PRE METABOLIC STATE - A NEW VARIANT TO BE INTRODUCED

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ABSTRACT

BACKGROUND
In this era of busy and stressful life, medical students rarely get time for their own health concerns. They lead sedentary life style with less physical activities and also have immense physical, mental, social and emotional stress which has detrimental effects on their health. These hard facts impose a negative effect on their metabolic health in specific relating to weight gains, altered lipid profiles, raised blood glucose levels and even stress induced elevated blood pressure. Keeping this context we proposed to study to coin a new terminology as pre- metabolic state.

AIM
To evaluate and coin a new term of pre-metabolic state in potentially obese candidates through assessment of their various metabolic parameters.

OBJECTIVES
To assess the biological/serological markers according to the NHANES (The National Health and Nutrition Examination Survey) guidelines for metabolic states and to correlate the clinical and physical findings in these medical graduates with their biochemical profiles.

METHOD
120 medical students were assessed on the basis of a detailed history on a basis of a predesigned questionnaire attending Internal medicine OPD. Detailed anthropometric measurements and blood pressure was recorded. Blood glucose, lipid profile was estimated.

STATISTICAL ANALYSIS
Chi-Square test was applied and (p<0.005) was considered significant.

RESULT
Overweight subjects had increased prevalence of pre-hypertension and hypertension, impaired blood glucose level, decreased HDL and elevated triglyceride level.

CONCLUSION
A new terminology like "premetabolic state" may be proposed for overweight individuals who also have any one criteria of metabolic syndrome present in them.

KEYWORDS
Premetabolic state, Metabolic syndrome, Pre hypertension, Hypertension.

INTRODUCTION: The yin and yang between communicable and non-communicable diseases has been always there, however with change in life styles and major transitions in working trends and patterns amongst human beings has opened wide the door for emergence of an array of non-communicable diseases. The global trends of current times has shown a remarkable upsurge in cardiovascular and diabetes mellitus and their associated complications.[1] Presently various meta analytical works on international fronts points towards obesity as a major harbinger of propagating and accentuating cardiovascular diseases as well as Diabetes Mellitus.

Indian as well as international studies on epidemiology suggest a rapidly rising trend in cardiovascular diseases especially in the last two decades. And by 2020 India will have a large proportion of population contributing to morbidity and mortality due to cardiovascular diseases.[2,3] The obesity patterns along with diabetes and cardiovascular

diseases together contribute towards causation of the metabolic syndrome and south Asians approximately 20% to 25% have developed the same in the past decade or so.[4,5] In this era of busy and stressful life, medical students rarely get time for their own health concerns. They lead sedentary life style with less physical activities and tow along immense physical, mental, social and emotional stress which have detrimental effects on their health. These students can face a definite impact over their metabolic health in specific relating to weight gains, altered lipid profiles, raised blood glucose levels and even stress induced elevated blood pressure. Students seem to be are unaware about it & which may lead to metabolic syndrome and end up with severe complications like cardiovascular disease, Type-2 DM etc.

People with abnormal glucose metabolism, hypertension and obesity with dyslipidemia together constitute "metabolic syndrome," posing a major public health challenge to the health systems in developed and developing countries.[6] The main reason why metabolic syndrome is attracting scientific and commercial interest is that the factors defining the syndrome are all factors associated with increased morbidity and mortality in general and CVD in particular.[1] Pre hypertension and pre diabetes are terms already coined in the field of medicine. Keeping this context we proposed to study to assess and evaluate the pre-metabolic syndrome status of those candidates.

AIM: The aim of this study is to evaluate the prevalence of pre-metabolic states and or metabolic syndrome amongst the medical undergraduates and intervene by promoting awareness amongst them.

OBJECTIVES:
1. To clinical evaluate subjects for metabolic syndrome.
2. To assess and categorize subjects for pre-metabolic state.

MATERIALS AND METHODS:
Type of Study: Analytical Cross-sectional type of study.

