Original Research Paper

Volume - 10 | Issue - 12 | December - 2020 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Public Health

ASSOCIATION OF BODY MASS INDEX WITH SELECTED RISK FACTORS AMONG THE ETHNIC POPULATION OF TRIPURA- A CROSS SECTIONAL STUDY.

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ABSTRACT

INTRODUCTION: Obesity is one of the most significant multifactorial non-communicabledisorders that have reached a pandemic level in present era. Moreover, the cut off for its appropriate definition in different ethnic groups and races vary greatly. As per recent NCD initiative, Tripura reported 1,73,112 cases throughout the state. (www.tripurancd.org) However, there is paucity of exclusive data regarding the indigenous population, made vulnerable by modern lifestyle. **AIM:** To assess the association of BMI with blood pressure and biochemical risk factors for NCDs among the ethnic population of Tripura and to evaluate the role of obesity as a predisposing factor. **METHODS AND MATERIALS:** This cross-sectional facility-based study was conducted in the ethnic belt under Kherengbar CHC employing pre-designed questionnaire, anthropometry and laboratory investigations. Of the 182 ethnic subjects (≥30years) from the Tripuri tribe, 7.8%, 30.7%, 61.4% were in underweight, normal and pre-obese/obese categories respectively. Among the study population with hypertriglyceridemia (≥200mg/dl.) the prevalence of obesity was found to be 78.3%, among hypoalphalipoproteinemic subjects with HDL≤35mg/dl. 55.6% were obese, among systolic (≥140mmHg) and diastolic (≥90mmHg) hypertensives, prevalence of obesity was 64.58% and 66.66% respectively, and among hyperglycemic individuals with RBS≥140mg/dL prevalence was 55.2%. **RESULTS AND CONCLUSIONS:** This study brings into light that although indigenous populations were once thought to have a leaner body mass and lower prevalence of hypertension and metabolic disorders than non-ethnic populations, the trend is fast changing owing to societal intermingling and change in lifestyle.A higher BMI was observed among the ethnic Tripuri tribe of Tripura and also associated with dyslipidemia, hypertension and hyperglycemia. An increasing prevalence of obesity, hypertension and altered lipid profile among the ethnic population is an indication of the growing risk of cardiometabolic diseases.

KEYWORDS : Body Mass Index, Ethnic Population, Obesity, Biochemical Risk Factors, Cardiometabolic Disease, Hypertension, Lipid Profile.

INTRODUCTION

Of 56.9 million global deaths in 2016, 71% accounting for 40.5 million were due to non-communicable diseases (Global Health Observatory data). In 2016 itself, 31.5 million deaths (over three quarter) -- occurred in low- and middle-income countries across the world.[1] 46% of which took placebefore the age of 70 years, affecting the working age group specifically.[2] Non communicable diseases are not diseases of affluence yet their global prevalence are seen to dwarf the large spectrum of infectious diseases. Almost three-quarters of NCD related deaths occur in low- and middle-income countries.[2] Lifestyle variation among ethnic and rural populations owing to growing urbanization are associated with adverse NCD risk factors, irrespective of habitat.[3] A number of modifiable, non-modifiable and metabolic risk factors are contributors for non-communicable diseases. The World Health Organization (WHO) has enumerated the various causes of mortality being high blood pressure, (13%) tobacco use (9%), high blood glucose (6%), physical inactivity (6%) followed by overweight and obesity (5%).[4,5] A study conducted in Tripura found Body Mass Index (BMI) to be a better indicator of cardio-metabolic risk factors for NCDs, as against other factors in apparently healthy females and young adults.[6] A higher percentage of body fat at lower BMI may indicate increased risk of diabetes and cardiovascular disease.The mortality rates also increase with increasing degrees of overweight, as measured by body mass index. Moreover, a WHO expert consultation concluded after a thorough review that the proportion of Asian people with a raised risk of cardio-metabolic diseases is substantial at a BMI lower than the existing WHO cut-off point for overweight (25 kg/m^2).[7] To this purpose, 23 kg/m² has been chosen as public health action pointon the basis of meta-analysis results involving nine Asian countries and other published works.[8] However, there is paucity of exclusive data on the indigenous population of north-eastern India, made vulnerable by modern lifestyle. This cross-sectional facility-based study was conducted, employing a pre-designed questionnaire and followed by laboratory investigations, with an objective to assess the association of BMI with blood pressure and biochemical risk factors for NCDs among the ethnic population of Tripura and to evaluate the role of obesity as a predisposing factor. Ethnicity is complex construct of both social and epidemiological factors such as health beliefs and health practices and is crucial in determining pathological risks and exposures.[9]

