceride, and high-density lipoprotein) parameters were collected from the subjects on a pre-designed questionnaire. Socio-economic status was assessed using Kuppuswamy socioeconomic scale [14]. All the participants have explained the nature of the study in the language they understand easily. Ethical consideration was undertaken as per Helinsky declaration [15,] and informed consent was obtained from the patients. The clinical diagnosis was not performed but was collected from their recent medical reports.

Metabolic Syndrome Definitions: There are different diagnostic criteria proposed for defining metabolic syndrome by different national and international organizations. For the present study, two criteria's were considered to measure the presence of metabolic syndrome. The definitions and cut-offs are as follows-

The new International Diabetes Federation (IDF), 16 definitions for metabolic syndrome, must have central obesity (ethnic-specific for South Asians, ≥ 90 cm and ≥ 80 cm for male and female, respectively) with any other two of the following four factors:

ACCORDING TO INTERNATIONAL DIABETES FEDERATION (IDF)

Raised triglycerides	(>150 mg/dL or 1.7mmol/L)
Reduced HDL cholesterol	<40 mg/dL (1.03mmol/L) in males <50mg/dL (1.29mmol/L) in females
Raised blood pressure	SBP >130 mm Hg or DBP >85 mm Hg
Raised fasting plasma glucose	>100mg/dL (5.6 mol/L)

The National Cholesterol Education Program-Adult Treatment Panel III (NCEP ATP III) [17] defines the metabolic syndrome as the presence of at least three of the following five criteria:

ACCORDING TO NATIONAL CHOLESTEROL EDUCATION PROGRAM-ADULT TREATMENT PANEL III (NCEP ATP III)

Central obesity	Waist Circumference ≥102 cm in males and ≥88 cm in females
Blood pressure	SBP ≥130mmHg and DBP ≥85mmHg
Fasting glucose	≥100mg/dL
Triglycerides	≥150mg/dL
HDL cholesterol	<40mg/dL (1.03mmol/L) in males and <50mg/dL (1.29mmol/L) in females

Statistical Analysis: The statistical analysis was performed using the SPSS 16 version. The results for continuous variables were expressed as mean ± standard error of the mean (SEM) and percentage for categorical variables. The baseline characters were compared using Student's t-test between male and female participants. Linear regression was performed to study any association between anthropometric measurements and metabolic syndrome parameters. *P*-value of <0.05 was considered statistically significant.

RESULTS: The heterogeneous study population of 210 subjects with age range of 18-90 years (mean age 55.79±0.86 yr) consisted of 109 (51.9%) males and 101 (48.09%) females. All the participants belonged to sedentary physical activity, and according to Kuppuswamy socioeconomic scale, all belonged to middle-class status. The anthro-pometeric and biochemical details of the subjects are given in **Table 1**. There were no significant differences observed between males and females when compared using student's t-test.

The presence of metabolic syndrome was estimated by using IDF and NCEP-ATP III criteria. A high

prevalence of metabolic syndrome with 46.67% and 35.24% in study participants by IDF and NCEP-ATP III criteria, respectively has been observed **Table 2**.

TABLE 1: GENDER-WISE DISTRIBUTION OF DEMOGRAPHIC, ANTHROPOMETERIC AND CLINICAL PARAMETERS OF THE STUDY PARTICIPANTS (MEAN ± SEM)

Parameters	Males (n=109)	Females (n=102)	Total (n=210)
Demographic/Anthropometric			
Age (yr)	56.39 ± 1.14	55.14 ± 13.08	55.79 ± 0.86
Height (cm)	167.32 ± 1.51	152.46 ± 0.55	160.18 ± 0.97
Weight (kg)	80.05 ± 4.71	74.01 ± 0.53	77.14 ± 0.40
Waist (cm)	111.16 ± 1.61	92.12 ± 0.73	102.00 ± 1.12
Biochemical			
Triglyceride (mg/dL)	139.01 ± 1.73	149.71 ± 2.01	144.16 ± 1.37
FBS (mg/dL)	127.77 ± 4.36	126.80 ± 0.47	127.30 ± 2.71
SBP (mm Hg)	130.87 ± 1.76	129.79 ± 1.65	130.35 ± 1.21
DBP (mm Hg)	81.47 ± 0.50	80.64 ± 0.47	81.07 ± 0.35
HDL (mg/dL)	43.66 ± 0.94	52.25 ± 1.11	47.79 ± 0.78

No Significant differences observed between males and females. FBS- Fasting Blood Sugar; SBP- Systolic Blood Pressure; DBP- Diastolic Blood Pressure; HDL- High-Density Lipoprotein.

