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INFLUENCES OF AGE, SEX AND RAISED BODY MASS INDEX ON CARDIOVASCULAR DISEASE RISK FACTORS AMONG TRIBAL ADULTS OF INDIA

Introduction. *Rapid life style changes are leading causes of increased cardiovascular disease (CVD) risks among people in India today. Despite the country's high ethnic diversity, studies related to physiology and such health risks, particularly among the tribal populations have been limited.*

Materials and methods. *The present cross-sectional study was conducted among 1,434 tribal participants belonging to six tribes from the two states of West Bengal and Odisha. The aim of the present study was to understand the relationship of age (in years), sex and raised Body Mass Index (BMI) (kg/m^2) with selected CVD risk factors among the six tribes of India.*

Results. *In the males, raised BMI (kg/m^2) was found to influence CVD risks by significantly increasing the blood glucose among the age group (in years) of <40 years (Odds Ratio (OR)= 6.396, p≤ 0.05); isolated systolic hypertension among the age groups <40 years (OR= 2.387, p≤ 0.01) and ≥40 years (OR= 2.123, p≤ 0.05); isolated diastolic hypertension among the age groups <40 years (OR=4.74, p≤0.001) and >40 years (OR= 3.24, p≤ 0.001); hypertensive MAP among the age group <40 years (OR= 5.769, p≤ 0.001) and hypertensive blood pressure among the age groups <40 years (OR= 5.865, p≤ 0.01) and ≥40 years (OR= 3.127, p≤ 0.01).*

Conclusion. *Among females low BMI (kg/m^2) was seen to be linked with higher CVD risk. Influence of BMI (kg/m^2), age (in years) and sex on CVD risks can explain the increasing health threat among the tribal populations in India. Mean Arterial Pressure (MAP) can be considered to correctly indicate the cardiovascular risks; particularly in case of the younger population. An increasing tendency towards a double burden of disease is evident in the studied populations.*

Keywords: Cardiovascular Disease (CVD); Body Mass Index (BMI); Blood Pressure (BP); hypertension; tribal health; Mean Arterial Pressure (MAP)

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Introduction

The large-scale urbanization experienced in India in the last few decades has been found to be significantly associated with life style changes [Shetty, 2002; Scarborough et al., 2010], which in turn have been linked to increased prevalence of high blood pressure and cardiovascular disease (CVD) [Reddy et al., 2005]. Conventionally, it has been believed that tribal population groups are less exposed to socio-cultural and economic advancements [Pathy, 1998]; but in reality, they are not unaffected by the process of socio-economic and ecological change [Survival International…, 2007]. Studies related to health issues among the tribal populations of India have tended to focus on undernutrition [Indian Council…, 1971; 2000; 2004; Basu et al., 1990; Haque, 1990; Mahapatra, 1990; Radhakrishna, Ravi, 2004; Kar et al., 2007]. However, in the context of modernization and urbanization it has become necessary to conceptualize studies which assess the health status of various tribal groups with respect to obesity, metabolic measures, dietary profile and physical activity. Like metabolic risk factors, hypertension is mostly due to changing life styles and further increases the risk of CVD. These views have been supported by findings reported in a number of studies conducted among different tribal groups in India [Kusuma et al., 2001; Kerketta et al., 2009; Manimunda, 2011; Mandani, 2011; Sachdev, 2011; Meshram, 2012; Ramalingam et al., 2012]. The benefits of development in education, health and income generation has resulted in a significant amount of mainstreaming of Indian tribes [Behura, 1995; Deshingkar, Start, 2003; Deshingkar, Grimm, 2004; Deshingkar, 2005]. A number of tribal groups are capitalizing on economic opportunities that are available to them, with a desire to acquiring a better life style with modern life comforts [Rogaly et al., 2002; Dayal, Karan, 2003; Karan, 2003]. Thus, there is a growing concern about the increased life style risks among the tribal populations in the country. It is important to note that the anthropometric measures among the tribal populations in India can be associated with metabolic risk factors, to predict their cardiovascular health. Various anthropometric indexes have been used to map the CVD status and risks among India tribal groups.

The present study therefore, was undertaken on the six tribes of West Bengal and Odisha; three each from Birbhum district of West Bengal (Santals, Oraons and Koras) and Mayurbhanj district of Odisha (Santals, Bhumijs and Bathudis) with the aim to understand the relationship of age (in years), sex and raised BMI (kg/m^2) with selected CVD risk factors.

The present study while on one hand explains the influence and risk of BMI with varied age and sex categories; on the other hand, it explores the predictability of BMI with respect to CVD risk in the selected tribal population groups.

Materials and methods

Area and People

The study was conducted in the two states of West Bengal and Odisha in the eastern part of India (fig.1). According to the Census of India [2001], tribal population constitutes 5.50% of the total population of West Bengal and 22.13% of the total population of Odisha; additionally, the tribal populations of West Bengal comprise of 38 tribal groups, while those in Odisha comprise of 62 tribal groups [Census of India, 2001]. The districts where the study was undertaken; Birbhum in West Bengal and Mayurbhanj in Odisha, are both located in the northern parts of the respective states. Both the districts are dominated by tribal groups and the total number of their populations contributes significantly to the broader central Indian tribal sphere. For the study, the three main tribes were selected from each state, in West Bengal they were the Santals, the Oraons and the Koras; while in Odisha they were the Santals, the Bhumijs and the Bathudis. The Santals, Bhumijs and Koras belong to the Mundari language group of the Austro-Asiatic language family, while the Oraons and Bathudis belong to the Dravidian and Indo-Aryan language families [Ishtiaq, 1999]. A brief ethnography of each tribe along with a profile of the village studied was also collected as part of the investigation.

