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Original Research

A cross-sectional study to estimate the prevalence of metabolic and pre-metabolic syndrome among young adults in rural population of Chengalpattu district

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Abstract

Background: Metabolic syndrome is a globally trending health care problem with an increased risk of developing cardiovascular disease, insulin resistance, stroke, etc. The prevalence of this syndrome is soaring among Indians, especially in the rural background areas. However, not many studies were focused on young adults in the rural areas of Tamilnadu. Hence, the present study was done to estimate the prevalence of metabolic syndrome and pre-metabolic syndrome between 20 and 40 years and to assess the association between the lifestyle risk factors and metabolic syndrome in the rural population of Chengalpattu district. **Materials and methods:** It was an age and sex-matched, a cross-sectional study done at Chettinad Hospital and Research Institute, Kelambakkam. A total of 360 apparently healthy subjects, who has come for Master health check-ups were included in the study. A fasting blood sample was collected and measured for plasma glucose, serum triglycerides, and high-density lipoprotein. The study participants were then categorized based on NCEP ATP III guidelines. Data were presented as percentages (%). Student independent t-test was used to compare groups with continuous variables and for categorical variables, the chi-square test was used. All Statistical analysis was carried out using SPSS software. **Results:** The prevalence of metabolic syndrome was 36.6% of which male presents more with 37.8% and female with 35.4%. The prevalence of pre-metabolic syndrome was 27.3% among which 25.2% were males and 29.3% were females. The odds of risk of MS was significantly higher among males with increased waist circumference, alcohol drinking, and smoking habit. The odds risk of MS among females were significantly higher than those of alcohol and smoking usage, family history of hypertension, high fasting triglycerides, and low-HDL cholesterol in the serum. **Conclusion:** The huge surge in the prevalence rate of metabolic syndrome and the pre-metabolic syndrome has to be intervened by implementing various health care policies so that the mortality and morbidity can be significantly reduced among the young adults of the rural population.

Keywords: metabolic syndrome, pre-metabolic syndrome, rural population.

Introduction

Metabolic syndrome (MS), also known as syndrome X is a cluster of metabolic disorders which includes obesity, impaired glucose tolerance, hypertension, high serum triglycerides, and low-serum high-density lipoprotein [1]. The criteria proposed for defining MS as per NCEP ATP III guidelines 2002 (National Cholesterol Education Program Adult Treatment Panel) [2] is given in Table 1.

If three or more of the above criteria satisfied, the patient is said to suffer from metabolic syndrome.

Table 1: NCEP ATP III guideline for diagnosis of metabolic syndrome.

Criteria
Waist circumference >102 cm in males, and >88 cm in females
Fasting plasma glucose ≥100 mg/dl
Triglycerides ≥150 mg/dl
HDL-C <40 mg/dl in males, <50 mg/dl in females
Systolic blood pressure ≥130 mm Hg, diastolic blood pressure ≥85 mm Hg

HDL-C: high-density lipoprotein cholesterol.

Pre-metabolic syndrome (pre-MS) includes any of the two components of MS-like abdominal obesity, hyper triglyceridemia, low HDL-C, high blood pressure, and high fasting plasma glucose [3].

Metabolic syndrome often accelerates the development of type 2 diabetes mellitus (T2DM) and cardiovascular disease [4]. Few studies have reported a significant association between MS and pancreatic, colorectal, breast, and prostatic cancer [5, 6]. It is a vicious cycle often coupled with the habit of excess food consumption and a sedentary lifestyle [7, 8]. Early diagnosis, healthy lifestyle patterns, and timely intervention will help to reduce the incidence of MS-related T2DM and coronary artery disease.