METHODOLOGY

This was a facility based cross-sectional study conducted in the Kherengbar Community Health Centre, which primarily caters to an ethnic population comprising of the Tripuri tribe of Tripura. Consecutive subjects attending the out-patient department from August 2019 to January 2020 were included in the study after informed consent was obtained by qualified personnel of the Model Rural Health Research Unit (MRHRU), Tripura. 182 ethnic male and non-pregnant female between the age group of (30-69) years were included in the study, neither in immune-compromised state or clinically moribund. Authorized interviewers of the MRHRU collected specific personal data which included questions on personal history and demographic characteristics.Required vital (BP) and anthropological measurements (height, weight) were drawn from patient on-siteby competent staffs followed by screening via biochemical testing comprising of the blood sugar, triglycerides and high density lipoproteins, which were performed by trained technicians with the aid of a fully automated clinical chemistry autoanalyser, as per instrument protocol.

Ethical approval

Data confidentiality was maintained and ethical clearance obtained from the Institutional Ethical Committee of Agartala Government Medical College and Hospital.

Statistical analysis

Descriptive data analysis was done and tabulated to present study population characteristics and results are presented as frequencies, crude prevalence or population means (SE), standard deviations. A chi-square test was utilized to examine the association between hypertension, blood sugar, selected lipid profile determinants and BMI variables withp-value<0.05 set to denote statistical significance. We performed all of the analysis using IBM SPSS Statistics 25 software (2017. Armonk, NY, USA: IBM Corp).

RESULTS

Among the total 182 subjects enrolled in the study, 61.3% had a BMI≥23 (pre-obese/obese) of which 59% were males and 41% femalesin the obese category. Although 7.8% of entire population had a BMI<18.5, 42% among the >70years age group were found to be underweight. A rising trend of BMI with increasing age was observed and among those with BMI≥23kg/m², the highest proportion of 33.33% was found to be in the (50-59) year age group. (20-29=5%, 30-39=16%, 40-49=32%). However, there was a decrease thereafter with only 14% of pre-obese/obese subjects in the ≥60 year age group. This can be due to increased morbidity and mortality in the geriatric population leading to decline in the number. Majority of the study population and also pre-obese/obese subjects were married (98.03%). BMI corresponding to pre-obese/obese group was found to be higher among subjects educated only till high school (28%) and those with no formal schooling (27%) compared to rest. A reduced BMI was observed among the lower socioeconomic class with majority of population in the pre-obese/obese category hailing from upper socioeconomic class(Upper class=82%, Upper middle=15%, Middle=3%). The reason for this may be change in lifestyle and impact of sedentary jobs among the upper socio-economic section of the ethnic population. (Table-1: Sociodemography)

Table-1: Demographic data of the Tripuri tribe in relation to BMI

Variable	BMI<18.5 %(n=14)	BMI=18.5-<23 %(n=57)	BMI≥23 %(n=111)
Age in years			
• 20-29	1(7.69)	4(7.84)	5(4.90)
• 30-39	0(0.00)	3(5.88)	17(15.68)
• 40-49	1(7.69)	12(23.52)	35(32.35)
• 50-59	3(23.07)	15(29.41)	36(33.33)
• ≥60	8(61.53)	17(33.33)	14(13.72)
Sex			
• Male	7(53.84)	29(56.86)	60(58.82)
• Female	6(46.15)	22(43.13)	42(41.17)
Marital Status			
• Married	12 (92.30)	47 (92.15)	108 (98.03)
• Unmarried	1 (7.69)	3 (5.88)	2 (1.96)
• Widower	0(0.00)	1(1.96)	0 (0.00)
Education			
• No formal schooling	8(61.53)	18(33.33)	21(19.60)
• <Primary	3 (23.07)	5(9.80)	6 (5.88)
• Primary	1 (7.69)	11 (19.60)	19 (17.64)
• High school	1 (7.69)	14 (25.49)	34 (31.37)
• Secondary school	0 (0.00)	2 (3.92)	8 (7.84)
• College/University	0 (0.00)	3 (7.84)	16 (14.70)
• Post-graduation	0 (0.00)	0 (0.00)	3 (2.94)
Socioeconomic status			
• Upper class	8 (66.66)	30 (65.21)	77 (81.91)
• Upper middle class	4 (25)	11 (23.91)	14 (14.89)
• Middle class	1 (8.33)	3 (6.52)	3 (3.19)
• Lower middle class	0 (0.00)	2 (4.34)	0 (0.00)
• Lower class	0 (0.00)	0 (0.00)	0 (0.00)
Numbers in parentheses show percentage;			

Table-2(I), (ii): Distribution of subjects in different categories of BMI and BP.