Birbhum District

The scheduled tribe population in Birbhum district in West Bengal constitutes 6.74% of the district population and 4.61% of the state population [Census of India, 2001].

Santal

The Santal tribal community from the district speaks the Santali language. Traditionally the tribe was mostly dependent on forest produce and cultivation for its livelihood and was considered one of the more prosperous tribes of central India. However, a change in the occupation of the tribe from forest product collection and agriculture to migrant labour for industry and agriculture has occurred over a period of time. Each of the studied villages had access to facilities like roads, communication, electricity, drinking water, health and educational services. Consequently, changes in life style were also observed, for example it was found that community activities like dancing and singing have now been replaced by programs like video shows. Similarly, modern entertainment equipment like television sets and radios were found in many households. Brewing liquor at home and a heavy drinking habit was also observed.

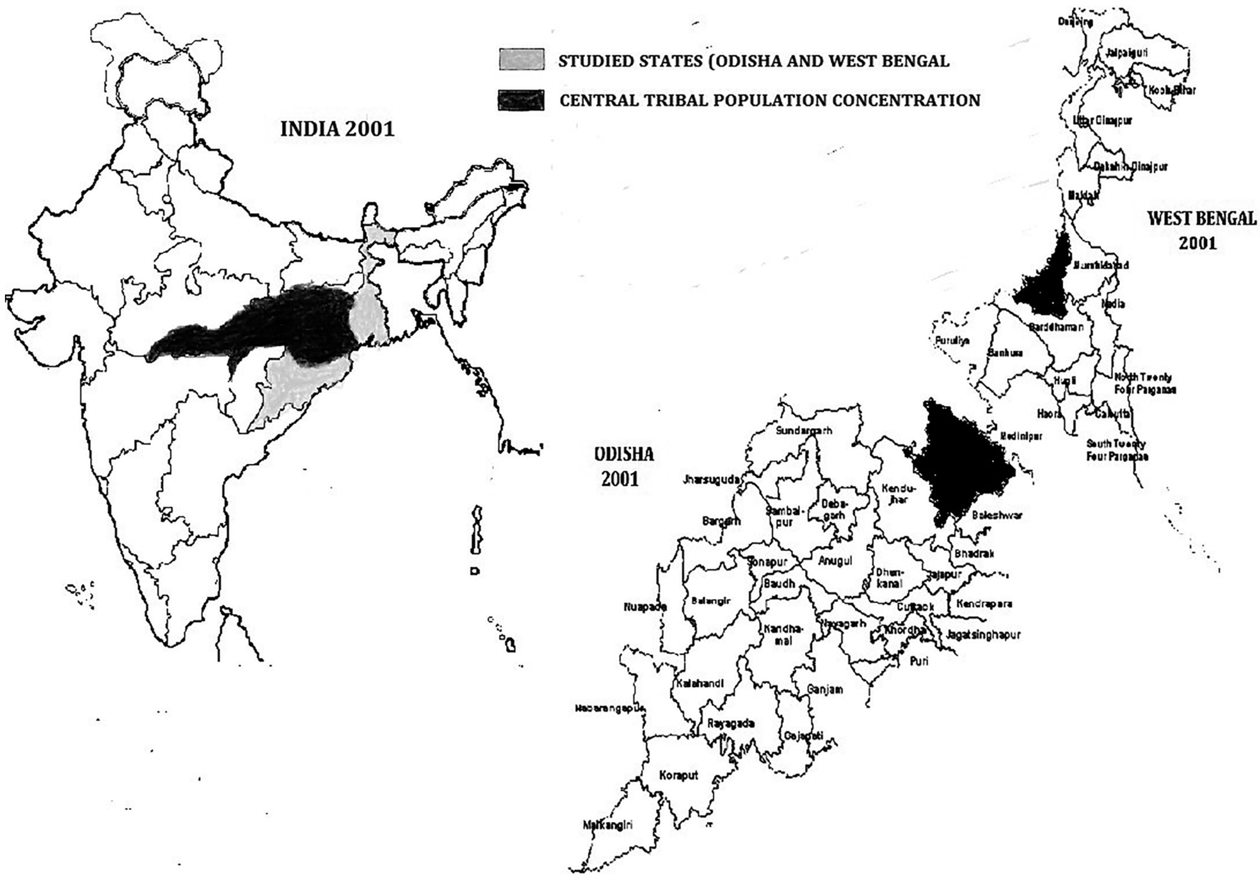

Figure 1. Geographic location of selected districts in West Bengal and Odisha states on India Map
Рисунок 1. Географическое расположение выбранных округов в штатах Западная Бенгалия и Одиша на карте Индии