The prevalence of MS is steadily increasing in both developed and developing countries [9]. Globally it ranges between 20% and 25% [10]. In South Asia, the prevalence of MS is 26.1 % [11]. Due to diversity in socioeconomic status, degree of urbanization, cultural factors, lifestyle modifications, etc., there occurs drastic variation in the prevalence of MS and pre-MS in India [12]. Enough data is not available which has a great negative impact while developing strategies for reducing the mortality and morbidity associated with MS. Hence, the present study was conducted to estimate the prevalence of pre-MS and MS along with its components among the young adults between 20 years and 40 years residing in the rural area of Chengalpattu district and also to explore the association between MS and various risk factors.

Materials and methods

Study design

The present study was conducted on a total of 360 subjects who visited Chettinad hospital and research institute, Kelambakkam from 1st January 2021 to 31st December 2021. It was an age and sex-matched, cross-sectional study.

Inclusion and exclusion criteria

The study subjects included were apparently healthy young adults aged between 20 and 40 years who came to the Chettinad Hospital and Research Institute for master health check-ups.

The subjects were categorized as a case of either metabolic syndrome if three or more of the criteria as proposed by NCEP ATP III guidelines were fulfilled or pre-metabolic syndrome if two of the criteria were met.

Those subjects who were sick and require hospitalization, those who were not willing to give written informed consent, subjects under medication like steroids which may influence the study, patients suffering from systemic disorders like diabetes mellitus, hypertension, chronic renal failure, etc., patients under treatment for cancer, pregnant and breast feeding women were excluded from the study.

Ethical approval

The present study was carried out after getting approval from the Institutional Human Ethical Committee, Chettinad Hospital and Research Institute. Informed written consent was obtained from all the subjects included in the study.

Data collection

The basic demographic details, socioeconomic status, personal and family history of the study subjects were collected through a validated semi-structured questionnaires. After 12 hours of fasting, 5 ml of venous blood sample was collected

Table 2: Prevalence of metabolic syndrome among study participants (n = 360).

Gender	Frequency	Metabolic syndrome (%)	Frequency	Pre-metabolic syndrome (%)
Male	96	37.8	64	25.2
Female	35	35.4	29	29.3

using aseptic, standard technique, processed and measured for plasma glucose, triglycerides, and high-density lipoprotein using Siemens dimension RxL, a fully automated clinical chemistry analyzer.

Statistical analysis

Data were presented as percentages (%). Student independent t-test was used to compare groups with continuous variables and for categorical variables, a chi-square test was used. For all the hypothesis test, the level of significance adopted was 5%. A p-value less than 0.05 was considered statistically significant. All statistical analysis was carried out using SPSS software. The odds ratio was calculated to find the strength of association between MS and its components using MedCalc statistical software.

Results

The overall prevalence of MS among the young adult population residing in rural areas of Chengalpattu district was 36.6% of which male presents more with 37.8% and female with 35.4% (table 2) which was similar to the study conducted by Njelekela M. A., et al. and Fezeu L., et al. [13, 14]. The overall prevalence of PMS was 27.3% among which 25.2% were males and 29.3% were females.

Males show more preponderance of MS among the study population. In males, the prevalence rate of MS was more with alcohol and smoking habits. Likewise, the higher rate was seen in those with a family history of hypertension, and abnormal biochemical parameters like hyper triglyceridemia (table 3), and hyper fasting glycaemia. These results were similar to the previous

Table 3: Prevalence of metabolic syndrome based on demographic, biochemical and clinical profile of the study participants among males.

Background variables	Frequency	Metabolic syndrome (%)
Fasting triglyceride	138	54.3
Fasting HDL-cholesterol level	85	33.5
Fasting blood sugar	134	52.8
Systolic blood pressure	76	29.9
Diastolic blood pressure	89	35
Waist circumference	8	3.1
Family history of diabetes mellitus	109	42.9
Family history of hypertension	131	51.6
Alcohol habit	161	63.4
Smoking habit	135	53.1

Table 4: Prevalence of metabolic syndrome based on demographic, biochemical and clinical profile of the study participants among females.

