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# Evaluating gender disparity in the association of obesity, nutritional status and hypertension among older adults in periurban Birbhum District, West Bengal, India 

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#### Abstract

Objective: The objective intends to assess the gender disparity in the association of obesity, nutritional status and hypertension among older adults in periurban Birbhum district, West Bengal

Materials and Methods: The present study aimed to explore the gender differential in the association of anthropometric measures including body mass index, waist circumference, and waist-hip ratio and blood pressure (systolic and diastolic) among adults population in periurban Birbhum District, West Bengal. The sample contains 285 males and 351 females aged 27 years and above. . The research was carried out in two blocks named Rampurhat and Mallarpur of Birbhum district. Study area and participants were selected through simple random sampling (SRS) technique. Anthropometric measures were taken and various risk factors such as Body Mass Index (BMI), Waist Hip Ratio (WHR) and Blood Pressure (Systolic and Diastolic) were calculated. Data were analyzed using the Stata (Version 12).


Results: Descriptive statistics (percentages) along with bivariate analysis were presented. Multivariable binary logistic regression analyses were used to examine the associations between the outcome variable (hypertension) and High Risk (WHR) factors. Percentage of hypertensive population is study area was 19.97. The paper has
shown that females were engaged more in sedentary activities and experienced hypertension and high WHR than male population. Education level of female population was also low (illiterate around $55 \%$ ) and $8.5 \%$ crossed the secondary and higher secondary level. Multivariable logistics regression (MLR) revealed that socioeconomic variables had an impact on hypertension and high WHR. Both adjusted and unadjusted logistic regression analysis has been done on gender wise hypertensive population.

Conclusion: This study aimed to explore the difference in association with hypertension among anthropometric indices of obesity, including BMI, waist circumference and waist-hip ratio, among the study population of periurban population in Birbhum district. Socio-demographic characteristics have an impact on NCDs and most important of the risk factors are behaviorable and hence modifiable.

## Keywords: Body Mass Index, Waist Hip Ratio, Hypertension, Obesity

## Introduction

Overweight, obesity and waist-hip ratio (WHR) are associated with increased risk for development of diabetes and hypertension. Obesity, raised blood glucose, high BP, high cholesterol levels, physical inactivity, sedentary behaviour, alcohol consumption and smoking behaviour are the major risk factors of NCDs [Christofaro D.G et al. 2013, Tsioufis C et al 2011]. Obesity is a well-known determinant factor of hypertension [Gutema BT et al. 2020]. The prevalence of high hypertension in low and middle income countries has also been reported more than in high-income countries. Also, the number of people whose hypertension is undiagnosed or untreated or have uncontrolled hypertension is higher in low and middle income countries [WHO 2013]. Waist-hip ratio (WHR) is an indicator that complements BMI measurement to identify individuals at risk of obesity-related morbidity [WHO 2011]. NCDs are no longer diseases of the affluent, as LMICs (low and middle -income countries) have the highest mortality and morbidity associated with the disease. Anthropometric indices of obesity include body mass index (BMI), waist circumference, and waist-hip ratio, and the latter two indices are supposed to indicate the degree of abdominal obesity (Ahmad N et al. 2016). World Health Organization (WHO) reports have documented that a 12 -year follow-up of middle-aged men with high WHR was associated with increased risk of myocardial infarction, stroke, premature deaths and insulin resistance [WHO 2011].

Cardiovascular disease is the major cause of death, accounting for $29 \%$ of all fatalities, followed by cancer, persistent respiratory conditions, and diabetes [Kumar D et al 2015]. Due to increasing urbanisation and changes in life-style, the periurban study population is likely at risks of NCDs.

