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JOURNAL OF PREVENTIVE MEDICINE AND CARE
ISSN NO: 2474-3585

Research

DOI: 10.14302/issn.2474-3585.jpmc-20-3672

Prevalence and Risk Factors of Metabolic Syndrome Among Teaching Staff of Engineering Colleges in Central India

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Abstract

Background: Prevalence of Metabolic syndrome is high among Asians including Indians, and is high among those having sedentary occupations. Teaching is one of the important occupations, which demands no strenuous physical activity. However, there is little information available about the prevalence of metabolic syndrome among teaching staff of engineering college. Hence, the present study was conducted to study its prevalence, certain risk factors and co-morbidities among teaching staff of engineering institutes.

Methods: Teachers from engineering colleges of Nagpur city were the study subjects. Data was collected by interview technique. Clinical examination and laboratory investigations like Fasting blood glucose, High Density Lipoproteins and Serum Triglycerides were done. National Cholesterol Evaluation Programme (NCEP) Adult Treatment Panel Three (ATPIII) criteria were used to study Metabolic syndrome. Blood pressure and anthropometric measurements like height, weight and waist circumference were obtained by standard methods.

Results: The prevalence of metabolic syndrome was found to be 20.5%. It was 25.32% in females and 19.31% in males. It was more common in subjects of higher age group, muslim religion, and among widows and separated. Alcohol consumption, smoking and sedentary life style was found to be significantly associated with presence of metabolic syndrome. Frozen shoulder, fungal infection and stroke were common co morbidities found among subjects having metabolic syndrome.

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Citation: Sanjay Agrawal, Sanjeev M. Chaudhary, Sanjay S. Kubde, Manjusha Dhoble, Moin Shaikh (2020) Prevalence and Risk Factors of Metabolic Syndrome Among Teaching Staff of Engineering Colleges in Central India. Journal of Preventive Medicine And Care - 3(2):8-16. https://doi.org/10.14302/issn.2474-3585.jpmc-20-3672

Keywords: metabolic syndrome, engineering teacher, co-morbidity, physical inactivity

Recieved: Dec 21, 2020 **Accepted:** Dec 23, 2020 **Published:** Dec 25, 2020

Editor: Khuram SHAHZAD, Department of Polymer Engineering and Technology, University of the Punjab, Lahore, 54590 Pakistan.

Introduction

The rapid rise of non communicable diseases (NCDs) is presenting a challenge in twenty-first century which is threatening economic and social development of the world as well as the lives and health of millions across the globe. As many countries are struggling to control infectious diseases, they are facing an explosion in chronic diseases- a situation for which they have neither the resources and personnel, nor the health service infrastructure required to respond effectively. Of the 57 million deaths that occurred globally in 2008, 36 million – almost two thirds – were due to NCDs, comprising mainly cardiovascular diseases, cancers, diabetes and chronic lung diseases. Especially in developing countries, the burden of chronic diseases is increasing rapidly and will have significant social, economic, and health consequences in the coming years.

India is also undergoing rapid urbanization with increased industrialization, rising incomes, expanded education and improved health care. There is increase in smoking habits, an unhealthy diet, physical inactivity and adoption of other unhealthy lifestyles leading to rise in prevalence of non communicable diseases. On the other hand, modern medical care is now enabling many with chronic diseases to survive. The impact of chronic diseases on the lives of people is serious when measured in terms of years of loss of life, disablement, family hardship, poverty and economic loss to the country.

Metabolic syndrome , which is also known as "Syndrome X," was first described by Reaven in his 1988 Bantin Lecture[1]. It is characterized by clustering of cardiovascular risk factors, namely central obesity, elevated blood pressure, elevated plasma glucose, and dyslipidemia. It is increasingly attracting the attention of international research institutions and scientific societies, as a major modifiable determinant of cardiovascular disease and type 2 diabetes. There are various definitions proposed for the metabolic syndrome. National Cholesterol Education Program – Adult Treatment Panel III (NCEP-ATP III)[2] and the American Heart Association (AHA)/ National Heart Lung and Blood Institute (NHLBI)[3] defined the Metabolic syndrome as presence of any three out of the five components namely central obesity, raised triglycerides, low HDL, raised plasma glucose and raised blood pressure. On the other hand, the International Diabetes Federation (IDF)[4] definition includes central obesity as an essential component of the Metabolic syndrome in addition to any two of the four above-mentioned components.

