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Research Article

PREVALENCE OF OBESITY AND METABOLIC SYNDROME AMONG ADULTS IN TERTIERY CARE HOSPITALS OF COSTAL ANDHRA

N. Sumanth*, N. Ramya, J. Venkatesh, V. Lokesh reddy

A. M. Reddy Memorial College of Pharmacy, Affiliated by Acharya Nagarjuna University, Petlurivaripalem, Narasaraopet, Guntur (Dt).

***Corresponding author's Email:** sumanthnanda@gmail.com

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ABSTRACT

Objective: The Study entitled "Prevalence of Obesity and Metabolic Syndrome among Adults in Tertiary Care Hospitals of Coastal Andhra" was designed to assess the awareness of Obesity and Metabolic syndrome reporting at a reputed pharmacy institute in Andhra Pradesh, India, and also to evaluate the impact of an educational intervention carried out in this study. A suitable collection data form, attitude survey questionnaire was designed and validated by pilot study and the study was conducted among inpatients and out patients of hospitals.

Method: This cross- sectional study, of 6 month duration included a total of 353 participants. An interactive educational intervention was designed for all participants in hospital. The impact of effectiveness of educational intervention among the patients was evaluated by means of questionnaire survey. The paired t-test in SASversion8 was used for statistical calculation. In our study a total of 353 participants responded and involved in the collection data form and questionnaire survey. Participants involved in the study were 196 male and 157 female patients in hospitals. The overall response rates between collection data and questionnaire was statistically significant ($P < 0.045$) which shows effectiveness of educational intervention for improving awareness of obesity and metabolic syndrome among the adult participants.

Conclusion: The study concluded that imparting the awareness of obesity and metabolic syndrome among the adult patients by means of continuous educational intervention would bring up updated knowledge about of cardiovascular diseases and other causing diseases.

Keywords: Obesity and metabolic syndrome, Questionnaire, collection data form.

INTRODUCTION

The Data from the WHO suggests 65% of the world's population live in countries where overweight and obesity kills more people than underweight. The WHO defines "overweight" as a BMI greater than or equal to 25, and "obesity" as a BMI greater than or equal to 30.[1] Both overweight and obesity are major risk factors for heart disease and stroke, and diabetes. A surrogate marker for body fat content is the body mass index (BMI), is measured by weight (kilograms) divided by height squared (square meters). A better way to define obesity would be in terms of percent total body fat[2]. Based on BMI, should take the overweight and obesity prevalence of all inpatient and outpatient. Other studies states that more than 75% of population was having obesity and overweight in south coastal India.

Metabolic syndrome:

The term "metabolic syndrome" represents a "constellation" of lipid and nonlipid risk factors for cardiovascular disease and is closely linked to a generalized metabolic disorder referred to as insulin resistance. It has been recognized as a secondary target for increased behavioural therapy in Third

Report of the National Cholesterol Education Program Expert Panel on Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III [ATP III]) in 2000.4 the components of MetSyn identified in these guidelines have been shown to be highly predictive of cardiovascular risk. Metabolic syndrome is a disorder which is diagnosed by a co-occurrence of three out of five of the following medical conditions: waist circumstance , high blood pressure, high fasting blood sugar high serum triglycerides, and low high-density lipoprotein (HDL) levels.[3]

Obesity increases the risk of developing cardiovascular disease and diabetes. Obesity is a rapidly growing health problem in the world conferring substantial excess risk for morbidity and mortality.[5] Characteristics of BMI-metabolic risk sub phenotypes have been described in selected study samples, from which the prevalence data has been collected from the respective hospital. Furthermore, both obesity and MetS are risk factors for type 2 diabetes but whether elevated BMI in their absence confers risk for type 2-diabetes is imprecise.[5]

The prevalence of obesity and metabolic syndrome is rapidly increasing in India and other South Asian countries have increased mortality and morbidity due to CVD and T2DM. These Asian Indian studies refer to the fact that high prevalence of diabetes and cardiovascular diseases is seen in people originating from South Asian nations, and lower rates of obesity (as defined by conventional body-mass-index criteria).[7]These disturbances include high FBS and increased levels of waist circumstances, low levels of high-density lipoprotein (HDL) and high levels of triglycerides, and hypertension. All of these risk factors have been taken as a metabolic syndrome (MetS).[8]

WHO Clinical Criteria for Metabolic Syndrome:

Insulin resistance, identified by one of the following:

- Type 2 diabetes
- Impaired fasting glucose
- Impaired glucose tolerance

Plus any two of the following:

- Blood pressure (≥140 mm Hg systolic or ≥90 mm Hg diastolic)
- Plasma triglycerides ≥1.7 mmol/L
- HDL cholesterol <0.9 mmol/L in men or <1.0 mmol/L in women
- BMI >30 kg/m^2 and/or waist: hip ratio >0.9 in men, >0.85 in women
- Urinary albumin excretion rate ≥20 μg/min or albumin: creatinine ratio ≥3.4 mg/mmol.[8]

Dyslipidaemia consists of an aggregation of lipoprotein abnormalities including elevated serum triglyceride, increased small LDL particles, and a reduced level of HDL cholesterol (HDL-C). The metabolic syndrome is often may cause increase in levels of lipid profile.[9]

The primary goal of clinical management in individuals with the metabolic syndrome is to reduce risk for cardiovascular disease. Even in people with the metabolic syndrome, therapy is directed toward the major risk factors: LDL-C, blood pressure, and diabetes mellitus. Prevention of type 2 diabetes mellitus is another important goal when it is not present in a person with the metabolic syndrome.[9]

Overt hypothyroidism acts as a CVD risk factor through several mechanisms, as a result of which the incidence of heart attack can increase over two fold in hypothyroid subjects[10]. A positive association between overt hypothyroidism and hypercholesterolemia is well recognized[11]. In addition it is reported that thyroid hormones influence vascular smooth muscles, consequently reducing arterial resistance, and causing a decline in diastolic blood pressure. Moreover, insulin sensitivity can be affected by thyroid function and a positive association between overt hypothyroidism and BMI has been well documented[12].

This increase in prevalence of obesity has occurred among both men and women and across all racial/ethnic and age groups. Other studies of cohort studies as well as national surveys have shown that obese individuals have an increased risk of several adverse health outcomes of diabetes mellitus, cardiovascular disease (CVD), arthritis, disability, and mortality.[13] Due to the limitations of BMI scale, current reports by the World Health Organization and other organizations suggest combining the measurements of BMI and abdominal obesity.

Abnormalities in adipose tissue metabolism may be the crux of the issue. Adipose tissue in obese people is insulin resistant, which raises no esterified fatty acid levels, worsening insulin resistance in muscle and altering hepatic metabolism[17-18]; in addition, the adipose tissue of obesity exhibits abnormalities

in the production of several adipokines that may separately affect insulin resistance and/or modify risk for ASCVD.34 These include increased production of inflammatory cytokines,[19,20] plasminogen activator inhibitor- 1, and other bioactive products[20,21]; at the same time the potentially protective adipokine, adiponectin, is reduced.[22,23] All of these changes have been implicated as causes of the metabolic risk factors.

The metabolic risk factors consist of those factors that seemingly have a direct effect on atherosclerotic disease. Among these, as stated earlier, *atherogenic dyslipidaemia* consists of an aggregation of lipoprotein abnormalities including elevated serum triglyceride and apoB, increased small LDL particles, and a reduced level of HDL-C.1 Among triglyceride-rich lipoproteins, remnant lipoproteins almost certainly are the most atherogenic.1 Many studies further suggest that the smallest particles in the LDL fraction carry the greatest atherogenicity.[30] The atherogenic potential of lipoprotein remnants and small LDL could be confounded in part by their common association with an increased total number of apoB-containing lipoproteins in circulation; this increased number is reflected by an elevation of serum total apoB.[31] Finally, the lipoprotein field widely holds that low levels of HDL are independently atherogenic1; multiple mechanisms are implicated to explain this relationship.

Recently, this syndrome has been noted to be associated with a state of chronic, low-grade inflammation.[24, 25] Some researchers speculate that inflammation of this type underlies or exacerbates the syndrome. For example, inflammatory cytokines reportedly induce insulin resistance in both adipose tissue and muscle.[26, 27] In the presence of obesity, adipose tissue indeed produces cytokines in excess, whereas output of adiponectin is diminished; these responses appear to heighten the connection between obesity and inflammation.[19] Interestingly, insulin-resistant people manifest evidence of low-grade inflammation even without an increase of total body fat.[28]

The aim of this study to assess the prevalence of obesity and metabolic syndrome of both genders and create awareness among adults about obesity and metabolic syndrome (cardiovascular diseases, diabetes and thyroid) and life style modifications.

