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Clustering of CVD risk factors among metabolic syndrome patients: Glimpses from Eastern India

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Abstract
Background: The metabolic syndrome is also known as syndrome X the insulin resistance syndrome, and the deadly quartet. The constellation of metabolic abnormalities includes glucose intolerance (type 2 diabetes, impaired glucose tolerance, or impaired fasting glycaemia), insulin resistance, central obesity, dyslipidemia and hypertension, all well documented risk factors for cardiovascular disease. With a shift towards unhealthy diet coupled with sedentary lifestyle, development of metabolic syndrome is on the rise even among young adults.
Objective: The objective of this study was to find out the prevalence of individual metabolic syndrome components and major lifestyle risk factors associated with it.
Methodology: Screening of Metabolic Syndrome patients was carried out on an outdoor patient basis by using the definition given by National Cholesterol Education Program Adult Treatment Panel III criteria. (NCEP ATP III 2004). Lifestyle risk factors were assessed on the basis of patients self-report and validated food frequency questionnaire & 24 hour dietary recall method was used to assess the food intake.
Results: A total of 3147 participants assessed for diagnosis of metabolic Syndrome, of which 278 patients had diagnosed to have metabolic syndrome disorder by using NCEP ATP-III criteria. Among the five components of metabolic syndrome, highest proportions (87.1%) of respondents were suffered from hypertension followed by hypertriglyceridemia which was 83.8%. About three-fourth (75.2%) of the respondents had central obesity followed by hyperglycemia which was 70.5%. More than half (65.1%) of the participants was observed for low HDL cholesterol. Only 15.1% were doing some type of physical exercise and 32.5% were smoking. Regarding the consumption of fruits and vegetables around 89.1% were taking green vegetables less than two serving/day and only 8.9% were consuming vegetables greater than 2 servings.
Conclusion: These data highlights newer advancements in the field of Metabolic Syndrome, which can serve as potential strategies to combat it. Public health interventions targeting adults, therefore, should center on prevention through education, modification of diet and lifestyle, and focusing on environment, so that these changes are acceptable and sustainable.

Keywords: Metabolic syndrome, lifestyle, hypertension

Introduction
Metabolic syndrome (MetS) is a complex disorder that increases a person's risk to cardiovascular diseases (CVD) and diabetes (DM). It is a cluster of interrelated factors including high fasting blood glucose, increased level of triglycerides, low levels of high density cholesterol (HDL), elevated blood pressure and abdominal obesity [4]. The prevalence of Metabolic Syndrome increasing all over the world. Around 25% of world population has suffered from metabolic syndrome [4]. Prevalence of this syndrome is differed by age, sex and ethnicity [5, 6]. It is not only affected the developed country but also prevalent in developing country like India. In India, urban Indians are most susceptible to its development due to urbanization, mechanization, changes in diet (increased consumption of fat and processed food") and sedentary habits without overlooking the fact that it also increasing at a faster rate even in rural Indian populations. A cross-sectional study Conducted in rural district of Wardha, Central India, in adults above the age of 18 years, reported that Metabolic syndrome was significantly higher among females (7.6%) in comparison to males (2.9%) using the ATPIII guidelines for diagnosis. However, the prevalence notched up to 10.7% and 8.2% among males and females respectively when Asia Pacific guidelines modified for waist circumference were used [7].

