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Original Article

Public Health Section

Prevalence of Cardio-metabolic Risk Factors: A Cross-sectional Study among Employed Adults in Urban Delhi, India

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ABSTRACT

Introduction: Many studies have shown increasing prevalence of Cardiovascular Diseases (CVD) among employed adults. Metabolic Syndrome (MS) which is a predictor of increasing CVD is a cluster of risk factors like central obesity, dyslipidemia, hyperglycaemia and hypertension. Heredity, poor dietary choice, unhealthy lifestyle, job stress are some of the causes responsible for increased prevalence of cardiovascular risk among employed adults.

Aim: To measure the prevalence of cardio-metabolic risk factors among employed adults in urban Delhi, India.

Materials and Methods: Study design was cross-sectional with purposive sampling of 200 apparently healthy adults (both males and females) working in urban Delhi, India. Sociodemographic profile, anthropometric measurements (height, weight and waist circumference) and biochemical measurements (lipid profile and fasting glucose) and blood pressure were documented. Physical activity pattern was assessed using WHO Global Physical Activity Questionnaire (GPAQ). Univariate and multivariate regression analysis for associating cardio-metabolic risk factors among adults were performed using the SPSS 18.0 software.

Results: High prevalence of metabolic syndrome among males (66.6%) and females (57.2%) of 25 to 45 years of age was reported. Overall prevalence of MS was 62% among the study population. Central obesity (50.5%, p<0.04), low HDL (62%, p<0.05), hypertriglyceridemia (56.5%, p<0.00), hypertension (39%, p<0.00) and high fasting glucose (10.5%, p<0.76) were the most common abnormalities among males and females. Incidence of high BMI (54.5%, p<0.05) was positively correlated with MS risk factors. Associated cardio-metabolic risk factors besides MS were family history (43.5%, p<0.72), smoking (17.6%, p<0.001), drinking (18%, p<0.001) and physical inactivity. It was found that 32.8% of the subjects had low, 60.4% had moderate and only 7.0% had high physical activity.

Conclusion: Employed adults in urban Delhi, India are at high risk of developing CVD due to high prevalence of MS and high Body Mass Index (BMI).

Keywords: Cardiovascular diseases, Central obesity, Metabolic syndrome

INTRODUCTION

Cardio-metabolic risk factors characterized by central obesity, dyslipidemia, hyperglycaemia and hypertension are currently a major global public health challenge especially in India [1-3]. Asians are at a high serious risk of developing CVD and Type 2 diabetes and important determinants of both these non-communicable diseases are insulin resistance and clustering of cardio-metabolic risk factors [4,5]. This is because of the influence of extent of urbanization, lifestyle patterns, and socioeconomic/cultural factors.

Asian Indians have traditionally been considered a high risk population with respect to diabetes and CVD, and the numbers are consistently on the rise [6] especially among employed adults. Reasons cited for high prevalence of CVDs among employed adults include job stress, irregular food habits, lack of regular exercise, inadequate sleep, and unhealthy habits like smoking and drinking [7-10].

Employed adults spend a considerable amount of time outside home and consume at least one meal at their workplace. Hence, what they consume at work may play an important role in their health [9,10]. This study was planned to estimate the prevalence of cardio-metabolic risk factors among employed adults in urban Delhi, India.

MATERIALS AND METHODS

In this cross-sectional study, data was gathered from apparently healthy employed adults aged 25 to 45 years (both male and female) from September 2016 to February 2017. Out of 10 private/government organizations approached, four organizations (two private and two government) gave permission to conduct the study. The sample size was statistically computed on the basis of the prevalence of MS among adults in urban Delhi [9], considering 95% confidence levels, relative precision of 5% and a dropout rate of 20%.

Inclusion criteria: Age 25-45 years, no prior history of any disease. Employed adults willing to volunteer for the study were enlisted; out of which 200 adults were enrolled by purposive sampling. Health camps were organised to collect data at the concerned organizations. Subjects were enrolled only after clearly stating the aim, purpose and the motive of the study. At the end of it, only those who gave a written consent to participate in the study were selected. The study was approved by the Ethics Committee, Institute of Home Economics, University of Delhi, India.