## Outcome Variables

Systolic blood pressure (SBP) and Diastolic blood pressure (DBP) were calculated as the mean of these two measurements. We measured hypertension, in the left arm twice at the heart rate. The position of the individual in the sitting position was measured after 5 minutes of rest using an electronic device Omron (Kyoto, Japan). The average of the last two readings was considered for the statistical analysis. Hypertension is defined as when an individual had systolic blood pressure of more than equals to 140 mmHg and/or diastolic blood pressure of more than equals to 90 mmHg [JNC 8]. Therefore, the variable was coded in binary form i.e., 0 and 1. WHR classification based on WHO is healthy when $\leq 0.85$ for women and $\leq 0.90$ for men. Hence, we categorized WHR as healthy when calculated at $\leq .85$ (low risk) and as risk WHR for $>0.86$ for women(high risk) and WHR as healthy when WHR calculated at $\leq .90$ as heathy (low risk) and as risk for $>0.90$ for men (high risk). Therefore, the variable was coded as binary form 0 and 1 . Odds ratio (OR) was estimated with $95 \%$ confidence interval (CI).

## Explanatory variables

BMI was calculated by dividing the weight (in kilograms) by the square of height (in m). Using this, the respondent were categorized as underweight ( $<18.5 \mathrm{~kg} / \mathrm{m} 2$ ), normal or lean BMI ( $18.5-24.99 \mathrm{~kg} / \mathrm{m} 2$ ), overweight \& Obese ( $\geq 25 \mathrm{~kg} / \mathrm{m} 2$ ) based on the revised consensus guidelines for WHO.

Religion was coded as Hindu, Muslim and Christian. Caste was recoded as Scheduled Tribes, Scheduled Castes, Other Backward Classes, and others. The Scheduled Castes include a group of the population that is socially segregated and financially/economically by their low status as per Hindu caste hierarchy. The Scheduled Castes and Scheduled Tribes are among the most disadvantaged socioeconomic groups in India. The Other Backward Classes are considered low in the traditional caste hierarchy, but include the intermediate socioeconomic groups. The "others" caste category is identified as those having higher social status.

In the study, we have considered those people who drink alcohol at least once in last 14 days and in smoking \& smokeless tobacco we have taken those who take at least once in daily.

Again, in the study, sanitation facility has been divided into categories such as present and in use, present and not in use and absent. Here open defecation is represented by absent. Level of education has been divided into no education, read and write (education without formal education), primary, middle school, secondary, higher secondary, graduation and above.

In the formation of wealth index, five groups have been created such as poor, poor middle, middle, upper middle and upper. Wealth index was calculated on the basis of type of house, type of fuel materials used for cooking, sanitation and household assets through principal components analysis (PCA) guidelines.

## Data analysis

Data were analyzed using Statistical Package Stata (Version 12). Continuous variables were summarized as the mean $\pm$ standard deviation. Univariable and multivariable logistic regression was conducted to explore the association between sociodemographic variables and health status parameters of the participants. In logistic regression, adjustment was done for the following covariates for each anthropometric variable: WHR, physical activity, alcohol consumption and tobacco users (for hypertensive) and hypertension, physical activity, alcohol consumption and tobacco users (for high WHR). All the health status parameters were regrouped into binary (normal and high) as they were treated as the dependent variables. Statistical significance was determined at a pvalue $\leq 0.05$. Data entry was performed in the MS excel spreadsheet.

## Results:

## Gender wise distribution of Waist Hip Ratio, BMI and Hypertension

Within the age group 27 to 85 anthropometric indicator such as WHR was significantly ( $\mathrm{p}<0.01$ ) different between male and female, but Systolic and Diastolic Blood Pressure were statistically significant at $5 \%$ level ( $\mathrm{p}<0.005$ ). The study population had mean weight $(\mathrm{kg}) 51.15 \pm 10.69$, height $(\mathrm{cm}) 1.55 \pm .087$, Waist Hip Ratio 0.93 $\pm 0.71$, body mass index (BMI) $21.10 \pm 3.69$, systolic blood pressure $(\mathrm{SBP})=123.30 \pm 16.49$ and Diastolic blood pressure $(\mathrm{DBP})=75.87 \pm 9.39$. Weight $(\mathrm{kg})$ and height $(\mathrm{m})$ were statistically significant between male and female population in study area $(\mathrm{P}=0.00)$.