Kora

In West Bengal, the Koras are a smaller tribal community in comparison to the Santals. They speak Khotta among themselves [Risley, Crooke, 1999]. Traditionally, the Koras depended on manual labour and agriculture for their livelihood, however the present study found them shifting towards daily wage labour for sustaining themselves. Besides cultivators and agricultural labourers, the Koras were also found to be engaged as share croppers, construction workers and woodcutters. They have a traditional community council to control their social affairs. The religion of the Koras is a mixture of their traditional faith and Hinduism. They are mostly non vegetarian. Alcoholic behaviour was found prevalent in the Kora villages observed during the study. Predominantly cultural liquor was found to be consumed; a preference for foreign liquor was observed among the industrial and migrant labour class of the tribe. However, unlike the Santals, the Koras are yet to witness a significant occupational shift from traditional patterns. Facilities like road communication, piped drinking water, etc., were not available in all the Kora villages studied; though access to electricity was found in all the villages inhabited by the Koras. Schooling facilities up to middle-level as well as health facilities were available within reach of most of the villages. Most villages also had Village Health Workers, though village level trained female attendants were absent. Several television sets and radios were seen in the villages and some people even subscribed to newspapers.

Oraon

Oraons, the other major tribal community in West Bengal are also known as the Kurukh tribe according to their spoken language – Kurukh [Risley, Crooke, 1999]. This tribe is mainly found in the states of Jharkhand, Bihar, West Bengal and Odisha. Oraons are believed to have first settled in the Chhota Nagpur Plateau and are considered to be the second largest tribe in Bihar and Jharkhand.

Traditionally, the Oraons depended on agriculture for their living. Some of them worked as paid labourers and collected forest produce. Oraons are further divided into sub-groups like Kudas and Kisans, who follow patrilineal family customs. There are a total of 14 clans in the Oraon tribal community. The present study found that the Oraons have also adopted new occupational and livelihood means like becoming industrial and migrant labours along with the traditional forest produce collection and agriculture. Facilities like road, communication, electricity and drinking water were found available in the villages studied. Educational institutions like schools and colleges, health facilities like health centres, private clinics, pharmacy shops etc. were found available within reach of the villages. Presence of modern entertainment sources like television sets and radios was also seen in Oraon households. Moderate to heavy consumption of both cultural as well as foreign made liquor was seen among the males of all ages in the Oraon villages. Elderly and middle-aged women were seen to consume only cultural liquor.

Mayurbhanj District

Mayurbhanj district of Odisha is a tribal dominated district. Out of the 62 types of tribes in Odisha; Mayurbhanj alone houses 53 types. A large portion of the district population, which is mainly tribal, falls below the primary educational level. As per the Census of India [2001], the Scheduled Tribe (ST) population in the district constitutes 56.60% of the total population. In the present study, the Santal, Bhumij and Bathudi tribes from the district were studied.

Santal

Santals in Odisha speak Santali which is a Mundari language [Ishtiaq 1999]. Santals live in scattered settlements. The Santal families are mostly nuclear and patrilineal. The sex ratio among the Santals was 976 females per 1,000 males. The overall literacy rate was 40.46%, while among the males it was 55.86% and among the females it was 24.75%.

Bhumij

Bhumijs of Odisha speak the Bhumij language which is an Austro-Asiatic language [Risley, Crooke, 1999]. As per the Census of India, 2001 the sex ratio of the tribe was 984 females per 1,000 males. The overall literacy rate among the tribe was 36.48%, while among the males it was 51.09% and among the females it was 21.72%. The Bhumijs live in scattered settlements in nuclear and patrilineal families.

Bathudi

Bathudi people speak Odiya language which is an Indo-Aryan language [Ishtiaq, 1999]. As per the Census of India [2001], the sex ratio among the Bathudis was 1,003 females per 1,000 males. The overall literacy rate among the Bathudis was 49.56%, while among the males it was 66.25% and among the females it was 33.03% [Census of India, 2001]. The Bathudis live in uniclan and homogenous settlements. The Bathudi families are mostly nuclear, patrilocal and patrilineal.

The present findings from Odisha show an average literacy rate of 54.16% among the three studied tribal groups which varies from a minimum of 52.16% among the Bhumijs to a maximum of 57.17% among the Bathudis.

Preparation and consumption of liquor locally called Handia, Mahuli and Chaulli was observed among all the three tribes in Odisha. It was found that many tribal families earn their livelihood by selling liquor prepared at home from different fruits like mango, banana, jackfruit etc. It was also seen that the habit of consuming cultural alcohol has largely been replaced by foreign made liquor types among the people working in factories or as migrant and daily wage labourers in towns and cities.

Sample

Villages in each of the two states which had a preponderance of the chosen tribes were selected for the study, while also taking into consideration the fact that the selected tribal villages exhibited differential developmental activities. From these villages, adult male and female participants in the range of 20 to 60 years were picked through random sampling. The sample size was estimated following the formula provided by Daniel [1999].

The study thus comprised a total sample size of 1,434 adult tribal males (705) and females (729) belonging to the six chosen tribes. However, there was a deficit of six participants. For further investigation, these total 1,434 tribal participants were subdivided according to sex into age groups (years) of less than 40 years (<40) and more than or equal to 40 years (≥40) old.

The sub division of the sample is as under:

West Bengal: 123 Santal males, 122 Santal females; 114 Kora males, 121 Kora females; 112 Oraon males, and 124 Oraon females constituting 716 tribal subjects.