Prevalence of Metabolic syndrome is high among Asians including Indians and is rising particularly with the adoption of modernized lifestyle. Many studies in India have reported high prevalence of Metabolic syndrome in a range of 9–48%.[5] But there are limited data on comparison of the Metabolic syndrome criteria in the same study population to assess the strengths and limitations of the proposed criteria in the context of South Asian ethnicity. Teaching is one of the important occupations, which demands no strenuous physical activity. Teaching staff is usually sedentary. It was observed in many studies that the metabolic syndrome and cardiovascular diseases are rising in sedentary population. However, there is little information available about the prevalence of metabolic syndrome among teaching staff of engineering college. Hence, the present study was conducted to study its prevalence, certain risk factors and co-morbidities among teaching staff of engineering institutes.

Material and Methods

The present cross sectional study was carried out among teaching staff of engineering colleges in central part of Nagpur city. Four engineering colleges were selected randomly from the list of engineering colleges of Nagpur. Institutional ethics committee's clearance was sought before the start of study. The necessary permission was obtained from the Principal of each engineering college for conducting the present study. Study subjects were explained regarding objective and nature of study, and their consent was sought before data collection. Members of the physical education department of engineering college co-operated in conducting the study. They made necessary arrangements to carry out the physical examination and facilitated the interviewing of study subjects.

The list of teaching staff was obtained from

college authority. A time schedule was prepared for study subjects so that they could participate in the study conveniently. All individuals who participated in this project received a verbal explanation of the procedures involved and the benefits expected from the study. All respondents were asked to sign an informed consent form prior to the commencement of the study. Anonymity of the study subjects and confidentiality of all the data was assured during the process of data collection and it was explained that all results would be reported as a group data so that no individual could be identified.

Those study subjects who could not be examined due to absence on the day of data collection were called at Urban Health Training Centre for examination and laboratory investigations. The pilot study was done on 100 participants. The pilot study was carried out to check the feasibility and to test the proforma. Necessary changes were made in the proforma after pilot study. The pretested structured questionnaire was used for collection of data. Data was collected by interview technique. Clinical examination and necessary laboratory investigations were done. National Cholesterol Evaluation Programme (NCEP) Adult Treatment Panel Three (ATPIII) criteria were used to study Metabolic syndrome. Physical activity assessed by using joint FAO/WHO expert consultation, Rome, Oct.2001. Blood pressure and anthropometric measurements like height, weight and waist circumference were obtained by standard methods**.** After an overnight fasting, blood samples for High Density Lipoproteins and Serum Triglycerides were taken. Five milliliters of venous blood was taken from the ante- cubital fossa with all aseptic precautions and placed in empty sterile tubes. The samples were transported to the Biochemistry laboratory of the Medical College, for analysis within a day, using an automated ARCHITECT c8000 machine. Fasting blood sugar was measured by using Accu-check glucometer.

Data Analysis

Epi info version 7, open Epi info and Statcal were used to analyze the data. Chi square tests were used to examine differences in responses among the demographic variables, risk factors and knowledge on a number of variables.

Sample Size

Assuming prevalence of 0.5, confidence level of 90% and relative error of 10%, sample size (n) was estimated as $n = Z^2_{(1-\alpha)} \times p \times (1-p) / d^2 = 3.84 \times 0.5 \times 0.5 / (0.05)^2 = 384$

A total of 152, 128, 77 and 43 teachers of the four engineering institutes were included in our study, which made the total sample of 400.

Results

Out of a total of 400 teachers, 321(80.25%) were males and 79 (19.75%) were females. As seen in table 1, majority of the subjects were of over 40 years of age, maximum study subjects belonged to Hindu religion, were from nuclear family, were married and consumed a mixed diet. Around 7% subjects had diabetes mellitus, and similar number of subjects had hypertension. Maximum subjects were doing moderate physical activity. BMI of around half of the study subjects was found to be in normal range.

Table 2 shows mean and standard deviation of different components of metabolic syndrome among the subjects. Except triglycerides, mean of all the parameters was more among males as compared to females, though the difference was statistically not significant. In contrast, prevalence of individual component of metabolic syndrome was higher in females, for all components except high density lipoprotein (Table 3).

Majority of the study subjects i.e. 41 (10.25%) were having 3 components of Metabolic Syndrome at a time, followed by 30 (7.5%) subjects who were having 4 components. Eleven subjects (2.75%) were having 5 components of Metabolic Syndrome at a time (Table 4).