A Potential of dietary risk factors, such as high intakes of saturated fatty acids and low intakes of omega-3 fatty acids are also reported to contribute to the development of cardiovascular disease [8]. In addition, inadequate physical activity, smoking, and extreme alcohol consumption have been linked with increased risk of central obesity and other metabolic abnormalities [9]. The exact mechanisms of the complex pathways of metabolic syndrome are not clear yet, but it is known to be a complex interaction between genetic, metabolic and environmental factors. Sedentary lifestyle is also associated with the CVD events and related mortality. Many components of metabolic syndrome are associated with a sedentary lifestyle, including increased adipose tissue; reduced HDL cholesterol; and a trend toward increased triglycerides, blood pressure, and glucose in the genetically susceptible. Studies have indicated that smokers have a higher risk of becoming insulin resistant, hence, smoking can be considered as a modifiable risk factor for Metabolic Syndrome [10, 11]. In a cross-sectional study of 3452 men, ≥20 years of age from a nationally representative sample of Koreans, a positive association between smoking and Metabolic Syndrome were found [12]. Some studies indicated an inverse association with the alcohol consumption to HDL cholesterol, triglycerides and blood pressure [13]. Alcohol consumption of less than 40 g/day for men and less than 20 g/day for women suggested lower prevalence of MetS in comparison to non-alcoholics, as demonstrated by a meta-analysis of seven observational studies [14]. Some studies reported that obesity is a major root cause of Metabolic Syndrome. A persistent obesity dysregulates metabolic process thus begins a cluster of conditions; dysglycemia, dyslipidemia, hypertension, and procoagulant state, known as the Metabolic Syndrome. Increasing burden of Obesity, Metabolic Syndrome, T2DM, and CVD in developing countries has created an urgent need to strategize health policies and mass intervention programs to tackle nutrition and continue efforts to manage under-nutrition. Clearly these efforts require a thorough understanding of factors influencing and driving obesity and the metabolic syndrome in developing countries. In view of these facts this study was designed to assess the various lifestyle risk factors which were present in metabolic syndrome patients. In view of these facts this study was designed to identify metabolic syndrome patients with the proportion of individual component and the various lifestyle risk factors present in patients.

Methodology

Study Population

This study was performed on Indian population at the Department of Cardiology, Sir Sunderlal Hospital Banaras Hindu University Varanasi on an outdoor patient basis. Participants were men and women aged 30-70 years who were visiting the OPD for the first time were considered for this study. The criteria for identifying the patients of metabolic syndrome are depending on the definition given by the Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (NCEP ATP III) (modified 2004). The inclusion criteria were as follows: Waist circumference (males: ≥90 cm and for females: ≥80 cm),Triglycerides ≥150 mg/dl, Low HDL (Males <40 mg/dl and for females <50 mg/dl, Systolic blood pressure ≥130 mmHg and/or Diastolic blood pressure ≥85 mmHg, and fasting blood sugar ≥100 mg/ dl. To be enrolled in the study, patients had to have ≥3 of the above-mentioned criteria to be classified as having metabolic syndrome.

Study Design

This was a hospital based cross sectional study. A general screening was carried out for all the individuals (3145) during the study period for eligibility in the study. A total of 278 men & women who had ≥3 components of the metabolic syndrome and met the inclusion criteria were included in the present study. After screening details of dietary history and lifestyle risk factors were recorded in self-administered interview schedule for each study subjects.

Ethical clearance

The present study was approved by the institutional ethics committee on biomedical research in humans of institute of medical sciences Banaras Hindu University Varanasi India and written informed consent was obtained from all potential participants at the screening visit.

Assessment of food intake and lifestyle risk factors

Dietary assessment was performed with the food frequency questionnaire and 24 hour dietary recall methods. Food Frequency Questionnaire (FFQ) is the standard method to know the dietary pattern in studies of chronic disease all over the world. All food records were analyzed by a specially designed computerized program using the food database of Nutritive value of Indian foods (ICMR 2010). Data obtained from the 24-hour food records were processed and converted to the gram equivalents by using the Indian system of food equivalents. Each food and beverage was then coded according to the software and entered into a computerized nutrition database which contains the nutritional values of all Indian foods, for analysis.

Other major risk factors such as smoking, drinking alcohol, physical activity pattern, and family history of diseases etc. are assessed on the basis of their self-report only and no any other method was used to assess the presence of these risk factors.

Assessment of Clinical & Biochemical Measurements

All the clinical and biochemical assessment was performed by the trained routine clinical staff at Sir Sunder Lal Hospital Banaras Hindu University Varanasi By using standard procedure.

Statistical analysis

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) software (version 16, SPSS). Continuous variables were expressed as mean ± standard Error, and categorical variables (dichotomous variables) were expressed as frequencies and proportions (percent).