Table-1: Difference of mean (SD) among Gender wise Study Population

| Indicators | All Subjects $\mathrm{X} \pm \mathrm{SD}$ | Male $\mathrm{X} \pm \mathrm{SD}$ | Female $\mathrm{X} \pm \mathrm{SD}$ | $\mathrm{P}-$ <br> values |
| :--- | :---: | :---: | :---: | :---: |
| Age | $50.35 \pm 11.98$ | $50.09 \pm 12.49$ | $50.56 \pm 11.57$ | 0.623 |
| Weight $(\mathrm{kg})$ | $51.15 \pm 10.69$ | $54.76 \pm 10.29$ | $48.22 \pm 10.11$ | 0.00 |
| Height $(\mathrm{m})$ | $1.55 \pm .087$ | $1.62 \pm 0.66$ | $1.49 \pm 0.58$ | 0.00 |
| WC $(\mathrm{cm})$ | $79.90 \pm 11.10$ | $80.92 \pm 10.57$ | $79.07 \pm 11.46$ | 0.04 |
| HC $(\mathrm{cm})$ | $85.60 \pm 8.01$ | $85.23 \pm 7.21$ | $85.90 \pm 8.61$ | 0.30 |
| WHR | $0.93 \pm 0.71$ | $0.94 \pm 0.66$ | $0.91 \pm .073$ | 0.00 |
| BMI | $21.10 \pm 3.69$ | $20.78 \pm 3.47$ | $21.36 \pm 3.84$ | 0.05 |
| SBP | $123.30 \pm 16.49$ | $124.05 \pm 14.75$ | $122.70 \pm 17.78$ | 0.30 |
| DBP | $75.87 \pm 9.39$ | $76.65 \pm 8.61$ | $75.23 \pm 9.94$ | 0.06 |

Key: $\mathrm{SD}=$ Standard Deviation, $\mathrm{X}=$ mean value, $\mathrm{P}=$ probability, $\mathrm{WC}=$ Waist Circumference, $\mathrm{HC}=$ Hip circumference, WHR = Waist Hip Ratio, BMI= Body Mass Index, SBP=Systolic Blood Pressure, DBP= Diastolic Blood Pressure

Table-1: Gender wise socioeconomic and obesity characteristics of hypertensive study population