Background variables	Frequency	Metabolic syndrome (%)
Fasting triglyceride	54	54.5
Fasting HDL-cholesterol level	55	55.6
Fasting blood sugar	44	44.4
Systolic blood pressure	30	30.3
Diastolic blood pressure	44	44.4
Waist circumference	43	43.4
Family history of diabetes mellitus	43	43.4
Family history of hypertension	51	51.5
Alcohol habit	62	62.6
Smoking habit	53	53.5

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studies carried out by Lu, K., et al., and Ding, C., et al., [15, 16]. Odds risk of development of MS was significantly higher among males who lead sedentary lifestyles as suggested by increased waist circumference, alcohol drinking, and smoking habit (table 5).

The odds of risk of MS among females in the study population was significantly higher than those of alcohol and smoking usage, family history of hypertension, high fasting triglycerides, and low-HDL cholesterol in the serum (table 6).

Discussion

An exorbitant rate of prevalence of MS of 36.6% was found in the rural population of young adults of Chengalpattu district. In recent times, the prevalence of MS has surged more in India traversing from 11% to 41% [17].

Gender dissimilarity in the prevalence rate of MS may be attributed to distinct sex hormones, variation in body composition with respect to lean and fat mass, and adipose tissue distribution between the two sexual categories.

Table 5: Odds ratio between risk factors, and metabolic syndrome in males.

Variables	Metabolic syndrome		
	OR	95% CI	p-Value
Alcohol habit	0.351	0.2449–0.5030	p<0.0001*
Smoking habit	0.5356	0.3760–0.7628	p=0.0005*
Fasting triglyceride	0.5107	0.3585–0.7276	p=0.0002*
Fasting HDL-cholesterol	1.208	0.8397–1.7379	p=0.3084
Fasting blood sugar	0.5441	0.3821–0.7749	p=0.0007*
Systolic blood pressure	1.4231	0.9835–2.0590	p=0.0612
Diastolic blood pressure	1.1264	0.7846–1.6172	p=0.5187
Waist circumference	18.6835	8.8394–39.4910	p=0.0001*
Family history of diabetes mellitus	0.8083	0.5667–1.1528	p=0.2400
Family history of hypertension	0.5705	0.4007–0.8123	p=0.0019*

Table 6: Odds ratio between risk factors, and metabolic syndrome in females.

Variables	Metabolic syndrome		
	OR	95% CI	p-Value
Alcohol habit	0.3264	0.1829–0.5825	p=0.0002*
Smoking habit	0.4746	0.2682–0.8399	p=0.0105*
Fasting triglyceride	0.4557	0.2574–0.8068	p=0.0070*
Fasting HDL-cholesterol	0.4375	0.2470–0.7750	p=0.0046*
Fasting blood sugar	0.6836	0.3859–1.2109	p=0.1923
Systolic blood pressure	1.2578	0.6941–2.2795	p=0.4496
Diastolic blood pressure	0.6836	0.3859–1.2109	p=0.1923
Waist circumference	0.7122	0.4018–1.2625	p=0.2453
Family history of diabetes mellitus	0.7122	0.4018–1.2625	p=0.2453
Family history of hypertension	0.5147	0.2910–0.9103	p=0.0224*

Abnormal fat tissue deposition in the abdomen releases more cytokines and free fatty acids which then move to the liver triggering the early onset of insulin resistance, hypertension, and dyslipidemia [18].

The high prevalence of PMS among the young adults in the study population needs to grab more attention from the public as well as health care professionals. Timely intervention is required to prevent the progression of PMS to MS by bringing more awareness about lifestyle modification and healthy habits.

Conclusion

The present cross-sectional study among young adults of the rural populations has shown a soaring prevalence rate of MS in males compared to females. Also, prevalence rate of PMS was higher among the study subjects. All these warrant lifestyle changes and the necessary execution of public health care policies which may contribute to an overall reduction of mortality and morbidity in the population. Limitations of the present study includes a small sample size and a lack of age-specific evaluation.

Conflict of Interest

The authors declare no conflict of interest.

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