Study Design: Present study was carried out among 120 medical students at internal medicine OPD of DMIMS University, JN Medical College/ABVR Hospital.

Duration of Study: 6 months.

Students were primarily assessed on the basis of a detailed history on a basis of a predesigned questionnaire. Detailed information regarding disease and treatment status was obtained from the subjects. Anthropometry (waist circumference/waist-hip ratio), blood pressure was measured.

Study Sample: Total 3ml of blood sample was collected after informed and written consent from medical undergraduate students.

Following Examinations Were Carried Out:

Sl. No.	Test	Method
1	Anthropometrics measurement (waist circumference/ waist–hip ratio)	General Examination
2	Blood Pressure	Sphygmomanometer
3	Fasting blood sample of glucose	GOD-POD
4	Lipid Profile	Biochemical test

The NHANES (1999-2004) criteria applied in the present study to diagnose metabolic syndrome[7]: Blood Pressure was correlated according to as per JNC 8 guidelines and pre hypertension was categorized according to JNC 7 report.[8,9]
BP Scheme for Adults (in mm Hg).
- Normal: systolic BP <120 and diastolic BP <80.
- Pre-hypertension: SBP 120-139 or DBP 80-89.
- Stage 1 hypertension: SBP 140-159 or DBP 90-99.
- Stage 2 hypertension: SBP ≥160 or DBP ≥100.

Diabetes and Pre Diabetes Were Defined According to American Diabetes Association.[10]:
In accordance with NCEP-ATP (National Cholesterol Education Program-Adult Treatment Pane) III[11][12]:
- Waist circumference >90cm in men and >80cm in women.
- Fasting Plasma Glucose = >100mg/dl.
- Triglyceride = >150mg/dl.
- HDL = <40mg/dl.

We used these criteria for BMI calculation, plasma glucose, triglyceride and HDL estimation.

NHANES Criteria Suggest The Following:
- All individuals who are found to have at least 3 out of the above mentioned parameters to be present in them with a BMI of more than 25 are to fall under the category of metabolic syndrome.
- All individuals with a BMI of more than 30 but with no parameters positive are termed as healthy Obese individuals.[13][14]

Proposed Definition of Pre-Metabolic State: We propose to coin the term "Pre Metabolic state" for the candidates having BMI of more than 25 having less than 3 parameters (but at least one).

Inclusion Criteria: All students with Borderline BMI (>25) were selected for the study.

Exclusion Criteria:
1. All the cases of cardiovascular disease, Diabetes Mellitus Type 1/thyroid disorders.
2. Subjects who didn't give consent.

STATISTICAL ANALYSIS: Chi square will be applied and all the case will be categorized as under, healthy, borderline, pre-metabolic or metabolic syndrome.

OBSERVATION & RESULTS: 120 medical students were assessed on the basis of a detailed history on a basis of a predesigned questionnaire at internal medicine OPD. We have considered the cut-off or significant p-value <0.005.

Weight/height (BMI)	Blood Pressure			Statistical Significance
	Normal	Pre-HTN	HTN	
Normal (74)	60	8	6	Chi Sq.=65.20
Over weight (38)	2	28(73%)	8(21%)	d.f.=4
Obese (8)	1	5(62%)	2(25%)	p=0.0001

Table 1: Chi-Square Values for Obesity and Hypertension

Above Table shows significant value (p<0.005) for BMI and Hypertension (Systole).

Weight/height (BMI)	Blood sugar level			Statistical Significance
	Normal	Pre-DM	DM	
Normal (74)	35	21	18	Chi Sq.=15.55
Over weight (38)	7	19(50%)	12(31%)	d.f.=4
Obese (8)	0	6(75%)	2(25%)	p=0.0037

Table 2: Chi-Square Values for Obesity and Diabetes

Above Table show significant value (p<0.005) for BMI and Diabetes.