| Background Characteristics | Male( $\mathrm{N}=285$ ) |  | Female( $\mathrm{N}=351$ ) |  | Hypertensive Male(51) |  | Hypertensive Female |  | p-value |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | N | \% | N | \% | N | \% | N | \% |  |
| Religion |  |  |  |  |  |  |  |  |  |
| Hindu | 194 | 68.07 | 252 | 71.79 | 39 | 20.10 | 56 | 22.22 | 0.000 |
| Muslim | 88 | 30.88 | 98 | 27.92 | 12 | 13.64 | 20 | 20.41 | 0.000 |
| Christian | 3 | 1.05 | 1 | 0.28 | 0 | 0.00 | 0 | 0.00 |  |
| Caste |  |  |  |  |  |  |  |  |  |
| Scheduled Tribe | 26 | 9.12 | 26 | 7.41 | 4 | 15.38 | 3 | 15.38 | 0.070 |
| Scheduled Caste | 86 | 30.18 | 125 | 35.61 | 15 | 17.44 | 27 | 21.60 | 0.000 |
| Other Backward Classes | 72 | 25.26 | 65 | 18.52 | 12 | 16.67 | 14 | 21.54 | 0.000 |
| Others | 101 | 35.44 | 135 | 38.46 | 20 | 19.80 | 32 | 23.70 | 0.000 |
| Age Group |  |  |  |  |  |  |  |  |  |
| 27 to 40 years | 76 | 26.67 | 80 | 22.79 | 3 | 3.95 | 3 | 3.75 | 0.014 |
| 41 to 50 Years | 74 | 25.96 | 98 | 27.92 | 13 | 17.57 | 16 | 16.33 | 0.000 |
| 51 to 60 Years | 77 | 27.02 | 90 | 25.64 | 20 | 25.97 | 23 | 25.56 | 0.000 |
| 61 \& above | 58 | 20.35 | 83 | 23.65 | 15 | 25.86 | 34 | 40.96 | 0.00 |
| Education Level |  |  |  |  |  |  |  |  |  |
| No Education | 81 | 28.42 | 193 | 54.99 | 12 | 14.81 | 52 | 26.94 | 0.000 |
| Read \& Write | 0 | 0.00 | 1 | 0.28 | 0 | 0.00 | 0 | 0.00 |  |
| Primary | 54 | 18.95 | 46 | 13.11 | 7 | 12.96 | 1 | 2.17 | 0.004 |
| Middle School | 62 | 21.75 | 74 | 21.08 | 11 | 17.74 | 16 | 21.62 | 0.000 |
| Secondary \& Higher Secondary | 54 | 18.95 | 30 | 8.55 | 15 | 27.78 | 6 | 20.00 | 0.000 |
| Graduate \& above | 34 | 11.93 | 7 | 1.99 | 6 | 17.65 | 1 | 14.29 | 0.007 |
| Physical Activity |  |  |  |  |  |  |  |  |  |
| Sedentary | 127 | 44.56 | 301 | 85.75 | 27 | 21.26 | 71 | 23.59 | 0.000 |
| Moderate | 150 | 52.63 | 48 | 13.68 | 23 | 15.33 | 5 | 10.42 | 0.000 |
| Heavy | 8 | 2.81 | 2 | 0.57 | 1 | 12.50 | 0 | 0.00 | 0.343 |
| Obese/Overweight |  |  |  |  |  |  |  |  |  |
| Yes | 37 | 12.98 | 58 | 16.52 | 8 | 21.62 | 13 | 22.41 | 0.000 |
| No | 248 | 87.02 | 293 | 83.48 | 43 | 17.34 | 63 | 21.50 | 0.000 |
| Waist Hip Ratio |  |  |  |  |  |  |  |  |  |
| High Risk | 208 | 72.98 | 281 | 80.06 | 43 | 20.67 | 70 | 24.91 | 0.000 |
| Low Risk | 77 | 27.02 | 70 | 19.94 | 8 | 10.39 | 6 | 8.57 | 0.000 |
| Tobacco Consumption |  |  |  |  |  |  |  |  |  |
| Yes | 205 | 71.93 | 77 | 21.94 | 38 | 18.54 | 22 | 28.57 | 0.000 |
| No | 80 | 28.07 | 274 | 78.06 | 13 | 16.25 | 54 | 19.71 | 0.000 |
| Alcohol Consumption |  |  |  |  |  |  |  |  |  |
| Yes | 61 | 21.40 | 14 | 3.99 | 8 | 13.11 | 5 | 35.71 | 0.000 |
| No | 224 | 78.60 | 337 | 96.01 | 43 | 19.20 | 71 | 21.07 | 0.000 |

The mean age of respondents was 50.35 years (mean age $\pm$ SD: $50.35 \pm 11.98$ ). The mean age female population was 50.56 years (mean age $\pm$ SD: $50.56 \pm 11.57$ ) and mean age of male population was 50.09 years (mean age $\pm$ SD: $50.09 \pm 12.49$ ). The overall prevalence of hypertension was $19.97 \%$ ( $17.89 \%$ in men and $21.65 \%$ in women).

Females are found more hypertensive than males.

Hypertension was comparatively low for ST population (both male and female). About $28.42 \%$ of males and $54.83 \%$ of females were illiterate or not completed primary education. Only $8.55 \%$ females crossed the secondary and higher secondary level. Moreover, $21.62 \%$ and $22.41 \%$ of males and females were found overweight/obesity. High-risk waist hip ratio was observed among $20.67 \%$ males and $24.91 \%$ females. About $28.56 \%$ females were used smoking and smokeless tobacco in sample population and p-value highly significant. Sedentary life style among study population increased with age that may be one of the leading causes to hypertension.

In sample population $21.40 \%$ males and $3.99 \%$ females drink alcohol, but females were more hypertensive than males and p- value is highly significant.