Results and Discussion

Table 1: Distribution of respondents according to their socio-demographic Characteristics

Socio-demographic Characteristics	Respondents (N=278)	
	No.	Percentage (%)
Gender		
Male	163	58.6
Female	115	41.4
Age in years		
31-40	54	19.4
41-50	98	35.3
51-60	81	29.1
61-70	45	16.2
Educational Status		
Illiterate	45	16.2
Primary & Upper primary	37	13.3
Secondary & Higher secondary	93	33.5
Graduate & above	103	37.0
Residence		
Urban	99	35.6
Rural	136	48.9
Slum	43	15.5
Socio-Economic status (As per the B. G. Prasad classification)		
Upper	52	18.7
Upper Middle	77	27.7
Middle	48	17.3
Lower Middle	60	21.6
Lower	41	14.7

Total 278participants were included in this study. Out of 278 participants, more than half (58.6%) of the participants were males and 41.4% were females. On the contrary one study by Zungu Li *et al*. (2008) reported more female compared to male in a study on hypertensive patients. The higher number of male in this study was due to the higher attendance by men at OPD. Similar findings also reported by other studies [15].

It is evident from the table-1 that Among the 278 participants selected, majority of the participants (35.3%) were in the age group of 41-50 years, 29.1% were in the age group of 51-60 years, 19.4% were in the age group of 31-40 years and 16.2% were in the age group of 61-70 years. Among 278 study subjects, more than one-third (37.0%) of the respondents were educated up to graduation and above, followed by one-third (33.5%) of the respondents were educated up to secondary and higher secondary level and 13.3% of the respondents were educated up to primary and upper primary level, while 16.2% of the respondents were illiterate. Another study reported out of all hypertensive patients 46.6% had only attained secondary level education, followed by those who attended primary school [15]. Socio-demographic characteristics of the study sample shows that nearly half of the (48.9%) participants belong to rural area, 35.6% were from urban area and 15.5% participants from slum area. Socio-economic status of the family indicated that nearly one-third (27.7%) of the participants were from upper-middle class followed by 21.6% from lower-middle, 18.7% from upper socio-economic class, 17.3% were from middle class and 14.7% from lower socio-economic background.

Table 2: Prevalence of the metabolic syndrome components of participants

Components of Metabolic Syndrome	Participants (N=278)	
	No.	(%)
Hypertension [1]	242	87.1
Central obesity [2]	209	75.2
Low HDL cholesterol [3]	181	65.1
Hypertriglycerolemia [4]	233	83.8
Hyperglycemia [5]	196	70.5

1. Defined as systolic blood pressure >130 mm Hg and diastolic blood pressure >85 mm Hg or as the use of hypotensive therapy.
2. Defined as waist girth >82 cm in women and >102 cm in men.
3. Defined as HDL-cholesterol concentration >40 mg/dL in men and 50 mg/dL in women.
4. Defined as serum triacylglycerol concentration >150 mg/dL.
5. Defined as fasting blood sugar concentration >100 mg/dL.

Table-2 shows the prevalence of all five components of metabolic syndrome. Among these five components highest proportion (87.1%) of respondents were hypertension followed by hypertriglycerolemia which was 83.8%. About three-fourth (75.2%) of the respondents had central obesity followed by hyperglycemia which was 70.5%. More than half (65.1%) of the participants was observed for low HDL cholesterol.

However a study by Fulvio Muzio *et al*. (2007) found that the prevalence of hypertension in metabolic syndrome patients was 90% which is higher than the present study and hyperglycemia among 62%, followed by central obesity in 100% and low HDL cholesterol among 52% [16].

Table 3: Distribution of respondents according to their physical activity pattern

Physical activity level	Participants (N=278)	
	No.	Percentage (%)
Sedentary	115	41.3
Lightly active	81	29.1
Moderate	64	23.1
Highly active	18	6.5

Table-3 revealed that out of 278 participants, about 41.3% were sedentary workers, nearly one-third (29.1%) of the participants were lightly active, 23.1% were moderate workers and remaining 6.5% were highly active workers.