Odisha: 121 Santal males, 119 Santal females; 116 Bhumij males, 122 Bhumij females, 119 Bathudi males and 121 Bathudi females comprising a total of 718 tribal subjects.

Criteria used to exclude individuals from the sample were: growth and developmental disorders, severe health problems in last one year and existence of any secondary cause of hypertension. The sample size for the present study was tested at 5.00% level of significance with a power of 80.00%.

The study was conducted between June 2011 and July 2013 in different phases. All the participants were picked up randomly and were not related to each other. Informed written consent from the participants participating in the study was obtained prior to the actual commencement of the study. For illiterate participants, approval of consent was collected by taking thumb impression in the consent form after adequately explaining the nature of the study. Prior ethical clearance from the Department Ethical Committee was obtained to conduct the research.

Anthropometric and CVD Risk Variables

The primary information about the participants who took part in the study, like name of the tribe, age (in years) and sex were recorded in a structured schedule. Standard techniques were followed while taking all the anthropometric measurements [Lohman et al., 1988]. Standing height (cm) and weight (kg) was measured to the nearest 0.1 cm and 0.1 kg respectively. Stature was measured by using movable Martin's anthropometer and weight by using an Omeron Karada Scan Body Composition Monitor. The participants were encouraged to remove their shoes and heavy clothing before giving the measurements. Body mass index (kg/m^2) was calculated as weight in kilogram (kg) divided by height in metre squared (m^2) – kg/m^2. Blood pressure (both systolic and diastolic) was recorded by using a standard mercury sphygmomanometer on the right arm of the participants after ensuring a minimum 5-minute rest before the measurement. Two measurements were taken with a time gap of at least 5 minutes and the average of the two was recorded. Two trained anthropologists were involved in the data collection process. In order to avoid measurement and data entry bias, all the measurements were taken by one anthropologist while all the data was entered in the datasheet by the other. During the study the same instruments were used for taking the measurements of all the participants. Participants with Systolic Blood Pressure (SBP) ≥130 mmHg and Diastolic Blood Pressure (DBP) ≥85 mmHg were considered to be at hypertensive risk as per the International Diabetic Federation (IDF) criteria [Zimmet, Alberti, 2006]. Participants with blood pressure ≥130/85 mmHg but <140/90 mmHg were considered as pre-hypertensive. Participants with blood pressure ≥140/90 mmHg but <160/100 mmHg were considered as hypertensive stage-I; while participants with blood pressure ≥160/100 mmHg were considered as hypertensive stage-II. The participants were also tested for random blood glucose with an automated analyzer by enzymatic method using commercial kits. Observed values were placed in two categories of risk, the first category being between ≥140 mg/dl and <180 mg/dl and the second category as ≥180 mg/dl. Mean arterial pressure (MAP) is the main determinant of blood flow and signifies the adequacy of blood flow to vital tissues. It is derived from the cardiac cycle. Observational studies with respect to hypertension in India, and particularly among tribal populations face serious short comings with respect to reporting blood pressure measurements. Mean arterial pressure (MAP) is a direct indicator of the risks of raised blood pressure on different organs [Andrews, Nolan, 2006]. While a subject having blood pressure values within the normal range and another subject characterized by a condition of true isolated systolic hypertension present the same mean arterial pressure value, it on the other hand, explain that they could both have the same values of heart rate, stroke volume, and systemic vascular resistance. We can conclude that different pressure values can correspond to the same mean blood pressure value. Mean arterial pressure (MAP) of 100 was considered as pre-hypertensive and that of 107 as hypertensive conditions. World Health Organisation (WHO) guidelines for Asian populations was considered for the present study which has identified additional trigger points for public health action as 23 kg/m^2 or higher, representing increased risk, and 27.5 kg/m^2 or higher as representing high risk for many Asian populations [WHO Expert…, 2004].

Statistical Analysis

After incorporating and systematising the data in Microsoft Excel 2007, further analysis was carried out using SPSS Version 16.0 for Windows, SPSS Inc., Chicago, Illinois, USA. Descriptive statistics such as mean and Standard Deviation (SD) along with significance level (p-value) for t-test for each variable was estimated for the selected anthropometric variables. One-Way Analysis of Variance (One-Way ANOVA) test was carried out between age, sex, various metabolic variables and BMI. Partial correlations were calculated between various variables. Finally, analysis was done to understand the association of BMI with different metabolic risk factors and to find out bisexual variation in the prevalence of hypertension among the tribes chosen for the study. Normal and selected risk categories were calculated in percentage. Mean values for normal and each risk category among males, females and in the total population were calculated and were presented as bar graphs. The p-value was considered at <0.05 level, while values between 0.05 to 0.09 levels were considered as suggestive [Hulleys, Cummings, 1988].

Results

A total of 1,434 tribals in the age range of 20 to 60 years were investigated during the present study. Of this total, 705 were males and 729 were females.

Table 1 shows the distribution of age, blood glucose, anthropometric and metabolic variables in the study population. Anthropometric characteristics showed significant inter-group differences for all the selected anthropometric and metabolic variables. It can be said that the mean SBP (127.03 mmHg) lies close to the risk cut-off value of 130 mmHg. Similarly, the mean BMI (19.35 kg/m^2) is close to the lower cut-off for normal range of BMI.