Table-2(I)

BP (Systolic) in mm. of Hg	<18.5	18.5-22.9	>=23
<120 (18.6%)	10.5% (3)	47.4% (15)	42.1% (13)
120-129 (11.76%)	0%	33.3% (6)	66.7% (14)
130-139 (22.55%) (Stage 1 HTN)	0% (0)	17.4% (7)	82.6% (33)
>140 (47.06%) (Stage 2 HTN)	12.5% (10)	22.91% (19)	64.58% (54)

Table-2(ii)

BP (Diastolic) in mm. of Hg	<18.5	18.5-22.9	>=23
<80 (15.53%)	6.3% (1)	43.8% (12)	50% (14)
80-89 (32.04%) :Stage 1	3% (1)	27.3% (15)	69.7%(40)
>90 (52.42%) :Stage2	11.11%(10)	22.22%(21)	66.66%(63)

A rising prevalence of systolic (stage 2=47.06%) and diastolic (stage 2=52.42%) hypertension was seen among the ethnic population. An association of pre-obesity/obesity with stage 1 and stage 2of both systolic (84% and 65%) and diastolic (69.7% and 66.66%). hypertension was observed. There was a significant association between pre-obesity/obesity and development of hypertension. (Table-2 (i),(ii))

Table-3: Distribution of subjects in different categories of BMI and Random Blood Sugar.

RBS	<18.5	18.5-22.9	>=23
<140mg/dl. (80%)	7.6% (11)	32.8 (47)	59.7 (86)
>140mg/dl. (20%)	13.8 (4)	31.0 (11)	55.2 (19)

20% of the total study population had blood sugar level ≥140mg/dl. Although majority of subjects with raised blood sugar were pre-obese/obese, no significant association was observed between BMI and blood glucose, probably because of the small sample size. (Table-3)

Table-4: Distribution of subjects in different categories of BMI and Triglyceride.

Triglyceride	<18.5	18.5-22.9	>=23
<200 mg/dL (76.8%)	9.8% (13)	35% (48)	55.3 (76)
>200 mg/dL (23.12%)	2.7% (1)	18.91% (7)	78.3% (32)

23.12% among the ethnic study population were found to have a triglyceride level >200mg/dl.78.3% of this population with hypertriglyceridemia belonged to the pre-obese/obese group. Although the prevalence of triglyceridemia was 23.12%, a significant association was observed in the pre-obese/obese category of the ethnic study population. (Table-4)

Table-5: Distribution of subjects in di erent categories of BMI and HDL.

HDL	<18.5	18.5-22.9	>=23
<35mg/dL (61.36%)	3.7% (4)	40% (44)	55.6% (61)
>35mg/dL (38.63%)	5.9% (4)	52.9% (37)	41.2% (28)

A lowered level of High Density Lipoprotein was seen in 61.36% of the ethnic study population with 55.6% among the pre-obese/obese group. A high prevalence of low HDL among the ethnic study group including more than half of the pre-obese/obese category was observed.