AIMS & OBJECTIVES

The proposed title "*Prevalence of obesity and metabolic syndrome among adults in tertiary care hospitals of coastal Andhra*" aimed to achieve the following objectives:

- To assess the prevalence of obesity and metabolic syndrome among adults.
- To evaluate the all characteristics of metabolic syndrome and obesity by the NCEP ATP III criteria
- To create awareness about obesity and metabolic syndrome to the participants by means of using standardised tools.

METHODOLOGY

Study design: A hospital based cross-sectional survey was conducted in tertiary care hospitals.

Study site: The study was carried out in the reputed health care organisations of Lalitha super specialities hospital located at Guntur and Andhra hospitals located at Vijayawada affiliated by A.P. Government.

Study Period: 06 Months.

Study Population & Sampling: During the study period of 06 months (December - June), there were total of 353 subjects involved in the study.

Study Criteria: The study will be carried out by considering the following criteria:

Inclusion criteria:

- Patients having age between 20-80years.
- Data collected from both inpatients and outpatients.

Exclusion Criteria:

- Pregnant women &women having gestational diabetes.
- Patient who have severe concomitant medical diseases.

Study Tools:

A Self-administered collection data form was prepared using information and thorough review from the literature survey and factors used in previous studies and it was validated by faculties in department of pharmacy practice and Doctors of general medicine and dietician of lalitha hospitals.

Adult Treatment Panel III (ATP III) of the National Cholesterol Education Program suggested and classified the test values of metabolic syndrome and obesity as

- TG ≧ 150 mg/dl or taking drugs for elevated triglycerides;
- HDL-C<40 mg/dl for men and < 50 for women;

- Systolic BP ≧ 130 mmHg or diastolic BP ≧ 85 mmHg.
- FBS ≧ 110 mg/dl

Obesity is also classified based on scale of standard BMI scale –

- Normal:18-25 kg/m^2;
- overweight:25-30kg/m^2;
- Obese: ≥30kg/m^2.

Collection data form includes the demographic details of patients participated in the study. We also prepared a questionnaire to the patient awareness about obesity and metabolic syndrome and counselled.

Validation:

Two general medicine doctor and one dietician and pharmacist with experience in drug use studies were asked to evaluate the clarity, relevance and conciseness of items included in the collection data form & questionnaire. The observations and comments of the doctors were taken in to the account. In order to test the validity and reliability of the collection data form & questionnaire. The overall Cronbach's alpha value was 0.528 and no modifications have been carried out.

The collection data form was designed specifically to take test values of lipid profile and blood pressure and blood sugar and also calculate the BMI of the patient by using the standard BMI scale.

The questionnaire was designed specifically to answer the awareness about obesity and metabolic syndrome. In order to preclude any potential bias the disclosure of name of the responder was made optional.

Study procedure:

A Total of three hundred fifty three subjects were recruited, (196 male; 157 female) aged from 20 and above were included in this survey.

An interview with a simple questionnaire which included age, gender, medications and a detailed medical history was carried out on these 353 subjects. Besides the questionnaire interview on blood pressure (BP), Anthropometric measurements (height, weight), and were taken in all subjects. Body mass index (BMI) was calculated as body weight (in kilograms) divided by the square of body height (in metres). Demographic factors (age, sex, and obesity) and lifestyle factors (smoking habits, physical activity, and alcohol consumption) were determined. BP was measured from the right arm after the participant had rested for 20 minutes in a sitting position. Blood samples were drawn from each participant after 12 hours of overnight fasting to measure their total cholesterol (T-CHOL), HDL-C, TG, and fasting blood sugar (FBS).

Final Annexure-1take diagnostic values according to NCEP ATP III cut off values. More than that of values of F.B.S and lipid profile concluded that diabetes and cardiovascular diseases.

From annexure-2 take answers and awareness about obesity and metabolic syndrome and give counselling to the disease of metabolic syndrome under the guidance of clinical doctors and pharmacist in tertiary hospitals.

Data Analysis:

The filled collection data form and questionnaire were analysed as per the study objectives. The various parameters such as sex distribution, professional status, educational qualifications, and the knowledge, attitude and practice scores were analyzed. The data obtained were entered in Microsoft excel spread sheet and were analysed.

To measure the BMI and Lipid profile test of NCEP ATP III cut off values among adults to evaluate the impact of effectiveness and prevalence of educational intervention among all inpatient and outpatient, the mean and standard deviation of all tests to show the prevalence of obesity and metabolic syndrome.

All results obtained were entered in Microsoft excel, and the statistical calculations were performed using SAS Version 9.1. The level of statistical significance was set at $p<0.05$ *(paired t-test)*.