Table 1: Distribution of age, blood glucose, anthropometric and cardiovascular risk variables in the study populations (n=1,434)
Таблица 1: Распределение по возрасту, уровню глюкозы в крови, антропометрическим показателям и показателям сердечно-сосудистого риска в исследуемых популяциях (n=1,434)

Variables	Mean	SD	p-value
Age (in years)	40.21	12.43	<0.001
Blood Glucose (mg/dL)	116.74	34.09	<0.001
SBP (mmHg)	127.03	20.45	<0.001
DBP (mmHg)	80.21	12.88	<0.001
MAP (mmHg)	95.82	14.31	<0.001
BMI (kg/m^2)	19.35	2.94	<0.001

Notes. t-test was used for generating the p-values. SD= Standard Deviation.

Примечания. Для получения p-значений использовали t-тест. SD = стандартное отклонение.

Table 2 shows the analysis of variance for the selected variables by age and sex. From this table, it is evident that there is a significant variation between the two age group categories of <40 and ≥40 years old among the tribal males and females, as well as in the total tribal population with respect to the selected variables. The mean values for SBP for males, females and total population lie above the cut-off value for hypertensive risk (≥130 mmHg) in the age group category of ≥40 years old. Similarly, mean values of MAP among males, females and total population lie either above the cut-off value for hypertensive risk (100) or very close to it in the age category of ≥40 years old.

Table 3 represents the correlation coefficients between the selected variables. Overall, the F-values for SBP, DBP and MAP are significant (p≤0.001) among males, females as well as in the total population. The level of variance for random blood glucose level among the females as well as in the total population is also significant (p≤0.001). It is also noteworthy that mean BMI lies close to the lower cut-off value (i.e., 18.5 kg/m^2) for normal individuals in both the age group categories among males, females as well as in the total population. The mean BMI value is observed to be lower among the ≥40 years old age group than in the <40 years old age group. Significant correlation is evident among most of the variables, indicating a strong relationship between age and the selected risk factors.

Table 2: One-Way Analysis of Variance (One-Way ANOVA) test for blood glucose, BMI and CVD risk factors among selected variables by age and sex in the studied populations (n=1,434)
Таблица 2: Тест однофакторного дисперсионного анализа (One-Way ANOVA) для определения уровня глюкозы в крови, ИМТ и факторов риска сердечно-сосудистых заболеваний среди выбранных переменных по возрасту и полу в исследуемых популяциях (n = 1,434)

Variables	Male (n=705)				
	<40 years (n=358)		≥40 years (n=347)		F-value
	M	SD	M	SD	
Blood Glucose (mg/dL)	117.41	34.70	122.29	39.60	3.03[c]
SBP (mmHg)	122.34	13.78	130.00	21.88	31.25[a]
DBP (mmHg)	75.57	10.67	80.44	12.64	30.59[a]
MAP (mmHg)	91.16	10.43	96.96	14.81	36.32[a]
BMI (kg/m^2)	20.13	2.49	19.57	2.85	7.58[b]
Variables	Female (n=729)				
	<40 years (n=368)		≥40 years (n=361)		F-value
	M	SD	M	SD	
Blood Glucose (mg/dL)	110.05	24.58	117.55	35.10	11.21[a]
SBP (mmHg)	120.55	16.92	135.45	24.11	93.51[a]
DBP (mmHg)	79.08	11.84	85.77	14.02	48.58[a]
MAP (mmHg)	92.90	12.69	102.33	16.05	77.55[a]
BMI (kg/m^2)	18.85	2.85	18.86	3.30	.000
Variables	Total population (1,434)				
	<40 years (n=726)		≥40 years (n=708)		F-value
	M	SD	M	SD	
Blood Glucose (mg/dL)	113.68	30.20	119.88	37.42	11.93[a]
SBP (mmHg)	121.43	15.44	132.78	23.19	119.48[a]
DBP (mmHg)	77.35	11.41	83.16	13.62	76.85[a]
MAP (mmHg)	92.04	11.66	99.70	15.68	110.49[a]
BMI (kg/m^2)	19.48	2.75	19.21	3.11	3.13[c]

Notes. M=mean, SD= Standard Deviation. Mean values are significantly different between <40 years and ≥40 years age groups: [a]p≤0.001, [b]p=0.006, [c]p=0.05-0.09.

Примечания. M = среднее, SD = стандартное отклонение. Средние значения значимо различаются между возрастными группами <40 лет и старше 40 лет: [a]p≤0.001, [b]p=0.006, [c]p=0.05-0.09.

Table 4 shows the influence of BMI (≥23 kg/m^2) on the selected CVD risk measures by age and sex. There is a significant difference between the males and females as well as between the two age group categories. Males in the age category of <40 years old, with an elevated level of BMI ≥23 kg/m^2 are seen to be six times more susceptible to developing high blood sugar levels of ≥180 mg/dl (Odds Ratio (OR)=6.396, p≤0.001) in comparison to those with BMI <23 kg/m^2. Females in the age category of ≥40 years old, with raised BMI are seen to be highly vulnerable with two times the risk (OR =2.473, p ≤0.05) of developing high blood sugar levels of ≥140 mg/dl, and more than six times the risk (OR =6.156, p ≤0.001) of developing sugar levels of ≥180 mg/dl. The overall female population with a raised BMI level of ≥23 kg/m^2 carries two times (OR =1.983, p ≤0.05) and more than three times (OR =3.606, p ≤0.01) the risk of developing raised sugar levels of ≥140 mg/dl and ≥180 mg/dl. The population as a whole with BMI ≥23 kg/m^2 is two times more susceptible (OR=2.616, p≤0.01) to developing raised sugar level of ≥180 mg/dl.