Table-2 : Gender wise socioeconomic and obesity characteristics of high waist hip ratio study population

| Background Characteristics | Male(N=285) |  | Female( $\mathrm{N}=352$ ) |  | Male (High Risk)(208) |  | Female ( High Risk)(282) |  | p -value |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | N | \% | N | \% | N | \% | N | \% |  |
| Religion |  |  |  |  |  |  |  |  |  |
| Hindu | 194 | 68.07 | 253 | 71.88 | 140 | 72.16 | 193 | 76.28 | 0.000 |
| Muslim | 88 | 30.88 | 98 | 27.84 | 67 | 76.14 | 89 | 90.82 | 0.000 |
| Christian | 3 | 1.05 | 1 | 0.28 | 1 | 33.33 | 0 | 0.00 | 0.423 |
| Caste |  |  |  |  |  |  |  |  |  |
| Scheduled Tribe | 26 | 9.12 | 27 | 7.67 | 19 | 73.08 | 21 | 70.37 | 0.000 |
| Scheduled Caste | 86 | 30.18 | 125 | 35.51 | 57 | 66.28 | 93 | 74.40 | 0.000 |
| Other Backward Classes | 72 | 25.26 | 65 | 18.47 | 55 | 76.39 | 55 | 84.62 | 0.000 |
| Others | 101 | 35.44 | 135 | 38.35 | 77 | 76.24 | 113 | 83.70 | 0.000 |
| Age Group |  |  |  |  |  |  |  |  |  |
| 27 to 40 years | 76 | 26.67 | 80 | 22.73 | 54 | 71.05 | 65 | 81.25 | 0.000 |
| 41 to 50 Years | 74 | 25.96 | 98 | 27.84 | 54 | 72.97 | 74 | 75.51 | 0.000 |
| 51 to 60 Years | 77 | 27.02 | 90 | 25.57 | 51 | 66.23 | 74 | 82.22 | 0.000 |
| 61 \& above | 58 | 20.35 | 84 | 23.86 | 49 | 84.48 | 69 | 82.14 | 0.000 |
| Education Level |  |  |  |  |  |  |  |  |  |
| No Education | 81 | 28.42 | 193 | 54.83 | 57 | 70.37 | 153 | 79.27 | 0.000 |
| Read \& Write | 0 | 0.00 | 1 | 0.28 | 0 | 0.00 | 1 | 100.00 |  |
| Primary | 54 | 18.95 | 46 | 13.07 | 35 | 64.81 | 32 | 69.57 | 0.000 |
| Middle School | 62 | 21.75 | 75 | 21.31 | 45 | 72.58 | 64 | 85.33 | 0.000 |
| Secondary \& Higher Secondary | 54 | 18.95 | 30 | 8.52 | 43 | 79.63 | 26 | 86.67 | 0.000 |
| Graduate \& above | 34 | 11.93 | 7 | 1.99 | 28 | 82.35 | 6 | 85.71 | 0.000 |
| Physical Activity |  |  |  |  |  |  |  |  |  |
| Sedentary | 127 | 44.56 | 301 | 85.51 | 108 | 85.04 | 239 | 79.40 | 0.000 |
| Moderate | 150 | 52.63 | 49 | 13.92 | 93 | 62.00 | 41 | 83.67 | 0.000 |
| Heavy | 8 | 2.81 | 2 | 0.57 | 7 | 87.50 | 2 | 100.00 | 0.000 |
| Obese/Overweight |  |  |  |  |  |  |  |  |  |
| Yes | 37 | 12.98 | 58 | 16.48 | 36 | 97.30 | 56 | 96.55 | 0.000 |
| No | 248 | 87.02 | 294 | 83.52 | 172 | 69.35 | 226 | 76.87 | 0.000 |
| Tobacco Consumption |  |  |  |  |  |  |  |  |  |
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| Yes | 205 | 71.93 | 77 | 21.88 | 148 | 72.20 | 60 | 77.92 | 0.000 |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| No | 80 | 28.07 | 275 | 78.13 | 60 | 75.00 | 222 | 80.73 | 0.000 |
| Alcohol Consumption |  |  |  |  |  |  |  |  |  |
| Yes | 61 | 21.40 | 14 | 3.98 | 44 | 72.13 | 9 | 64.29 | 0.000 |
| No | 224 | 78.60 | 338 | 96.02 | 164 | 73.21 | 273 | 80.77 | 0.000 |

In table 2, a proportion of $21.88 \%$ of the women smoked tobacco. Also, a proportion of $3.98 \%$ of women consumed alcohol in the current study. Waist hip ration was higher among normal and backward classes. In study, WHR increased with age. Nowadays for increased sedentary activity, WHR increased, but WHR was higher for females than males in sample study. In each case, p-value highly significant.