Weight/height (BMI)	Waist Circumference		Statistical Significance
	Normal	Abnormal	
Normal (74)	60	14	Chi Sq.=28.68
Pre-obese (38)	13	25	d.f.=2
Obese (8)	2	6	p=0.0001

Table 3: Chi-Square Values for Obesity and Waist Circumference

Above Table shows significant value (p<0.005) for BMI and Waist Circumference.

Weight/height (BMI)	HDL		Statistical Significance
	Normal	Abnormal	
Normal(74)	65	9	Chi Sq.=27.19
Pre-obese(38)	17	21(55%)	d.f.=2
Obese(8)	3	5(62.5%)	p=0.0001, Significant

Table 4: Chi-Square Values for Obesity and HDL

Above Table shows significant value (p<0.005) for BMI and HDL.

Weight/height (BMI)	TG		Statistical Significance
	Normal	Abnormal	
Normal (74)	61	13	Chi Sq.=62.18
Pre-obese (38)	3	35(92%)	d.f.=2
Obese (8)	1	7(87.5%)	p=0.0001, Significant

Table 5: Chi-Square Values for Obesity and Triglyceride

Above Table shows significant value (p<0.005) for BMI and Triglyceride.

DISCUSSION: Metabolic syndrome is a constellation of interrelated risk factors of metabolic origin- metabolic risk factors-that appears to directly promote the development of atherosclerotic cardiovascular disease (ASCVD).[15] The most widely recognized of the metabolic risk factors are the atherogenic dyslipidaemia along with obesity, elevated blood pressure, and elevated plasma glucose.[16] Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have a negative effect on health, leading to reduced life expectancy and/or increased health

problem.[17] In Western countries, people are considered obese when their body mass index (BMI) a measurement obtained by dividing a person's weight by the square of the person's height, exceeds 30kg/m^2, with the range 25-30 kg/m^2 defined as overweight. Obesity increases the likelihood of various diseases, particularly heart disease, type 2 diabetes, obstructive sleep apnoea, certain types of cancer, and osteoarthritis.[17] Obesity is most commonly caused by a combination of excessive food energy intake, lack of physical activity, and genetic susceptibility.

Hypertension is defined as a systolic blood pressure (SBP) of 140mm Hg or more, or a diastolic blood pressure (DBP) of 90mm Hg or more.[18] Hypertension puts strain on the heart, leading to hypertensive heart disease and coronary artery disease if not treated. Hypertension is also a major risk factor for stroke, aneurysms of the arteries (e.g. aortic aneurysm), peripheral arterial disease and is a cause of chronic kidney disease.

Diabetes mellitus (DM), also known as simply diabetes, is a group of metabolic diseases in which there are high blood sugar levels over a prolonged period.[19] This high blood sugar produces the symptoms of frequent urination, increased thirst, and increased hunger. Untreated, diabetes can cause many complications.[20] Acute complications include diabetic ketoacidosis and non-ketotic hyperosmolar coma.[21] Serious long-term complications include heart disease, stroke, kidney failure, foot ulcers and damage to the eyes.[20]

Hyperlipidaemia, hypolipoproteinaemia, or hyperlipidaemia (British English) involves abnormally elevated levels of any or all lipids and/or lipoproteins in the blood.[22] It is the most common form of dyslipidaemia (which includes any abnormal lipid levels). Lipid and lipoprotein abnormalities are common in the general population, and are regarded as a modifiable risk factor for cardiovascular disease due to their influence on atherosclerosis.

Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health. Body mass index (BMI) is a simple index of weight-for-height that is commonly used to classify overweight and obesity in adults. It is defined as a person's weight in kilograms divided by the square of his height in meters (kg/m^2).

The WHO definition is:
- A BMI greater than or equal to 25 is overweight.
- A BMI greater than or equal to 30 is obesity.