It has also been found that the tribal males with BMI ≥23 kg/m^2 are two times more likely to develop raised SBP levels of ≥130 mmHg and ≥140 mmHg. Similarly, they are also more vulnerable to developing high DBP of ≥90 mmHg. The risk of developing pre-hypertensive BP of ≥130/85 mmHg was found to be higher by almost two times among the males with BMI <23 kg/m^2. It may be mentioned here that, among the males in the age category ≤40 years old and who have BMI ≥23 kg/m^2, the risk of developing hypertension (≥140/90 mmHg) is around six times more than those with BMI <23 kg/m^2. The overall risk of developing hypertension among the males with BMI ≥23 kg/m^2 is two times greater than males with BMI <23 kg/m^2. Except raised blood sugar level, other selected metabolic measures do not show significant association with BMI among females (Table 4). When both the sexes and age categories are considered, it is found that BMI ≥23 kg/m^2 significantly influences most of the metabolic risk factors and that the tribal males with BMI ≥23 kg/m^2 are more vulnerable to various metabolic risks as compared to tribal females (Table 4).

Table 3: Correlation coefficients (Pearson) between the selected variables among the studied populations (n=1,434)
Таблица 3: Коэффициенты корреляции (Пирсона) между выбранными переменными среди исследуемых популяций (n=1,434)

Variables	Correlation Coefficients (two tailed)					
	Age (in years)	Blood Glucose (mg/dL)	SBP	DBP	MAP	BMI
Age (in years)	1.000	.098***	.299***	.236***	.284***	–.051$^{\wedge}$
Blood Glucose (mg/dL)	–	1.000	.110***	.015	.062$^{\wedge}$	.094***
SBP (mmHg)	–	–	1.000	.722***	.910***	.144***
DBP (mmHg)	–	–	–	1.000	.944***	.076**
MAP (mmHg)	–	–	–	–	1.000	.114***
BMI (kg/m^2)	–	–	–	–	–	1.000

Notes. Correlation between the selected variables is significantly high: *** p≤0.001, ** p≤0.01, * p≤0.05, ^ p≤0.05-0.09 (suggestive).

Примечания. Корреляция между выбранными переменными достоверно высока: *** p≤0.001, ** p≤0.01, * p≤0.05, ^ p≤0.05-0.09 (предположительно).

Table 4: Influence of BMI (≥23 kg/m^2) on selected CVD risks among studied populations (n=1,434)
Таблица 4: Влияние ИМТ (≥23 кг/м^2) на отдельные риски сердечно-сосудистых заболеваний среди исследуемых групп населения (n=1,434)

Variables	Age group (in years)								
	Male			Female			Total		
	OR for ≤40 yrs	OR for >40 yrs	OR for Total	OR for ≤40 yrs	OR for >40 yrs	OR for Total	OR for ≤40 yrs	OR for >40 yrs	OR for Total
Blood Glucose ≥140 mg/dL	1.659	1.285	1.441	1.109	2.473*	1.983*	1.527	1.760*	1.677*
Blood Glucose ≥180 mg/dL	6.396**	.429	1.979	.000	6.156***	3.606**	3.232*	2.241^	2.616**
Pre-hypertensive SBP	2.112*	2.259*	2.128***	1.758	1.479	1.676^	2.101**	1.806*	1.911***
Hypertensive SBP	2.387*	2.123*	2.093**	1.182	1.088	1.237	1.818^	1.481	1.579*
Pre-hypertensive DBP	1.786	1.977*	1.845**	.867	1.259	1.159	1.213	1.517^	1.393^
Hypertensive DBP	4.740***	3.240***	3.633***	1.037	.836	.978	2.203*	1.516	1.755**
Pre-hypertensive	2.570*	1.917^	2.079**	1.794	1.264	1.526	2.140*	1.502^	1.715**
Hypertensive	5.865**	3.127**	3.500***	.451	.976	1.358	3.376**	1.672^	2.024***
MAP ≥100 (mmHg)	2.510**	2.417**	2.366***	1.068	1.714	1.524	1.746*	1.922**	1.824***
MAP≥107 (mmHg)	5.769***	1.752	2.531***	1.702	.822	1.119	2.967**	1.132	1.579*

Notes. All data are presented in Odds Ratio (OR) and 95% confidential interval (CI) i.e., OR (95% CI). Pre-hypertensive SBP=SBP≥130 mmHg, Pre-hypertensive DBP=DBP≥85 mmHg, Hypertensive SBP= SBP≥140 mmHg, Hypertensive DBP=DBP≥90 mmHg. The odds ratios between selected categories are significantly high: ***p≤0.001, **p≤0.01, *p≤0.05, ^ p≤0.05-0.09 (suggestive).