## Table-3: Univariable and multivariable odds ratios ( $\mathbf{9 5 \%}$ CI) for predictors of hypertensive study population

| Category of explanatory Variables | Univariable |  |  | Multivariable |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age Group | Crude odds ratio ${ }^{1}$ | Confidence Interval | P-vale | Adjusted odds ratio ${ }^{2}$ | Confidence Interval | P-vale |
| 27 to 40 years( Reference) |  |  |  |  |  |  |
| 41 to 50 Years | 5.070 | $2.044 \quad 12.575$ | 0.000 | 5.099 | $2.045 \quad 12.705$ | 0.000 |
| 51 to 60 Years | 8.669 | $3.572 \quad 21.040$ | 0.000 | 8.743 | $3.580 \quad 21.349$ | 0.000 |
| 61 \& above | 13.315 | 5.48632 .313 | 0.000 | 11.765 | $4.790 \quad 28.896$ | 0.000 |
| Gender |  |  |  |  |  |  |
| Female( Reference) |  |  |  |  |  |  |
| Male | 0.789 | . 53111.170 | 0.239 | 0.824 | . $5060 \quad 1.340$ | 0.435 |
| Hindu ( Reference) |  |  |  |  |  |  |
| Muslim | 0.768 | . 49291.195 | 0.242 | 0.681 | . 43071.075 | 0.099 |
| Christian |  |  |  |  |  |  |
| Scheduled Tribe( Reference) |  |  |  |  |  |  |
| Scheduled Caste | 1.598 | . 67263.794 | 0.288 | 1.524 | . 61823.755 | 0.360 |
| Other Backward Class | 1.506 | . 61003.717 | 0.375 | 1.293 | . 49053.405 | 0.604 |
| Others | 1.817 | . 77364.266 | 0.170 | 1.548 | . 61693.885 | 0.352 |
| Education Level |  |  |  |  |  |  |
| No Education( Reference) |  |  |  |  |  |  |
| Read \& Write |  |  |  |  |  |  |
| Primary | 0.284 | . 1308.6162 | 0.001 | 0.313 | .1430 . 6849 | 0.004 |
| Middle School | 0.809 | . $4877 \quad 1.341$ | 0.411 | 0.790 | . 47151.323 | 0.370 |
| Secondary \& Higher Secondary | 1.089 | $\begin{array}{lll}.6170 & 1.920\end{array}$ | 0.770 | 0.993 | $\begin{array}{lll}.5530 & 1.782\end{array}$ | 0.981 |
| Graduate \& above | 0.672 | . 28441.589 | 0.366 | 0.565 | . 23431.360 | 0.203 |
| Physical Activity |  |  |  |  |  |  |
| Sedentary(Reference) |  |  |  |  |  |  |
| Moderate | 0.555 | . 3504 . 8776 | 0.012 | 0.567 | . 3475 . 9261 | 0.023 |
| Heavy | 0.374 | . 04682.989 | 0.354 | 0.303 | . 03712.473 | 0.265 |
| Sanitary Latrine |  |  |  |  |  |  |
| Present and in use( Reference) |  |  |  |  |  |  |


| Present and not in use | 0.732 | .2087 | 2.564 | 0.625 | 0.913 | .2519 | 3.307 |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Absent | 0.932 | .5950 | 1.459 | 0.758 | 1.002 |  | .6254 |

Crude odd ratio ${ }^{\mathbf{1}}$ was calculated by logistic regression analysis
Adjusted odd ratio ${ }^{2}$ was calculated by multiple logistic regression analysis after adjusting for waist hip ratio, physical activity, drinking alcohol and smoking