In our study, out of 120 medical undergraduates, proportions of overweight students were 31% and obese were 6%. Overweight students having pre-hypertension were 73% and hypertension were 21%. Those with pre-diabetic states were 50% and diabetics were 31%. Students with deranged triglyceride were 92% and with deranged HDL level were 55%. Obese students having pre-hypertension were 62% and hypertension were 25%. Those with pre-diabetic states were 75% and diabetics were 25%. Students with deranged triglyceride were 87.5% and with deranged HDL level were 62.5%.

A study done by Zeena Salman et al[23] and Erem et al,[24] showed that students with higher degree of overweight and obesity were more closely linked to hypertension which was very similar with our studies which revealed that students who are overweight and obese were more closely linked to pre-hypertension (73% in overweight & 62% in obese) and even evident hypertension (21% in overweight & 25% in obese). This is possibly related to their sedentary lifestyle, altered eating habits, increased fat content of diet and decreased physical activities.

A study of Resnick HE et al[25] and Brancati FL et al,[26] showed that Weight gain was associated with substantially increased risk of diabetes among overweight adults. This study is in accordance with our study which revealed that obese individuals (75%) are more pre-diabetic as compared to overweight individuals (50%).

Data from study by William PT et al[27] and Gillian S. Boyd et al,[28] concluded that there is a high prevalence of dyslipidemia found in overweight individuals which supported our study as triglyceride (92%), HDL (55%) and levels are more deranged in overweight students along with obese students (87.5% triglyceride; 62.5% HDL).

A study by Sullivan PW et al in United State[29] and MS De Sereday et al in central region of Argentina, showed that Obesity significantly exacerbates the deleterious association between diabetes, hyperlipidaemia, and hypertension, and health function. On an overall basis the present study correlated well with other worldwide studies on linkages between Obesity and hypertension, hyperlipidaemia and dyslipidaemia, diabetes, emphasizing metabolic syndrome as a significant entity.

The present study all put immense emphasis on the fact that, the pre hypertensive, impaired diabetes and dyslipidaemias are to be also considered as significant markers in overweight individuals. The below given criteria's emerging from The National Health and Nutrition Examination Survey (NHANES) in the united states are specifically meant for South Asian individuals, which we have considered in the present study.

Followings are the NHANES (1999-2004) Criteria:
- Blood Pressure ≤140/90mmHg.
- Waist circumference <90cm in men and <80cm in women.
- Fasting Plasma Glucose = <100 mg/dl.
- Triglyceride = <150 mg/dl.
- HDL = >40mg/dl for men & >50mg/dl for women.

Any 3 of the above parameters if deranged in an individual with a BMI of 25 and above, will land up with metabolic syndrome.

All individuals with a BMI of 25 and above with less than 3 criteria positive but having at least one criteria positive, we propose the term are to Pre metabolic state for such individuals.

CONCLUSION: The present study did extensive research on the early deranged values of hypertension, diabetes mellitus and hyperlipidemia in overweight and obese individuals giving important significance to pre-

hypertension, impaired blood glucose levels and deranged hyperlipidemic values. Taking these parameters into consideration, we attempted to screen subjects with overweight.

Subjects having overweight did tend to show significant changes in categories of pre-hypertension and hypertension, impaired blood glucose level, and subjects also showed altered lipidemic levels, decreased HDL and elevated triglyceride level.

Taking all these findings into account of the present study, category of overweight individual need to be considered for screening and as potentials harbingers for development of metabolic syndrome.

According to NHANES guidelines all such individuals which fall under the overweight category and have any three markers of the NHANES guidelines as deranged should be proposed to be termed as "Pre-obese individuals" a terminology not yet utilized or in vogue in the scientific literature. Hence considering NHANES guidelines, the individuals with altered anthropometric measurements showing altered metabolic parameters (borderline levels) where categorized as potential candidates of pre-metabolic syndrome, whereas obese individuals with normal metabolic parameters where categorized as Healthy obese individuals.

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