Data Collection: Prior to data collection, pre-testing of questionnaire was done (n=20), which were excluded from the actual analysis. Information about sociodemographic characteristics (age, gender, religion, marital status, family type, etc.,), family history, brief dietary details (dietary pattern, frequently consumed foods etc.,), physical activity pattern, smoking and alcohol status was gathered with the help of a pre-tested questionnaire schedule. Anthropometric (height, weight and waist circumference), blood pressure (systolic/diastolic) and biochemical parameters (lipid profile and fasting glucose) were also assessed as discussed below. Consumption of any junk foods like deep fried snacks, pizzas, burgers, chips and cold drinks twice or more in a week was considered to assess the junk food

consumption. The WHO-GPAQ version 2.0 instruments were used to measure physical activity in three domains: work, transportation and leisure, respectively. Following the GPAQ analysis guide, the level of physical activity was classified as low, moderate and high based on MET – minutes/week.

Anthropometric measurements: Standing body height was measured with a commercial stadiometer in cm (to the nearest 0.5 cm). A digital scale, with an accuracy of 100 g was used to measure body weight and was recorded in kg. Waist circumference was measured in a horizontal plane, midway between the inferior margin of the ribs and the superior border of the iliac crest, using a standard inelastic measuring tape. Measurements were taken thrice and the mean was taken in all cases. All instruments used for measurement were calibrated twice weekly. BMI (kg/m^2) was calculated by dividing weight (in kg) by the square of height (in m). Systolic and diastolic blood pressures were measured using a standard sphygmomanometer with adult cuffs and recorded in mmHg. The measurements were repeated twice at an interval of 3 minutes in the sitting position and the mean was taken.

Biochemical measurements: Blood samples (5 ml) were drawn from the mid-cubital vein after 12 hours overnight fasting for measurement of lipid profile {Total Cholesterol (TC), High-Density Lipoprotein (HDL), cholesterol, and triglycerides} and fasting plasma glucose levels. Plasma glucose was measured using the glucose oxidase peroxidase method; serum TC and triglycerides by standard enzymatic procedures; and HDL cholesterol by direct assay method. They were recorded in mg/dl. Blood samples were obtained by trained technician and the analysis was conducted under standardized procedures in ISO 9001: 2001 certified laboratory.

Operational definition of MS: MS was diagnosed using the modified National Cholesterol Education Program—Adult Treatment Panel III (NCEP-ATP III) criterion, which considers ethnic differences in central obesity [Table/Fig-1] [1]. Obesity was measured in term of waist circumference and the BMI classification as given for Asians [11].

STATISTICAL ANALYSIS

Statistical analysis was performed using SPSS 18.0 program (Statistical Package for Social Sciences; SPSS). Mean and standard deviations were derived for numerical data. Prevalence is reported in percentages. Univariate and multivariate logistic regression was done to measure the association of conventional cardiovascular risk factors (independent variables) with MS (dependent variable).

RESULTS

The present study was done to ascertain the prevalence of cardio-metabolic risk factors among employed adults of urban Delhi, India. General characteristics of the study population are represented in [Table/Fig-2]. The age of the study population ranged from 25 to 45 years. Subjects were employed adults, with mean age of 34.3±7.2 years. Out of 200 adults, 102 were males (51%) and 98 were females (49%). BMI ranged from 16.4-35.96 with mean value of 25.5±4.4 SD, mean SBP/DBP was 127.8±12.7 SD/ 82.3±9.1 SD (mmHg) indicating that the study population was predominantly obese and pre-hypertensive. Adults in the study had abnormal lipid profile with higher triglycerides mean value of 156.2±54.9 mg/dl, HDL ranged from 30.4-81.6 (mean 43.6±6.6) mg/dl and fasting glucose had maximum range of 260.4 mg/dl (Range: 56-260.4 mg/

Variables	Condition
Waist circumference	>90 cm (40 inches) in males, >80 cm (35 inches) in females
Blood pressure	SBP ≥130 and/or DBP ≥85 or treatment for previously diagnosed hypertension
Triglycerides	≥150 mg/dl or drug treatment for elevated triglycerides
HDL	<40 mg/dl in males, < 50 mg/dl in females or drug treatment for low HDL
Glucose	>100 mg/dl or treatment for previously diagnosed diabetes

[Table/Fig-1]: Modified national cholesterol education program: Adult treatment panel III criterion for diagnosing MS. MS is diagnosed if at least three of the above five factors are positive [1,11].
HDL: High Density Lipoprotein, TG: Triglycerides

Characteristics (N=200)	Range	Mean ± SD
Age (In years)	25-45	34.3 ± 7.2
Anthropometric and physical parameters		
Weight (Kg)	38-107	68.0 ± 14.2
Height (cm)	145-185	163.0 ± 8.7
BMI (Kg/m^2)	16.4-35.96	25.5 ± 4.4
Waist circumference (cm)	63.5-111.7	92.7 ± 10.6
SBP (mmHg)	92-173	127.8 ± 12.7
DBP (mmHg)	58-99	82.3 ± 9.1
Biochemical parameters		
Total Cholesterol mg/dl	125.8-244.8	177.4 ± 26.1
Triglycerides mg/dl	61.5-337	156.2 ± 54.9
HDL mg/dl	30.4-81.6	43.6 ± 6.6
LDL mg/dl	57-157.9	101.6 ± 21.6
VLDL mg/dl	12.3-86	33.4 ± 15.0
Fasting Glucose mg/dl	56-260.4	88.9 ± 27.3

[Table/Fig-2]: General characteristics of the study population.