RESULTS:

Prevalence of obesity:

A total of three hundred and fifty three subjects were surveyed in this study (male/female: 196/157). Their anthropometric characteristics as well as their biochemistry study results were summarized in Table 2. The results showed that 42.4% of participants were overweight, 35.97% were obese, and only 15.5% were underweight. The prevalence of being overweight was 43.4% in men and 41.4% in women. The prevalence of obesity was 33.2% in men and 39.4% in women, respectively.

Table 1: Demographical characteristics of metabolic syndrome subjects

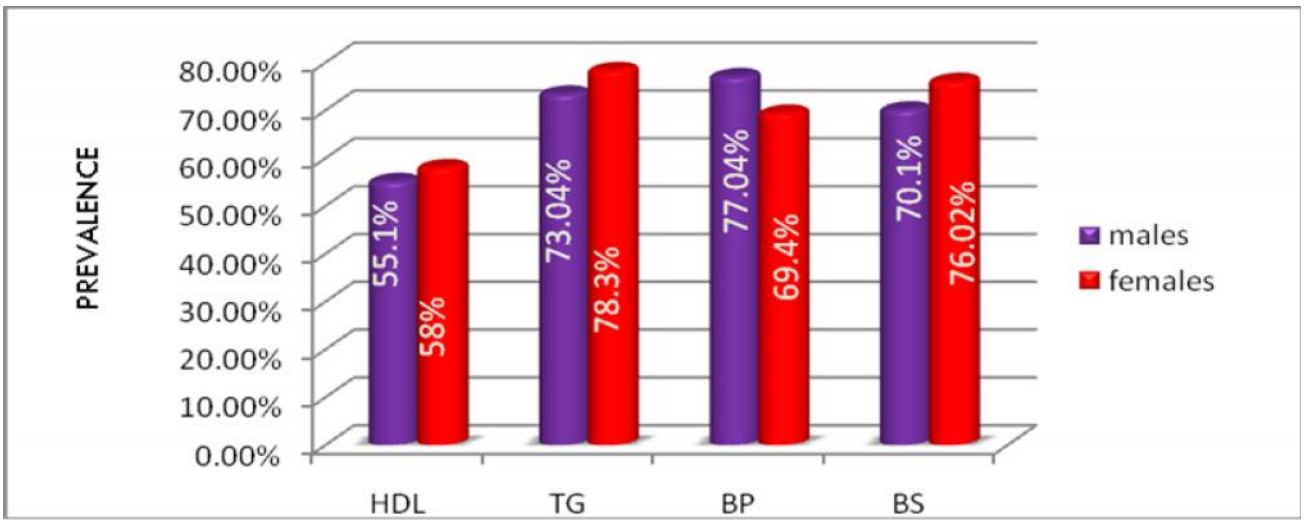
D.C	Males(n=196)	Females(n=157)	Total(n=353)
Age(yrs)	52.54±15.85	49.06±15.62	51.67±16
BMI(kg/m^2)	27.78±3.91	28.00±4.37	27.91±4.15
SBP(mmHg)	146±32.04	145±30.27	150±33.16
DBP (mmHg)	86.36±18.85	83.33±20.81	83.18±21.82
FBS(mg/dl)	171.76±62.21	166.73±60.65	168.12±61.57
HDL-C(mg/dl)	30.98±5.86	30.59±5.81	30.76±5.80
TG(mg/dl)	145.24±52.45	139.57±49.57	142.57±51.37

Table 2: Prevalence of metabolic syndrome and its component abnormalities

C.B	MALES	FEMALES	TOTAL	P-VALUE
Decreased HDL-C	55.1%	58%	56.37%	0.056
HIGH TG	73.4%	78.3%	75.63%	0.042
HIGH BP	77.04%	69.4%	73.65%	0.001
HIGH FBS	76.02%	70.06%	73.37%	0.097
THYROID	42.9%	60.05%	50.70%	0.025
Obesity	33.2%	39.4%	35.97%	0.057
Over weight	43.4%	41.4%	42.4%	0.001

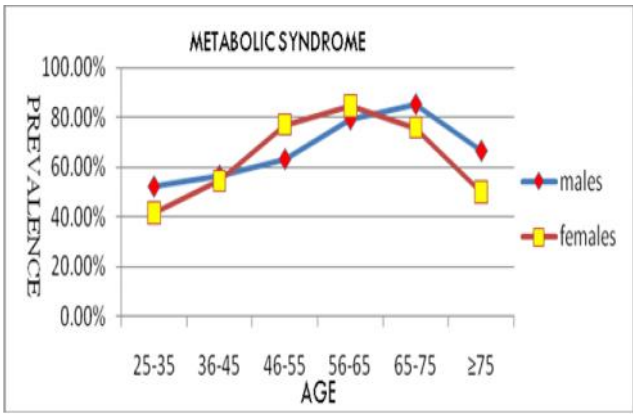
Table 3: Prevalence of metabolic syndrome between the ages