Примечания. Все данные представлены в виде отношения шансов (OR) и 95% доверительного интервала (CI), т.е. OR (95% CI). Предгипертензивное САД=САД≥130 мм рт.ст., Предгипертензивное ДАД=ДАД≥85 мм рт.ст., Гипертензивное САД=САД≥140 мм рт.ст., Гипертоническое ДАД=ДАД≥90 мм рт.ст. Отношения шансов между выбранными категориями значительно высоки: ***p≤0.001, **p≤0.01, *p≤0.05, ^ p≤0.05-0.09 (предположительно).

Discussion

The present study signifies the various aspects of BMI with respect to selected risk factors among the males and females of indigenous population groups in the age categories of <40 years and ≥40 years old. It was observed that a considerable proportion of the studied population was suffering from the stress of undernutrition.

The present study further found that in the pre-hypertensive risk category, the overall prevalence among males and females is close, while the gap is more pronounced between the two age group categories.

It was found that the younger male population (<40 years old) is comparatively healthier and better nourished than the older age group (≥40 years old). The mean BMI among the males was 20.13 (±2.49) kg/m^2 for the ≤40 years old age group while it was 19.57 (±2.85) kg/m^2 for the ≥40 years old age group. It is to be noted that tribal males in the <40 years old age group were found to be in more danger of developing metabolic risks like hypertension as compared to older males (≥40 years old). A study [Sesso et al., 2000] have shown in their study that MAP may be strongly associated with CVD risk in younger men. Dyer et al., observed that the steady component of BP (highly correlated with MAP) was strongly associated with CVD risk [Dyer et al., 1982].

Our study shows that male individuals with BMI ≥23 kg/m^2 are at higher risk which strongly influences their hyper-normal MAP in both the <40 years (OR=2.51, p=0.01) and ≥40 years old (OR=2.42, p≤0.01) age groups; with an overall OR of 2.37 (p≤0.001). The cardiovascular health of male individuals with BMI ≥23 kg/m^2 was strongly influenced by increasing the risk of isolated systolic hypertension (OR=2.11, p=0.05 for <40 years old; OR=2.26, p≤0.01 for ≥40 years old; OR=2.37, p≤0.001 for overall sample); isolated diastolic hypertension (OR=1.786, p=Non Significant (NS) for <40 years old; OR=1.977, p≤0.05 for ≥40 years old; OR=1.845, p=0.01 for overall sample) and pre-hypertensive condition (OR=2.57, p≤0.05 for <40 years old; OR=1.92, p=suggestive for ≥40 years old; OR=2.08, p=0.01 for overall sample). Similarly, BMI ≥23 kg/m^2 strongly influences the hypertensive MAP (OR=5.77, p≤0.001) as well as with hypertensive BP (OR=5.86, p≤0.002), along with isolated systolic hypertension (OR=2.387, p≤0.05) and isolated diastolic hypertension (OR=4.740, p≤0.001) in the younger age group (<40 years old) males.

Role of increased BMI in contributing towards CVD risks among indigenous Indian populations (Nicobarese tribe) has been reported previously [Manimunda et al., 2011]. However, with respect to ≥40 years old tribal males it was also observed that they were more likely to develop different metabolic risks (Table 4) when they had a low BMI status (Table 2). The overall tribal male population with raised BMI was two or more than two times likely to develop metabolic risks (p≤0.01).

Regarding the tribal females, it was found that the mean and standard deviation of the selected metabolic variables was higher than in the males, in both the selected age groups. The mean SBP and DBP with respect to all the selected risks are much higher among the tribal females than their male counterparts. Schall, in her meta-analysis on traditional and tribal societies has shown that older women are at double risk of hypertension than older men [Schall, 1995]. It was observed that the results among tribal females were less or non-significant with respect to developing metabolic risks at high BMI status. It may be due to fewer women in the raised BMI category along with the number of such women being very less to explain the status adequately. The mean BMI values for the <40 years and the ≥40 years old age group female participants were found to be 18.85 (±2.85) kg/m^2 and 18.86 (±3.30) kg/m^2 respectively. This is very close to the lower cut-off mark for normal BMI status i.e., 18.5 kg/m^2 as recommended by WHO for South Asian populations. This explains the high undernutrition stress among the females in both the younger as well as the older age group. Dettwyler in his study among rural populations of Mali showed that undernutrition among adult populations is due to undernutrition stress during childhood, a low protein diet and hard physical labour [Dettwyler, 1992]. In the present study it can be inferred that the high prevalence of raised SBP (135.45 ±24.11 mmHg) and (DBP 85.77 ±14.02 mmHg) among females with low BMI in the middle or older age groups might be due to low BMI status during the early years. The present results with respect to influences of low BMI leading to high blood sugar correspond to previous studies showing the influences of low BMI on glucose intolerance indicative of high glucose load [West, 1978; Swai et al., 1992; Van der Sande et al., 2001].

The above findings for the first time give very important observations that the Indian tribal populations on one end with respect to males are increasingly leading to high risk of obesity with additional fall in cardiovascular health while on the other hand for females, though they still suffering from high undernutrition, the risk of poor cardiovascular health is growing comparatively more than males.