TABLE 2: GENDER AND AGE-SPECIFIC PREVALENCE OF METS IN STUDY PARTICIPANTS USING NCEP-ATP III AND IDF CRITERIA

Age (years)	NCEP-ATP III			IDF		
	MetS (35.24%)			MetS (46.67%)		
	Male (%)	Female (%)	Total (%)	Male (%)	Female (%)	Total (%)
18-30	1.35	1.35	2.70	1.02	1.02	2.04
31-50	9.46	14.86	24.32	13.27	19.83	32.65
51-70	28.38	21.62	50.00	26.53	19.83	45.91
70 and above	9.46	13.51	22.97	6.12	13.27	19.39

IDF- International Diabetic Federation; ATP- Adult Treatment Panel

Table 2 shows the gender-wise prevalence of metabolic syndrome according to both criteria across different age groups. The present study revealed higher prevalence (IDF-45.91% and ATP III- 50%) of metabolic syndrome with the advancement of age (51-70 years) in both males and females with approximately half of the number of population. The metabolic syndrome in the age group of 51-70 years increased two folds from the age groups 31-50 years.

TABLE 3: GENDER-WISE DISTRIBUTION OF INCREASED CLINICAL PARAMETERS

Clinical parameters	MetS		Non MetS		Total (%)
	Male (%)	Female (%)	Male (%)	Female (%)	
Waist circumference					
IDF (M ≥90cm; F ≥80cm)	46 (46.94)	52 (53.04)	59 (52.67)	45 (40.17)	202 (96.19)
ATP (M ≥102cm; F ≥88cm)	28 (37.84)	35 (47.29)	32 (23.53)	32 (23.53)	127 (60.48)
Triglycerides					
IDF (>150mg/dl)	22 (22.25)	27 (27.55)	08 (7.14)	04 (3.57)	61 (29.05)
ATP (>150mg/dl)	18 (24.32)	19 (25.68)	12 (8.82)	12 (8.82)	61 (29.05)
Fasting blood sugar					
IDF (≥100mg/dl)	42 (42.86)	46 (46.94)	20 (5.36)	22 (19.64)	130 (61.90)
ATP (≥100mg/dl)	35 (47.29)	36 (48.65)	27 (19.85)	32 (23.53)	130 (61.90)
Systolic blood pressure					
IDF (>130mm Hg)	34 (34.69)	37 (37.76)	20 (17.86)	11 (9.82)	102 (48.57)
ATP (≥130mm Hg)	28 (37.84)	32 (43.24)	18 (13.24)	16 (11.76)	94 (44.76)
Diastolic blood pressure					
IDF (>85mm Hg)	24 (24.49)	19 (19.39)	10 (8.93)	07 (6.25)	60 (28.57)
ATP (≥85mm Hg)	20 (27.02)	16 (21.62)	07 (5.15)	05 (3.67)	48 (22.86)
High-density lipoprotein					
IDF (M <40mg/dl; F<50mg/dl)	26 (26.53)	33 (33.67)	10 (8.93)	09 (8.04)	78 (37.14)
ATP (M <40mg/dl; F<50mg/dl)	23 (31.08)	27 (36.49)	13 (9.56)	15 (11.03)	78 (37.14)

IDF- International Diabetic Federation; ATP- Adult Treatment Panel

The observations revealed an increase in some obese according to waist circumference (South Asian guidelines, IDF) **Table 3**. A total of 202 subjects were measured in the obese category, *i.e.* 96.19% of the study population and 60.48% obese according to NCEP-ATP III. The fasting blood sugar levels were also on high, *i.e*. 61.90% of the population studied. There was no significant association between anthropometric and biochemical parameters observed (results not shown).

DISCUSSION: There is a rapid increase in the prevalence of metabolic syndrome (as shown in the review table) and obesity in India [18, 19]. According to IDF and NCEP-ATP III criteria, 46.67% and 35.24% of the present study participants had metabolic syndrome which is comparable to the observations documented for metabolic syndrome which goes up to 47% [11, 20, 21, 22, 23].

