

# The prevalence of metabolic syndrome in a local population in India

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### Abstract

**Introduction:** People with metabolic syndrome are about twice as likely to develop cerebrovascular disease (CVD) and over four times as likely to develop type 2 diabetes compared to subjects without metabolic syndrome. This cross-sectional population based study was undertaken to explore the prevalence of metabolic syndrome in a local population in India.

**Materials and methods:** The prevalence was assessed in a group of 1,568 patients referred to High Tech Hospital affiliated to Vinayaka Missions University, Salem, India. We have analyzed the overall prevalence of metabolic syndrome, as well as the number of components of the metabolic syndrome present in the individuals in this study. For all subjects following variables were collected: age, gender, waist circumference, blood pressure and fasting clinical chemistry parameters. Blood pressure was monitored and measured in a sitting position by a mercury sphygmomanometer. Blood samples for HDL-cholesterol, triglyceride and fasting glucose were collected after 12h overnight fast.

**Results:** In our group 33.17% of males and 27.04% of females were identified as having the metabolic syndrome. Waist circumference, dyslipidemia and impaired glucose tolerance were significantly more prevalent in our male subjects than in females. Multiple logistic regression analysis showed that increasing age (OR (95% CI) = 1.06 (1.040–1.070);  $P < 0.001$ ) and male gender (OR (95% CI) = 1.50 (1.190–1.890);  $P < 0.05$ ) were significant predictors of metabolic syndrome in India.

**Conclusion:** The metabolic syndrome is substantially prevalent in India. Its prevalence increases with age and is higher in men than in women. A further study is required to understand the role and inter-relationship between some more and less known factors possibly associated with the metabolic syndrome.

**Key words:** dyslipidaemia; metabolic syndrome; prevalence; glucose intolerance; waist circumference

Received: January 22, 2010

Accepted: May 4, 2010

### Introduction

Metabolic syndrome (MS) also known as syndrome X is characterized by hypertriglyceridaemia and low concentration of high density lipoprotein (HDL) cholesterol (dyslipidemia), elevated blood pressure, impaired glucose tolerance and central obesity (1). People with MS are about twice as likely to develop cerebrovascular disease (CVD) and over four times as likely to develop type 2 diabetes compared to subjects without metabolic syndrome (2–4). It is well recognized that the syndrome has a genetic basis along with certain modifiable environmental factors (5,6). The present study was undertaken to report the prevalence of MS in the city of Salem, located in southern part of India.

### Materials and methods

#### Subjects

Patients who attended the High Tech Hospital affiliated to Vinayaka Missions University, Salem, India for routine medical checkup formed the cases for the present cross-sectional study. The total of 1,568 cases that referred to the hospital during June 2007 to September 2009 was enrolled into the study. Informed consent was taken from all the subjects.

Metabolic syndrome was diagnosed according to the NCEP-ATP III criteria (Third Report of the Natio-

nal Cholesterol Education Program Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults – Adult Treatment Panel III). Three or more of the following criteria formed the basis for defining metabolic syndrome:

1. hypertension, defined as a history of hypertension or a blood pressure greater than or equal to 130/85mm Hg;
2. hypertriglyceridaemia, defined as fasting triglycerides greater than or equal to 1.7 mmol/L;
3. hyperglycaemia, defined as a history of diabetes or a fasting blood glucose greater than or equal to 5.60 mmol/L;
4. low HDL-cholesterol, defined as a fasting HDL-cholesterol less than 1.00 mmol/L in men or less than 1.3 mmol/L in women; and
5. central obesity, defined as a waist circumference greater than 90 centimeters in Asian men or greater than 80 centimeters in Asian women (8,9).

**Methods**

The following parameters were collected: age, gender, waist circumference, blood pressure and fasting clinical chemistry parameters. Blood pressure was monitored and measured in a sitting position by a mercury sphygmomanometer (7). Blood samples collected after 12h overnight fast were analyzed to determine the concentrations of HDL-cholesterol, triglyceride and fasting glucose using Hitachi 901 Autoanalyzer (Roche Diagnostics GmbH, Germany) (8).