AGE	Total no. of subjects			Total no. of MS subjects		
	Males	Females	total	Males	females	Total
25-35	21	29	50	11(52.3%)	12(41.4%)	23(46%)
36-45	30	33	63	17(56.6%)	18(54.54%)	35(55.5%)
46-55	49	35	84	31(63.2%)	27(77.1%)	58(69%)
56-65	53	33	86	42(79.2%)	28(84.8%)	70(81.39%)
66-75	34	25	59	29(85.3%)	19(76%)	48(81.35%)
≥75	9	2	11	6(66.7%)	1(50%)	7(63.63%)
Total	197	156	353	136(69%)	105(67.3%)	241(68.2%)

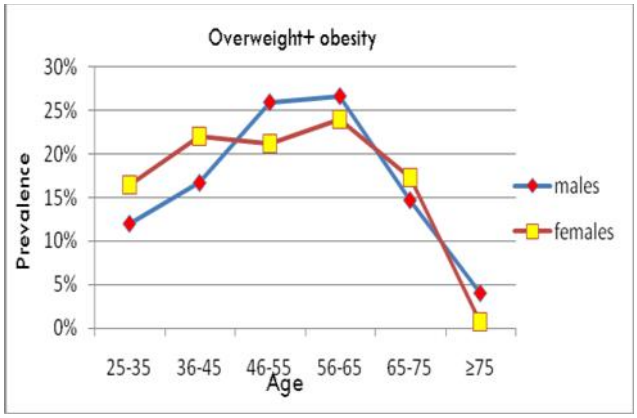


Graph 1: Prevalence of metabolic syndrome according to component abnormalities.

In comparisons of the prevalence of MetS in men and women, it showed that the prevalence in men was significantly higher than in women (men vs. women: 69% vs. 67.3%).



Graph 1: Metabolic syndrome in both genders between ages



Graph 3: Overweight, obesity in both genders between ages

Prevalence of metabolic syndrome:

The overall prevalence of metabolic syndrome in this study was 68.2% (Table 2). In terms of the five components, the overall prevalence was 56.37% in low HDL-C, 73.65% in high BP, 73.37% in hyperglycaemia, and 75.63% in hypertriglyceridemia (Table 2).

A very high prevalence rate of 69 % (n = 353) of metabolic syndrome was reported in this community. In this study, metabolic syndrome rates are significantly higher among males with 69% (n = 196) than in females at 67.3% (n = 157). Table 3 and Graph 1.

All the individual components of metabolic syndrome increased significantly with age. Overall in our study elevated triglycerides (75.63%) was the commonest abnormality observed and low HDL-C (56.37%) was the least common. Elevated blood sugar (70.06%) was the commonest abnormality among females, followed by elevated blood pressure (69.4%) and low HDL-C (58%) was the least common abnormality. Among males, elevated blood pressure (77.04%) was the commenest abnormality. Low HDL (55.1%) was the least common abnormality among males. Graph-1.

In comparisons of the prevalence of MetS in men and women, it showed that the prevalence in men was significantly higher than in women (men vs. women: 69% vs. 67.3%).

DISCUSION:

This was one of the large community-based surveys done from south Andhra for ascertaining the prevalence of cardiovascular risk factors with the aim of providing the baseline information on prevalence rates for intervention programmes to the policy planners.

In a detailed look of graph and stastes into the prevalence in the five components of MetS between men and women, it showed that men had a higher prevalence in having low HDL-C, and having high BP. But, the prevalence in low hyper-triglyceridemia was lower than that in women. In terms of the prevalence of having high FBS, there was no difference between men and women.

In the aspects of overweight and obesity, it showed that the prevalence increased with age, which reached a peak in the age group of 40-49 and decreased thereafter in both genders (Graph-1).In comparison of the increment in the prevalence of MetS in different age group, it seemed that the prevalence increased more rapidly in men when they became older and reached the peak in their eighties, while the prevalence of MetS in men reached the peak in their eighties and decreased thereafter. We further noticed that there was a crossover between the age of 40-49, when the curves showing the prevalence of MetS in men and women in different age groups were superimposed (Graph-2).