In the present study, considering both the criteria, *i.e*. NCEP-ATP III and IDF, half of the study participants with metabolic syndrome (50% and 45.91% respectively) are in the older age group of 51-70 years. These observations are going well with the results of Zafar *et al*., [10] and Kamble *et al*., [24], which showed a higher prevalence of metabolic syndrome in the population above 50 years of age.

TABLE 4: STUDIES SHOWING PREVALENCE OF METABOLIC SYNDROME IN INDIAN POPULATION

S. no.	Population	Diagnostic Criteria	No. of Individuals	Prevalence (%)			Reference
				Male	Female	Total	
1	Western UP	NCEP-ATP III	350	12.5	20.33	16.57	Bansal *et al*., [9]
2	Western UP	NCEP-ATP III	2982	9.6	13.8	11.7	Zafar *et al*., [10]
3	Mumbai	IDF	313	-	-	40.00	Madan and Narsaria[11]
4	Amritsar	ATP-III, IDF & mATP-III	300	-	-	ATP- 21.66 IDF- 24.33 mATP-III- 25.66	Randhawa and Sidhu [12]
5	Amritsar	WHO	1089	28.2	41.4	34.30	Singh *et al*., [25]
6	Kapurthala	NCEP-ATP III	351			17.38	Kaur [1]
7	Mandur/Goa	NCEP-ATP III	176			39.80	Peixoto and Shah [13]
8	Karnataka	mATP III	433		Urban 57.96 & rural 55.19	57.96 & 55.19	Shalini *et al*., [26]
8	Haryana	IDF	627			11.64	Pathania *et al*., [27]
9	Himachal Pradesh	NCEP-ATP III	118	53.10	46.90	-	Thakur *et al*., [28]
10	Eastern India	NCEP-ATP III	1178	34.20	52.20	43.20	Prasad *et al*., [20]
11	Mumbai	NCEP-ATP III	548	25.16	12.60	19.52	Sawant *et al*., [29]
12	Delhi	NCEP-ATP III	272	-	79.00	-	Agarwal *et al*., [30]
13	Eastern India	NCEP-ATP III		48.2	16.30	31.40	Das *et al*., [31]
14	Wardha district	ATP III & Asia-Pacific Guidelines	300	8.20	10.70	9.30	Kamble *et al*., [24]
15	North India	NCEP-ATP III	-	6.90	5.90	6.50	Kapil and Kaur [32]
16	Chandigarh	IDF & NCEP-ATP III	605	IDF 40.4 ATP 39.5	IDF 59.6 ATP 44.8	IDF 47.4 ATP III 38.5	Mangat *et al*., [22]
17	Local Indian Population	NCEP-ATP III	1568	33.17	27.04	-	Thiruvagounder [33]

The trend as in our study shows an increase in central obesity, one of the important components of metabolic syndrome by IDF criteria is comparable to other studies, which shows a similar trend [11]. The increased tendency of abdominal fat may lead to insulin resistance, elevated blood pressure and abnormal blood lipids and eventually diabetes [25]. Insulin resistance and abdominal obesity are major risk factors for metabolic syndrome [34, 35] with some other conditions *viz*. aging, physical activity, and hormonal imbalance. All these factors are increased in the study population except for the hormonal imbalance, which is not considered for the present study. It is also believed that South Asians tend central deposition of fat from childhood [36] and with the unique genetic profile they are more prone to cardiovascular risk [3, 18]. Therefore, with the transition in our lifestyle and dietary habits, regular physical activity should be increased and included in our routine to improve all these risk factors (insulin sensitivity, weight reduction, and other risk factors) [37, 38, 39] and James [40] had observed

negative association of metabolic syndrome with cardio-respiratory fitness. According to NCEP-ATP III [37], as diet is also an important component in improving these parameters, it should be low in saturated fats, trans fats, cholesterol, sodium, and simple sugars with sufficient fruits, vegetables, and whole grains [41]. The balanced combination of physical activity and controlled diet could be an effective measure to improve this state of metabolic syndrome.

CONCLUSION: India is experiencing a rapid nutritional transition resulting in both malnutrition and overnutrition. In our present study, the higher prevalence of metabolic syndrome (with increased waist circumference and hyperglycemia) and no physical activity is a clear indication for increased noncommunicable diseases which needs an intervention of regular physical activity to increase energy expenditure and increase insulin sensitivity as well as dietary modifications. There must be awareness programs from community health centers towards prevention, screening, early intervention and new treatment modalities with the aim to reduce the burden of non-communicable disorders in small towns of India.

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CONFLICT OF INTEREST: None

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