Previous studies among indigenous populations in India show that hypertension has a positive correlation with raised BMI which further exacerbates with growing age [Mukhopadhyay, Mukhopadhyay, 2001; Kusuma et al., 2002; Kerketta et al., 2009; Manimunda et al., 2011; Sachdev, 2011]. The present study shows raised BMI as a highly influencing factor for the hypertension and CVD risks among younger males in particular. The role of raised BMI in influencing CVD risks among younger populations is another novelty of the present study. This is indicative of changing life style among younger population groups.

We also found that individuals with BMI ≥23 kg/m^2 are strongly affected with hypertensive BP (OR=2.024 p≤0.001) and hypertensive MAP (OR=1.579, p≤0.05) along with isolated systolic hypertension (OR=1.579, p≤0.05) and isolated systolic hypertension (OR=1.755, p≤0.01).

Conclusion

So, as per the findings of this study, individual BP parameters like MAP, isolated systolic hypertension and isolated diastolic hypertension can be considered to plot cardiovascular risks, particularly in younger tribal populations. Though increased age, in general is a decisive factor for increased hypertensive risk, individuals with raised BMI in younger age are also equally vulnerable. Irrespective of age, a raised BMI puts at risk the cardiovascular health of younger males. This has also been observed in other Indian tribal groups [Bose et al., 2006; Chakraborty, Bose, 2008]. Stini in his hypothesis proposed that variation due to environmental stresses is reflected more among males [Stini, 1985]. In the tribal women, low BMI is highly prevalent, irrespective of age group, along with high prevalence percentage of hypertension; making the association between raised BMI non-significant with respect to most of the metabolic indicators of hypertension. Such trend is observable both in younger as well as older females.

Previous studies among indigenous Indian populations have shown an association of undernutrition and anaemia with high BP [Kerketta et al., 2009]. Studies have also shown that malnutrition [Marti et al., 2001] and particularly undernutrition [Chandara, 1991; 1997; Meydani, 1991; Mazari, Lesourd, 1998] influences the immune system negatively which may further lead to causation of disease conditions [Krause et al., 1999]. Results of the present study indicate that young tribal males are showing increasing tendency towards growing body weight, against the traditional wisdom, which in turn has been found to be strongly associated with metabolic risk factors. Tribal females are in more danger of developing metabolic risks at lower BMI irrespective of age. So, the present status of health suggests an increasing tendency towards a double burden of disease among the Indian tribal populations. Therefore, health of these indigenous population groups needs to be looked into holistically, so that timely intervention can be made against this silent epidemic.

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ВЛИЯНИЕ ВОЗРАСТА, ПОЛА И ПОВЫШЕННОГО ИНДЕКСА МАССЫ ТЕЛА НА ФАКТОРЫ РИСКА СЕРДЕЧНО-СОСУДИСТЫХ ЗАБОЛЕВАНИЙ СРЕДИ ВЗРОСЛОГО НАСЕЛЕНИЯ ШЕСТИ РОДОВЫХ ГРУПП ЗАПАДНОЙ БЕНГАЛИИ И ОДИША, ИНДИЯ

Введение. *Быстрые темпы изменения образа жизни являются основными причинами повышения риска сердечно-сосудистых заболеваний (ССЗ) среди людей в современной Индии. Несмотря на высокое этническое разнообразие населения страны, исследования, связанные с физиологическими особенностями и соответствующими рисками для здоровья, особенно среди племенного населения, немногочисленны.*

Материалы и методы. *Настоящее поперечное исследование было проведено среди 1434 участников из шести родовых групп из штатов Западная Бенгалия и Одиша. Цель работы заключалась в оценке взаимосвязи возраста (в годах), пола и повышенного индекса массы тела (ИМТ) (кг/м²) с отдельными факторами риска ССЗ среди шести родовых групп Индии.*

Результаты. *Было обнаружено, что у мужчин повышенный ИМТ (кг/м²) влияет на риск ССЗ путем значительного повышения уровня глюкозы в крови в возрастной группе до 40 лет (OR=6.396, p≤0.05); систолическая гипертензия среди возрастных групп до 40 лет (OR=2.387, p≤0.01) и выше (или равно) 40 годам (OR=2.123, p≤0.05). Диастолическая гипертензия была зафиксирована среди возрастных групп до 40 лет (OR=4,74, p≤0,001) и выше 40 лет (OR=3.24, p≤0.001); гипертензивное среднее артериальное давление – среди возрастных групп до 40 лет (OR=5.769, p≤0.001); гипертоническое артериальное давление – среди возрастных групп до 40 лет (OR=5.865, p≤0.01) и выше (или равно) 40 лет (OR=3.127, p≤0.01).*

Заключение. *Среди женщин было обнаружено, что низкий ИМТ (кг/м²) связан с более высоким риском ССЗ, т.е. растущую угрозу здоровью среди племенного населения в Индии можно объяснить влиянием ИМТ (кг/м²), возраста (в годах) и пола. Среднее артериальное давление (MAP) можно считать отчетливым свидетельством сердечно-сосудистых рисков, особенно в случае молодого населения. В изученных популяциях очевидна растущая тенденция к двойному бремени болезней.*

Ключевые слова: сердечно-сосудистые заболевания; ИМТ; давление; гипертензия; родовые группы; среднее артериальное давление

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