Study subjects having 3 and more than 3 components of Metabolic syndrome constituted 82 (20.5%). So the prevalence of metabolic syndrome was found to be 20.5%. In present study, as seen in table 5, metabolic syndrome was found to be significantly associated with advanced age, married status, alcohol abuse, smoking and physical inactivity.

Metabolic syndrome is a condition which causes biochemical changes in body making person prone to different kinds of diseases. These include life threatening diseases like myocardial infarction, stroke,

Table 1. Demographic characteristics of study subjects

	Male (n=321)		Female(n=79)	
	No.	Percent	No.	Percent
Age group (years)				
<30	6	1.87	2	2.53
31—40	99	30.84	24	30.38
41-50	143	44.55	31	39.24
51-60	73	22.74	22	27.85
Religion				
Hindu	199	62.00	39	49.37
Muslim	62	19.31	16	20.25
Buddha	29	9.03	17	21.52
Others	31	9.66	7	8.86
Marital status				
Married	287	89.40	70	88.60
Unmarried	12	3.74	1	1.27
Widowed	10	3.12	8	10.13
Divorced	12	3.74	0	0
Type of family				
Nuclear	238	74.14	59	74.68
Joint	71	21.12	14	17.72
Three Generation	12	3.74	6	7.59
Type of diet				
Vegetarian	60	18.69	31	39.24
Mixed	261	81.31	48	60.76
History of past illness				
DM	23	7.17	6	7.59
HT	24	7.48	8	10.1
MI	13	4.05	3	3.8
Family history				
DM	35	10.9	9	11.4
HT	32	9.97	10	12.7
Obesity	18	5.61	4	5.06
MI	13	4.05	1	1.27
Stroke	4	1.25	0	0
Physical Activity				
Sedentary	63	19.6	24	30.4
Moderate	222	69.2	53	67.1
Vigorous	36	11.2	2	2.53
BMI				
<18.5 (underwt.)	1	0.31	0	0
18.5-22.9 (normal)	169	52.6	45	57
23-27.49 (overwt.)	117	36.4	21	26.6
≥27.5 (obese)	34	10.6	13	16.5

Table 2. Mean and standard deviation of individual component of metabolic syndrome

Component of Metabolic syndrome	Male n=321	Female n =79	Total (n=400)
Waist circumference (cm)	85.50±5.07	81.02±5.72	84.61±5.49
Systolic BP (mmHg)	124.06±10.96	123.99±11.73	124.05±10.50
Diastolic BP(mmHg)	83.21±50.66	80.30±5.62	82.63±45.45
Blood glucose (mg/dl)	92.92±30.77	91.57±37.26	92.64±30.83
Triglycerides≥150mg/dl	140.03±11.98	141.94±14.34	140.4±12.4
High Density Lipoproteins(mg/dl)	51.43±9.20	44.81±8.16	51.12±9.3

Mean ± SD

Table 3. Prevalence of individual component of metabolic syndrome

Component of Metabolic syndrome	Male n=321 No.(%)	Female n=79 No.(%)	Total n=400 No.(%)
Waist circumference ≥cut off	45(14.01)	44(55.70)	89(22.25)
Elevated blood pressure+ Known cases	71(22.11)	23(29.11)	94(23.25)
Elevated blood glucose level + known cases	78(24.30)	25(31.64)	103(25.75)
Triglycerides≥150 mg/dl	40(12.46)	17(21.51)	57(14.25)
HDL≤ Cut off	76(23.67)	18(22.78)	94(23.5)

Table 4. Number of components of metabolic syndrome

No. of components of Metabolic Syndrome*	Male		Female		Total	
	No.	%	No.	%	No.	%
None	226	70.40	50	63.29	276	69.00
1	24	7.47	2	2.54	26	6.50
2	10	3.12	6	7.59	16	4.00
3	30	9.35	11	13.92	41	10.25
4	23	7.17	7	8.86	30	7.50
5	8	2.49	3	3.80	11	2.75
Total	321	100	79	100	400	100

Table 5. Factors associated with metabolic syndrome

Factors	Metabolic syndrome		Chi square value
	Present (n=82)	Absent (n=318)	
Age>40 years	69 (84.15)	200 (62.89)	13.3*
Sex- male	61 (74.39)	260 (81.76)	2.34**
Religion- Hindu	50 (60.98)	188 (59.12)	0.09**
Marital status- married	66 (80.49)	291 (91.51)	8.25*
Alcohol abuse	13 (15.85)	22 (6.92)	6.51*
Smoking	26 (31.71)	43 (13.5)	15.1*
Mixed Diet	67 (81.71)	242 (72.6)	1.16**
No Physical activity	44 (53.66)	231 (72.6)	10.9*

*df=1, p<0.05, significant

etc., and lifelong diseases like diabetes mellitus, obesity, hypertension and their related complications. In the present study, common co-morbidities associated with Metabolic syndrome found were fungal infection, frozen shoulder, stroke, cataract and myocardial infarction (table 6).