**Statistical analysis**

Data are presented as arithmetic mean ± standard deviation. Student’s t-test was used for comparison of numerical variables. Chi-square test was used to determine the level of significance for categorical variables. Multivariate logistic regression was used to define predictors of metabolic syndrome. Values of P < 0.05 were considered statistically significant.

Analysis was done using SPSS statistical software (Chicago, IL, USA).

**Results**

Out of 1,568 participants, there were 896 (56.8%) men and 672 (43.2%) women. Ten subjects did not participate in the study. The mean age was 49 ± 13 years (age range: 18–80 years), males: 50 ± 60 years; females: 53 ± 15 years.

The demographic characteristics of the population are shown in Table 1. Abdominal obesity, dyslipidemia and impaired glucose tolerance were more prevalent in male subjects than in the females. None of the studied variables differed significantly between various age groups, with the exception of waist circumference (Table 2). The prevalence of metabolic syndrome was 33.17% in men and 27.04% in women (Table 3), the difference was statistically different (P = 0.001).

Multiple logistic regression analysis showed that increasing age (OR (95% CI) = 1.06 (1.040–1.070); P

**TABLE 1.** Demographic characteristics of studied population.

	<b>Total N = 1,568</b>	<b>Male N = 896</b>	<b>Female N = 672</b>	<b>P (male vs. female)</b>
<b>Age (years)</b>	51 ± 15	53 ± 15	50 ± 16	< 0.001
<b>Waist circumference (cm)</b>	101.0 ± 10.2	105.0 ± 10.5	95.0 ± 9.5	< 0.001
<b>Systolic blood pressure (mm Hg)</b>	130.0 ± 12.5	130.0 ± 15	130.0 ± 10.0	0.859
<b>Diastolic blood pressure (mm Hg)</b>	77.0 ± 10.5	75.0 ± 7.5	80.0 ± 5.5	0.843
<b>HDL-cholesterol (mmol/L)</b>	0.88 ± 0.20	0.95 ± 0.25	0.80 ± 0.15	< 0.001
<b>Triglyceride (mmol/L)</b>	2.00 ± 0.93	1.85 ± 0.90	2.15 ± 0.95	< 0.001
<b>Glucose (mmol/L)</b>	6.10 ± 0.70	6.15 ± 0.95	6.05 ± 0.45	0.006

**TABLE 2.** Difference of clinical and biochemical parameters among age subgroups.

	< 40 years (N = 366)	40–50 years (N = 526)	50–60 years (N = 482)	> 60 years (N = 198)	P (ANOVA)
Age (years)	36 ± 5	49 ± 6	53 ± 6	65 ± 9	
Waist circumference (cm)	82.5 ± 8.5	102.5 ± 8.75	102.5 ± 5.0	84.0 ± 5.5	< 0.05
Systolic blood pressure (mm Hg)	128 ± 4.5	132 ± 5.0	135 ± 4.5	130 ± 5.5	0.859
Diastolic blood pressure (mm Hg)	80 ± 3.5	85 ± 5.5	85 ± 5.5	82.5 ± 4.5	0.843
HDL-cholesterol (mmol/L)	1.05 ± 0.10	0.95 ± 0.15	0.85 ± 0.15	0.90 ± 0.20	0.842
Triglyceride (mmol/L)	1.7 ± 0.40	2.0 ± 0.30	2.05 ± 0.20	2.00 ± 0.25	0.838
Glucose (mmol/L)	6.05 ± 0.45	6.10 ± 0.50	6.20 ± 0.45	6.10 ± 0.50	0.861

**TABLE 3.** Prevalence of components of metabolic syndrome.

Number	Men N (%)	Women N (%)	P (male vs. female)	Total N (%)
Number of components				
1	211 (24.7%)	192 (30.7%)	0.054	403 (25.63%)
2	186 (21.85)	109 (17.4%)	0.069	295 (18.69%)
3	162 (18.9%)	99 (15.8%)	0.052	261 (16.47%)
4	88 (10.3%)	53 (8.48%)	0.138	141 (8.93%)
5	33 (3.85)	17(2.72%)	0.138	50 (3.16%)
Metabolic syndrome	283 (33.17%)	169 (27.04%)	0.001	452 (28.14%)

< 0.001) and male gender (OR (95% CI) = 1.50 (1.190–1.890); P < 0.05) were significant predictors of metabolic syndrome.