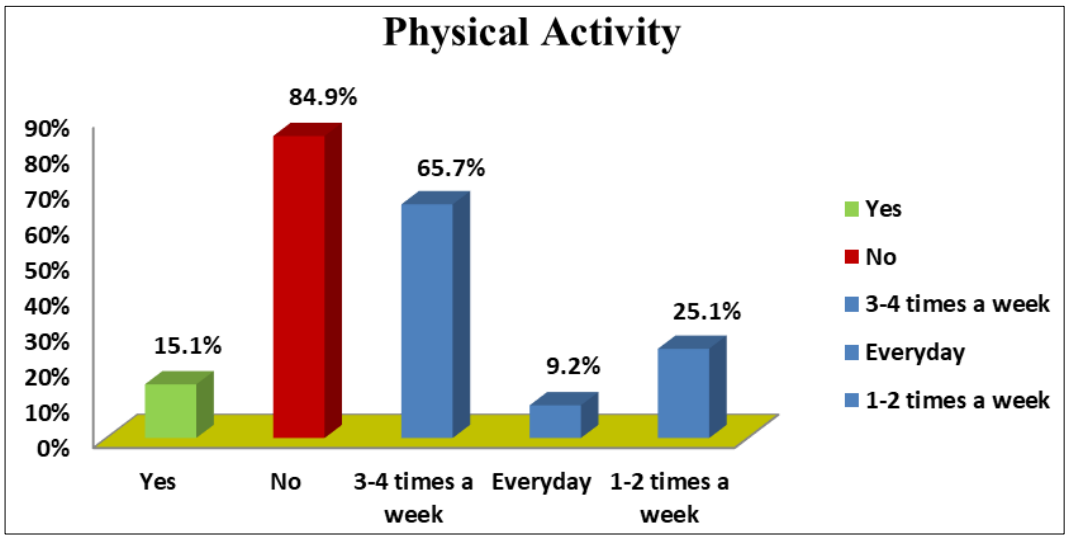

Fig 1: Participants' distribution of the frequency of physical activity

Fig.1 presented participants' responses about their involvement and frequency of physical activity. The results showed that only 15.1% of them indicated that they were involved in some form of physical activity, while 84.9% of the participants did not involve in any type of physical activity. Fig.1 also indicated that more than half (65.7%) of the participants did physical activity 3-4 times in a week, while 25.1% were did 1-2 times in a week and remaining 9.2% did every day any type of physical activity. Similarly very low number of hypertensive patients was involved in physical activities in a study by a study conducted by Zungu LI *et al*. (2008) [15].

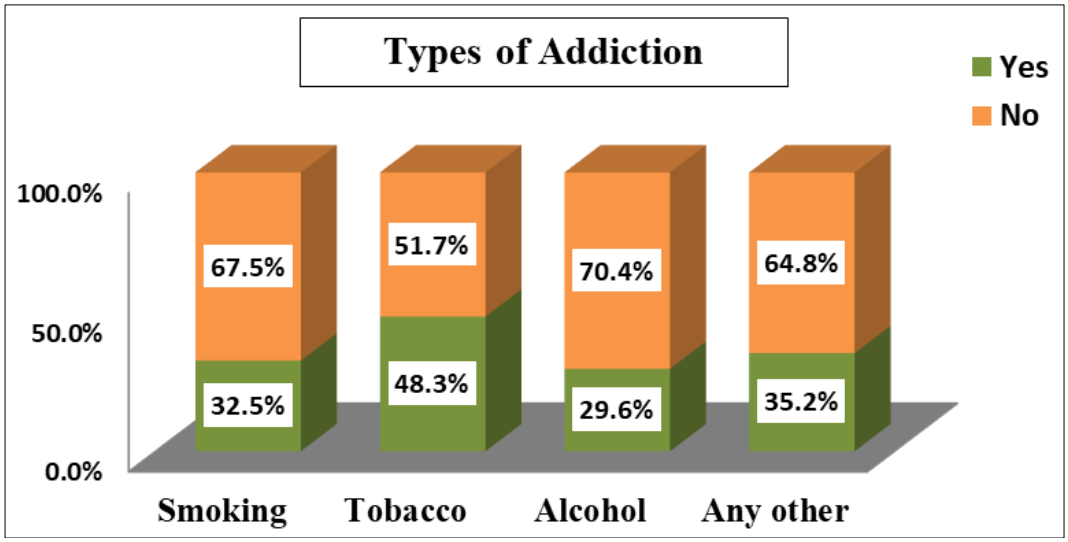

Fig 2: Distribution of the participants according to type of addiction (N=278)

As shown in fig. 2, about 65.8%of the participants reported tobacco chewing as a habit of addiction followed by smoking reported by nearly two-third (39.1%) of the participants, more than one-third (31.2%) were addicted by any other type of addiction (i.e. marijuana, bhang) and approximately one-fourth (24.9%) of the participants were consumed alcohol as an addiction.