Discussion

The prevalence found in our study was lower than that reported by Mishra et al (30%)[6] and Sarkar S et al (30%)[7], while it was higher than that reported by Gang Hu et al (15%)[8], Gupta et al[9] (13%) and Kamble P et al (17.3%)[10]. The finding that prevalence of Metabolic syndrome was higher in females as compared to males, is similar to many other previous studies.[10-14] However some authors found contradictory results, reporting a higher prevalence among men. [15-17]

In present study, Metabolic syndrome was found to be associated with advanced age. These findings were similar to Ford et al[12] who reported prevalence of 42.0% for participants aged 60-69 years and 43.5% in 70 years and above. Similarly Bjorn Hildrum et al[18]concluded that the prevalence of Metabolic syndrome increased with age affecting less than 10% people in their 20s and 40% of people in their 60s. Other researchers[19-21] have reported similar findings.

In the present study maximum 50% widow and separated had metabolic syndrome. 66 (18.49%) married study subjects were having metabolic syndrome and 1 (7.69%) unmarried subjects have metabolic syndrome. These findings were similar to Troxel WM et al[22] who reported divorced (OR= 2.47; 95% CI=1.02-5.97), and widowed (OR=5.82; 95% CI=1.88-18.03) women were significantly more likely to have the Metabolic syndrome, but contradictory to Bhanushali et al[23] who reported single women had significantly lower prevalence of Metabolic syndrome compare with married women (OR= 0.43, 95% CI=0.43-0.99). However Park et al[24] reported that prevalence of Metabolic syndrome was not statistically significant in divorced or widowed men and women compared with married men and women (OR= 0.82, 95% CI= 0.57-1.17 and OR=1.03, 95% CI=0.84-1.26, respectively).

The present study shows that, 37.14 % subjects with Metabolic syndrome used to consume alcohol, and the association was statistically significant. This finding was similar to some studies[25,26] while contradictory to others[27-29].

Present study found that 37.68 % study subjects with Metabolic syndrome were smokers and 16.92% were non-smoker. Smokers were more prone to develop Metabolic syndrome. This finding was similar to previous studies.[30-35] However Bhanushali et al[23] found no association between smoking and prevalence of Metabolic syndrome in African-American men and

Table 6. Co-morbidities associated with metabolic syndrome

Co-Morbidity	Metabolic Syndrome		
	Yes	No	Total
	No (%)	No (%)	No (%)
Fungal infection	21 (75.00)	7 (25.00)	28(100)
Frozen Shoulder	16 (76.19)	5 (23.81)	21(100)
Cataract	12 (63.16)	7 (36.84)	19(100)
Myocardial Infarction	10 (62.5)	6 (37.50)	16(100)
Stroke	3 (75.00)	1 (25.00)	4 (100)

women.

We found that vigorous physical activity was protective against metabolic syndrome. Similar finding has been reported in earlier studies. [36-42]

In the present most common co-morbidity associated with Metabolic syndrome was frozen shoulder followed by stroke, cataract and myocardial infarction.

Isomma et al[43] in a Botnia Study reported, in patient with Metabolic syndrome relative risk of CAD was 2.96 (CI 95% 2.36 to 3.72; *P<0.0001*) and cardiovascular mortality was significantly increased to 12% compared to 2% in subjects without Metabolic syndrome. Lakka et al[44] in another Finnish study, found that all cause mortality associated with the Metabolic syndrome increased 1.9 fold and CVD mortality 2.6 fold. Sattar N et al[45] reported Metabolic syndrome was associated with a 3.7 fold increase in coronary artery disease risk and 24.5 fold increase in incident diabetes compared to men without Metabolic syndrome, The Framingham Offspring Study[46] reported the risk of CHD increased 2.4 fold for men and 5.9 for women, while Bonora et al[47] in the Verona Diabetes Complication Study found 92.3% of the population with CVDs to have Metabolic syndrome according to World Health Organization criteria.

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