Distribution of various cardio-metabolic risk factors	Male (%)	Female (%)	Total (%)	p-value
	102 (51)	98 (49)	200 (100)	--
Waist circumference (Male >90 cm, Female >80 cm)	50 (49.01)	51 (52.04)	101 (50.5)	<0.04*
HDL (Male <40 mg/dl, Female < 50 mg/dl)	39 (38.23)	85 (86.7)	124 (62.0)	<0.05*
Triglyceride ≥150 mg/dl	42 (41.17)	71 (72.44)	113 (56.5)	<0.001*
SBP ≥130 mmHg and/or DBP≥85 mmHg	38 (37.25)	40 (40.81)	78 (39.0)	<0.001*
Fasting glucose >100 mg/dl	10 (9.8)	11 (11.22)	21 (10.5)	<0.76†
Current smoker Yes No	 16 (15.6) 86 (84.3)	 2 (2.0) 96 (97.9)	 18 (17.6) 182 (91.0)	<0.001*
Current alcohol use Yes No	 28 (27.4) 74 (72.5)	 8 (8.1) 90 (91.8)	 36 (18.0) 164 (82.0)	<0.001*
Junk food consumption Yes No	 41(40.1) 61 (59.8)	 59 (60.2) 39 (39.7)	 100 (50.0) 100 (50.0)	<0.82†
Family history of CVD Yes No	 48 (47.0) 54 (52.9)	 39 (39.7) 59 (60.2)	 87 (43.5) 113 (56.5)	<0.72†
Physical activity Low Moderate High	 20 (19.6) 77 (75.4) 5 (4.9)	 13 (13.2) 83 (84.6) 2 (2.0)	 33 (32.8) 160 (60.4) 7 (7.0)	<0.82†

[Table/Fig-3]: Distribution of various cardio-metabolic risk factors among study population.
*Significant <0.05, †Not significant

No. of components	Male (n=102)	Female (n=98)	Total (N=200)
0	03 (2.9%)	03 (3.1%)	06 (3.0%)
1	12 (11.8%)	17 (17.3%)	29 (14.5%)
2	19 (18.6%)	22 (22.4%)	41 (20.5%)
3	29 (28.4%)	27 (27.6%)	56 (28.0%)
4	35 (34.3%)	24 (24.5%)	59 (29.5%)
5	04 (3.9%)	05 (5.1%)	09 (4.5%)

[Table/Fig-4]: Percentage of participants with individual components of MS by NCEP ATP III Guidelines.

BMI classification	Components of metabolic syndrome						
	0	1	2	3	4	5	Total
Underweight (<18.00)	0	6 (54.5%)	5 (45.5%)	0	0	0	11 (5.5%)
Normal (18.00-22.99)	4 (8.7%)	9 (19.6%)	18 (39.1%)	12 (26.1%)	3 (6.5%)	0	46 (23%)
Overweight (23.00-24.90)	2 (5.9%)	3 (8.8%)	9 (26.5%)	10 (29.4%)	8 (23.5%)	2 (5.9%)	34 (17%)
Obese (>25.00)	0	8 (7.3%)	16 (14.7%)	38 (34.9%)	40 (36.7%)	7 (6.4%)	109 (54.5%)
Total	6 (3.0%)	26 (13.0%)	48 (24.0%)	60 (30.0%)	51 (25.5%)	9 (4.5%)	200 (100%)

[Table/Fig-5]: BMI classification with individual components of MS among the subjects.

dl, mean 88.9±27.3), indicating the presence of unknown diabetics in the study [Table/Fig-2].

Metabolic Syndrome: The prevalence of various components of MS were analysed and found to be statistically significant (p-value<0.05). About 62% of the working adults were observed to have MS. Prevalence of MS among males (66.6%) was more in comparison to females (57%).

A 50.5% of the subjects (49% males, 52% females) had waist circumference higher than the NCEP ATP III Criteria. Abnormal blood pressure was significantly prevalent (p-value <0.005) in 39% of subjects, 56.5% of the subjects had abnormal triglyceride levels.