Table 4: Frequency of Food Intake (servings/day) of the respondents (N = 278)

No. of Servings	Proportion of respondents	RDA for metabolic syndrome
Cereal & grains		
< 9 servings / day	33.5%	9-12 servings / day
9-15 servings / day	48.3%	
> 15 servings / day	18.2%	
Legumes & Pulses		
< 2 servings / day	87.6%	2-3 servings / day
> 2 servings / day	12.4%	
Green Vegetables		
< 2 servings / day	89.1%	3-5 servings / day
> 2 servings / day	10.9%	
Fruits		
< 2 servings / day	91.4%	2-3 servings / day
> 2 servings / day	8.6%	

As shown in the table-4 nearly half (48.3%) of the respondents consuming 9-15 servings of cereals per day and 18.2% were consuming >15 servings per day. While the recommendations for metabolic syndrome patients were 9-12 servings/day. Very small proportions of respondents were comes under the category of recommendations. Similarly for the pulses intake, very few (12.4%) of the respondents were consuming adequate amount of pulses however majority (87.6%) of the respondents were having below the recommendations. Green vegetables is a most important part of our diet but findings showed majority (89.1%) of the respondents were having < 2 servings/ day that is too below the recommendations for metabolic syndrome patients that is 3-5 servings/day.

Similarly, more than 2 serving of fruits were consumed by only 8.6% of respondents and majority (91.4%) of the respondents were consuming < 2 servings / day, while the recommended servings are 2-3 servings / day.

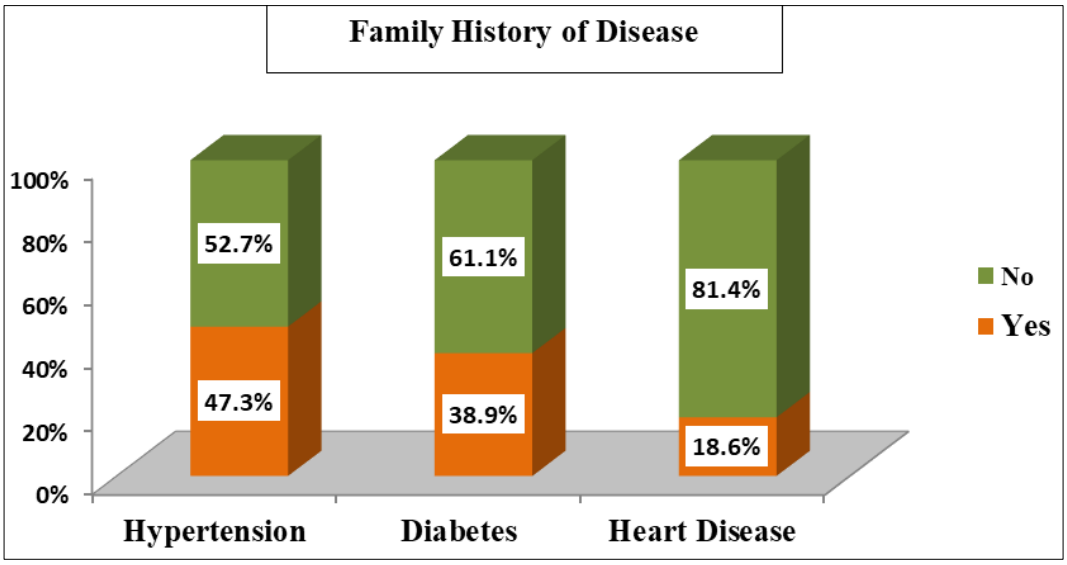

Fig 3: Family history of disease of the Respondents (N=278)

Fig. 3 illustrated that nearly half (47.3%) of the respondents reported the presence of a family history of hypertension compared to 52.7% who did not have a family history of the disease. Likewise nearly two-third (38.9%) of the respondents reported diabetes as a family history of disease remaining 61.1% of the respondents reported did not have family history disease. Among 278 respondents nearly one-fifth (18.6%) reported heart disease as a family history of disease, while 81.4% of the respondents had not any family history of disease.

Conclusion

Thus, Metabolic Syndrome is a chronic but preventable disease; and thus adequate knowledge of the disease and lifestyle modification are important features in its effective control and management. This study addressed the need of a comprehensive health education and health promotion programme targeting patients who are at risk and the community in general. Behavioural interventions are required to translate the knowledge to behavioural change in attitudes and life style practices.

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