Strengths of our analysis include the examination of a large, community-based sample of men and women across a broad age spectrum and standardized assessment of diabetes and CVD risk factors and outcomes, but there are limitations of our study in addition to those addressed above. We used a definition of metabolic risk restricted to traditional diabetes or CVD risk factors.

We used normal-weight, overweight, and obese BMI categories and risk factor clustering or IR to define the prevalence of BMI-metabolic risk sub phenotypes in a community-based sample. Assessment of metabolic risk, regardless of BMI, appears to identify individuals at

increased risk for future development of type 2 diabetes or CVD and who may benefit from interventions to reduce risk.

In our study, the prevalence of overweight and obesity were 43.4% and 33.2% in men, and 41.4% and 39.4% in women. Obesity is an important factor in developing MetS and many chronic diseases, such as cardiovascular disease, type 2 diabetes, hypertension, certain types of cancer, and mental problems.

The pathogenesis of MetS through which obesity interplay with insulin resistance remains to be fully established but many studies had focused on the role of body fat distribution. These metabolically obese, normal weight individuals may have high TG and low insulin sensitivity leading increase prevalence of metabolic syndrome and its associated disorders.

In our study, men had a significantly higher prevalence of MetS than women (69% vs. 67.3%). It showed that after the age of 50, the prevalence of MetS would be higher in men. Such phenomenon explained that women around the age of 50 are more likely to have estrogen deficiency, which can lead to prominent weight gain and may go on to develop MetS.

Given the number of serious health problems associated with obesity including type 2 diabetes, cardiovascular disease, and an increased risk for various types of cancer, the investigation of the healthy obesity phenotype may provide novel insights into the pathophysiology of obesity-related co-morbidities and help to identify at-risk obese individuals. Furthermore, it may help in the development of better interventions for obese patients. There are strong indications that weight loss may not have a beneficial effect on certain metabolic risk factors in MHO individuals and even result in a paradoxical response. Therefore, the one-size-fits-all approach regarding the consequences of obesity should be revisited, and the prevailing concept in the health care system that obesity is always bad should be re-evaluated. Also, a proper classification of the at-risk and metabolically benign obese individuals should be taken into account in medical research to prevent any bias in the interpretation of the results.

Dyslipidemia is a hallmark of the MetS. It is characterized by elevated TG and low HDL-C levels. In our analysis, dyslipidemia had the strongest and more consistent relationship with ischemic stroke among all the MetS components. There is a controversy regarding the association between serum TG levels and stroke. It has been shown that postprandial hypertriglyceridemia is associated with carotid artery atherosclerosis.

The prevalence of decreased HDL-C, high BP in men was higher than women in this study. The prevalence of high TG was much lower than that of other MetS components, and was also lower than other population based studies done in south Andhra Pradesh.

This study subjects were enrolled from out-patient clinics and hospitalization at the Andhra hospital, Vijayawada and lalitha super specility hospital, Guntur. Acute stress and selection bias could skew the data leading to limit the results applied to the general adults. So further population-based studies may have to be carried out to clarify what factors could be related to this phenomenon.

CONCLUSION

Based on the NCEP/ATP III guidelines, a little more than one-third of the adults in the south Andhra could be characterized as having metabolic syndrome. Metabolic syndrome increased with age but increased even more dramatically as BMI increased. The prevalence of metabolic syndrome varied by race and ethnicity but the pattern was different for males and females. Among the five diagnostic criteria for metabolic syndrome, high triglycerides, low HDL, hypertension, and hyperglycemia were the most prevalent.

1. The metabolic syndrome is a term for a constellation of endogenous risk factors that increase the risk of developing both ASCVD and type 2 diabetes mellitus.
2. The syndrome is not a discrete entity known to be caused by a single factor. Moreover, it shows considerable variation in the components among different individuals. This variation is even greater among different racial and ethnic groups.
3. The metabolic syndrome is a secondary target for reducing cardiovascular events. Smoking cessation, lowering the levels of LDL-C, and blood pressure management are primary targets for risk reduction.
4. Lifestyle interventions are the initial therapies recommended for treatment of the metabolic syndrome. If lifestyle change is not sufficient, then

drug therapies for abnormalities in the individual risk factors may be indicated.

5. To date, there is insufficient evidence for primary use of drugs that target the underlying causes of the metabolic syndrome.
6. Considerable additional research is needed to better refine the most appropriate therapies for individuals with the metabolic syndrome.

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