DISCUSSION

In the present study it was found that almost one in every three subjects among the ethnic study population were in the overweight category and predisposition to obesity was comparatively higher in males than females. This maybe the consequence of rise in sedentary jobs among the ethnic men, whereas the women of the ethnic households have still maintained their previous lifestyles to an extent, which also involves tending to personal land and farms along with household chores. Although majority of the study population had a normal range body mass index owing to the change in lifestyle and improved nutrition and healthcare among the ethnic population, a decline was observed in the geriatric group of age >70years, which maybe due to decrease in body weight caused by loss of lean body mass.[10] A low BMI in elderly is often an indicator of weight loss and malnutrition. This is a matter of concern as studies have shown age to be an important modifier in the association of BMI to mortality in the elderly.[11,12] Significant positive correlations were observed between BP and BMI with a rising trend of both systolic and diastolic BP with increasing BMI. Studies have shown a high preponderance of BMI on the blood pressure levels which is seen to have an even higher impact than race, ethnicity and sex.[13,14] Hence the cumulative effect of ethnicity and BMI can be a strong predictor for both systolic and diastolic hypertension.[15,16,17] Chances of high BP were lesser among underweight subjects as compared to those in the normal BMI category. Overweight subjects were more likely to have higher BP in all stages of prehypertension, stage-I and stage-II hypertension with more preponderance of stage-II among the pre-obese/obese group. This may be due to increased morbidity and mortality in overweight subjects with stage-II hypertension which limits the outpatient department visits. A positive but non-significant correlation was observed between BMI and blood sugar. Of the 20% ethnic subjects with RBS >140mg/dl, majority were in the pre-obese/obese category. This is in alignment with the numerous studies that have shown obesity to be the most important modifiable risk factor for Type II diabetes as obesity is known to affect insulin resistance.[18,19,20] However, racial factors and ethnicity may directly affect the relationship.[21,22] A raised triglyceride level was observed in 23% of the total ethnic population with 78% among them corresponding to the overweight category. Hypertriglyceridemia causes enlargement and proliferation of fatty cells by accumulated triglycerides in adipose tissues leading to obesity.[23] Lack of physical activity and change in dietary habits caused by rapid urbanization can be the reason for altered triglyceride levels and weight gain. Moreover increased production of hepatic triglycerides and reduced clearance of serum triglycerides via peripheral lipolysis leads to increased adiposity. Decreased removal of triglycerides increases the cholesterol ester transfer protein mediated lipid exchange. This pathway causes depletion of cholesterol esters in HDL and enrichment in triacylglycerol-rich lipoproteins.[24] Hence these two determinants of lipid profile are inversely associated to each other.[25] Similar findings are observed in this study with majority (55.6%) of the section with lowered HDL (<35 mg/dL) belonging to the pre-obese/obese group. The lowering of HDL- cholesterol and rise in triglycerides is determined by a number of genetic, lifestyle and environmental factors. Rare events of genetic disorders lowering HDL include defective cholesterol efflux through membrane transporter ABCA1,[26,27,28] mutation or hypercatabolism in apolipoprotein A-1.[29,30] Majority of incidences are related to lifestyle factors such as obesity, physical inactivity, diet, smoking, and alcoholic liver disease rendering lifestyle modification an important aspect of controlling cardio-metabolic pathologies.[31,32]

CONCLUSION

This study brings into light that although indigenous populations were once thought to have a leaner body mass and lower prevalence of hypertension and metabolic disorders than non-ethnic populations, the trend is fast changing owing to societal intermingling and change in lifestyle. An increasing prevalence of hypertension and altered lipid profile among the Tripuri ethnic group is an indication to the growing risk of cardiometabolic diseases. A community based study encompassing the various ethnic and non-ethnic sections of the state of Tripura is required for better knowledge and understanding of the pattern as well for planning relevant health policies in order to resist non-communicable diseases from gaining endemicity among the vulnerable sections.

Acknowledgement

We are grateful to the doctors and staff serving in the Out-patient Department of Kherengbar CHC and National Health Mission (NHM) Tripura for their co-operation and support in this study. We also thank the Department of Health Research (DHR) for providing the infrastructure and Indian Council of Medical Research- Regional Medical Research Centre (ICMR-RMRC), Dibrugarh for acting as the mentoring institute.

Applicability

Four key metabolic/ physiological changes are directly related to morbidity among obese in general population: raised blood pressure, hyperglycemia and hyperlipidaemia. This first evidence based data obtained from the indigenous people of Tripura can be used to sensitize the system as to further community based interventional strategies that can be taken up to control and monitor the cardio-metabolic morbidity and mortality among the population.

Limitation

This is a facility based pilot study subject to the voluntary out-patient attendance in the Kherengbar hospital. It should be conducted on community level with larger population to elicit more accurate data. The classification of obesity was done on the basis of BMI only. Waist circumference, waist-hip ratio and skinfold thickness were not included.

Funding

Biochemical test reagents utilized by fully automated clinical chemistry analyser from Sphera, available in MRHRU Tripura, funded by National Health Mission Tripura.

Conflict of interest

None declared

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