## Discussion

The National Cholesterol Education Program (NCEP) Adult Treatment Panel (ATP) III defined the criteria for the diagnosis of metabolic syndrome and laid down guidelines for its management (8). Insulin resistance is reported to be the key component for the clustering of risk factors that lead to metabolic syndrome (9).

In this cross-sectional population based study, 33% of men and 27% of women were diagnosed with the metabolic syndrome. Our results show that the prevalence of MS rises with age. Also, MS was more prevalent in men than in women. Asian

Indians are known to have lower body mass index (BMI) than Europeans (10). However, for any given BMI, Asian Indians have greater waist-to-hip ratios and abdominal fat than Europeans (11,12).

It will be useful to measure factors associated with MS in different population to identify the prevalence of the syndrome and also to establish whether its prevalence differs according to region, religion and life style (13). It would be possible to prevent the early precipitation of diabetes or cardiovascular events in a community by finding out the presence of metabolic syndrome. This may help to establish basic guidelines of prevention and cure (14). It will be the best approach to formulate a health policy at a community level to provide health care and also educate the medical graduates to understand the basic health needs of the community they serve.

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## Prevalencija metaboličkog sindroma kod lokalne populacije u Indiji

### Sažetak

**Uvod:** Osobe s metaboličkim sindromom imaju dvostruko veći rizik od razvoja cerebrovaskularnih bolesti te više od četiri puta veći rizik od razvoja šećerne bolesti tipa 2 u usporedbi s osobama bez metaboličkog sindroma. Ovo presječno populacijsko istraživanje je provedeno kako bi se istražila prevalencija metaboličkog sindroma kod lokalne populacije u Indiji.

**Materijali i metode:** Prevalencija metaboličkog sindroma utvrđena je u skupini od 1.568 bolesnika koji su upućeni u bolnicu u sklopu Sveučilišta Vinayaka Missions, Salem, Indija. Ispitana je ukupna prevalencija, kao i broj sastavnica metaboličkog sindroma prisutnih kod ispitanika. Prikupljeni su podaci o sljedećim varijablama: dob, spol, opseg struka, krvni tlak i biokemijski parametri natašte. Krvni tlak je izmjeren u sjedećem položaju živinim tlakomjerom. Uzorci krvi za određivanje koncentracije HDL kolesterola, triglicerida i glukoze natašte uzeti su ujutro nakon 12-osatnog posta.

**Rezultati:** U našoj smo skupini otkrili da 33,17% muškaraca i 27,04% žena ima metabolički sindrom. Prevalencija opsega struka, dislipidemije i oštećenog podnošenja glukoze bile su statistički značajno veća kod muških ispitanika nego kod žena. Analiza višestruke logističke regresije pokazala je da su starija dob (OR (95% CI) = 1,06 (1,040–1,070); P < 0.001) i muški spol (OR (95% CI) = 1,50 (1,190–1,890); P < 0.05) značajni predskazatelji metaboličkog sindroma u Indiji.

**Zaključak:** Metabolički sindrom je u Indiji prisutan u znatnoj mjeri. Njegova prevalencija raste sa dobi te je veća kod muškaraca nego kod žena. Potrebna su daljnja istraživanja kako bi se razumjela uloga međusobne povezanosti između nekih dobro poznatih i nekih manje poznatih čimbenika koji bi mogli biti povezani s metaboličkim sindromom.

**Ključne riječi:** dislipidemija; metabolički sindrom; prevalencija; netolerancija glukoze; opseg struka