As evident from [Table/Fig-3], abnormal lipid profile and blood glucose levels were found more in females than in male adults. About 62% of study population had low HDL levels, 50.5% of the population had high waist circumference. Thirty-eight males (37%) and 40 females (41%) were identified in hypertensive range. Elevated triglyceride levels in males were 41% while in females it was 72%. Reduced HDL cholesterol in males were 38% (<40 mg/dl), while 87% of females had HDL cholesterol <50 mg/dl. Abnormal fasting glucose values were not as prevalent as abnormal lipid profile among working adults. Elevated fasting glucose values of >100 mg/dl were found in 10% of males and 11% of females.

It was found that 32.8% of the subjects had low, 60.4% had moderate and only 7.0% had high physical activity. Males were found to be more physically active in comparison to females. It was found that sedentary lifestyle among employed adults was one of the significant risk factors for the prevalence of cardio-metabolic disease. This was also associated with smoking (17.6%, p<0.001) and drinking (18%, p<0.001) [Table/Fig-3].

Gender-wise distribution of subjects on the basis of the prevalence of various diagnostic components of MS [Table/Fig-4] shows that out of 200 subjects, 28% were diagnosed with three components of MS. A 34% subjects had more than three common components of MS. A 21% subjects had two diagnostic risk components prevalent and thus they were at risk of having MS just with mere addition of any one more component. It was found that 66.6% of males had three or more than three risk factors in common in comparison to females (57.2%). Although percentage prevalence of individual components of MS were more common in males rather than females but females (22.4%) were at a higher risk of having MS with two pre-existing components rather than males (18.6%).

High BMI (p-value<0.05) contributed significantly towards the development of MS. Nearly 54.5% of employed adults were obese and 17% were overweight. About 78% obese individuals had MS and 14.7% were on the verge of being obese with two prevalent components of MS. Total 39% normal and 26.5% overweight subjects had two out of five MS components prevalent and thus were at risk of developing CVD [Table/Fig-5].

Sedentary lifestyle among employed adults is one of the significant risk factors for the prevalence of overweight/obesity and cardio-metabolic risk factors [9,10]. In the present study, low physical activity was negatively correlated with increased BMI (p<0.005) indicating high cardio-metabolic risk among employed urban adults.

The development of obesity, or more specially an increase in abdominal fat, is thought to be the primary event in the progression of metabolic risk factors. Asian Indians have been shown to have tendency to develop central obesity [4,5]. In our study, abdominal obesity i.e. waist circumference >90 cms in males (49%) and >80 cms in females (52%), was reported in half of the subjects (p-value < 0.05).

DISCUSSION

Prevalence of cardio-metabolic risk factors is escalating in urban India [9,10]. Present study revealed high prevalence of MS among working adults (62%). Prevalence of MS among males (66.6%) was higher than females (57.2%) of 25 to 45 years of age.

The present study indicates a strong association between obesity and cardio-metabolic risk factors characterized by central obesity, dyslipidemia, hyperglycaemia and hypertension (p-value < 0.05). The findings of the study are concurrent to other studies indicating high prevalence of Metabolic Syndrome among employed adults [2,3,8,10].

According to a study conducted by Ervin RB [12], there were differences in the prevalence of each of the individual risk factors by gender. These findings were in concordance with the present study. Overall prevalence of metabolic syndrome was high in males but individual cardio-metabolic risk factors were higher in females in comparison to males.

In summary, abdominal obesity, high TG levels, hypertension, low HDL levels were the major components of MS among urban employed adults. Our findings corroborate the general conception that prevalence of cardio-metabolic risk factors is increasing among employed adults in urban India [6,8-10].

We need to address the link between sedentary lifestyle, unhealthy eating, obesity and other prevailing cardio-metabolic risk factors which contribute to high disability rates among the employed adult population in urban India. Healthy behaviours and intervention at early stage is priority to reduce the risk of developing CVDs in adult life.

STRENGTHS

Standardized data collection protocols were used in the study. The response rate of the subjects was very high (98%). In the present study, subjects with lipid abnormalities in MS were given first line of therapy i.e., lifestyle modifications along with dietary counselling and physical activity.

LIMITATION

The focus of the present study was to assess the prevalence of cardio-metabolic risk factors among working adults, therefore, 10 year and lifetime cardiovascular risk was not calculated for the subjects. Although, CVD risk score would have given better understanding of the increasing prevalence of cardiovascular diseases in urban India.

Job stress is one of the leading factor for poor lifestyle choices. Data on job stress for the subjects were collected and positively correlated with cardio-metabolic syndrome but could not support the present research article as it is reported elsewhere.

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