In table-3 unadjusted and mutually adjusted odds ratios and $95 \%$ confidence intervals from logistic regression analyses with hypertension as the dependent variable in sample population Adjusted for the confounding effects of WHR, physical activity , drinking alcohol and smoking, male were hypertensive (odds ratio 0.565; 95\% confidence interval: . 5060 1.340). Participants graduate and more were also hypertensive (odds ratio: 0.836; 95\% confidence interval: . 2343 1.360), Again participants were hypertensive with moderate physical activity ( 0.567 ; $95 \%$ confidence interval: . 3475 .9261) and heavy physical activity (odd ratio: 0.303 ; $95 \%$ confidence interval: $0371 \quad 2.473$ ). Regarding wealth index, participants were hypertensive where upper socioeconomic group (odd ratio: 0.773 ; $95 \%$ confidence interval: . 4066 1.470) and p-value significant at $5 \%$ level.

Table-4: Univariable and multivariable odds ratios ( $95 \%$ CI) for predictors of high waist-hip ratio among study population

| Category of explanatory Variables | Univariable |  |  | Multivariable |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age Group | Crude odds ratio ${ }^{1}$ | Confidence Interval | P-vale | Adjusted odds ratio ${ }^{2}$ | Confidence Interval | P-vale |
| 27 to 40 years( Reference) |  |  |  |  |  |  |
| 41 to 50 Years | 0.905 | $\begin{array}{ll}.5467 & 1.496\end{array}$ | 0.696 | 0.821 | .49291 .367 | 0.449 |
| 51 to 60 Years | 0.897 | . 54031.487 | 0.673 | 0.755 | . 44881.270 | 0.290 |
| 61 \& above | 1.595 | . 89362.847 | 0.114 | 1.272 | . 69912.313 | 0.431 |
| Gender |  |  |  |  |  |  |
| Female( Reference) |  |  |  |  |  |  |
| Male | 0.673 | . 464.974 | 0.036 | 0.778 | . 50161.206 | 0.262 |
| Religion |  |  |  |  |  |  |
| Hindu ( Reference) |  |  |  |  |  |  |
| Muslim | 1.786 | 1.1442 .786 | 0.011 | 1.893 | 1.1992 .988 | 0.006 |
| Christian | 0.114 | . 0111.111 | 0.062 | 0.162 | . 01621.620 | 0.121 |
| Caste |  |  |  |  |  |  |


| Scheduled Tribe( Reference) |  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Scheduled Caste | 0.820 | .409 | 1.641 | 0.575 | 0.731 | .3520 | 1.516 | 0.400 |
| Other Backward Class | 1.358 | .6377 | 2.891 | 0.427 | 1.175 | .5203 | 2.654 | 0.697 |
| Others | 1.377 | .6799 | 2.787 | 0.374 | 1.159 | .5380 | 2.494 | 0.707 |
| Education Level |  |  |  |  |  |  |  |  |
| No Education(Reference) |  |  |  |  |  |  |  |  |
| Read \& Write |  |  |  |  |  |  |  |  |
| Primary | 0.609 | $.3683 \quad 1.007$ | 0.053 | 0.693 | .4154 | 1.154 | 0.159 |  |
| Middle School | 1.107 | .6729 | 1.820 | 0.689 | 1.114 | .6722 | 1.845 | 0.675 |
| Secondary \& Higher <br> Secondary | 1.380 | $.7384 \quad 2.579$ | 0.313 | 1.291 | .6814 | 2.446 | 0.433 |  |
| Graduate \& above | 1.457 | $.6160 \quad 3.446$ | 0.391 | 1.448 | .6050 | 3.466 | 0.406 |  |
| Physical Activity |  |  |  |  |  |  |  |  |
| Sedentary(Reference) |  |  |  |  |  |  |  |  |
| Moderate | 0.478 | .3257 | .7003 | 0.000 | 0.541 | .3585 | .8168 | 0.003 |
| Heavy | 2.101 | .2624 | 16.817 | 0.484 | 2.593 | .3180 | 21.138 | 0.373 |
| Sanitary Latrine Use |  |  |  |  |  |  |  |  |
| Present and in use( <br> Reference) |  |  |  |  |  |  |  |  |
| Present and not in use | 0.594 | .2199 | 1.602 | 0.303 | 0.654 | .2358 | 1.812 | 0.414 |
| Absent | 0.760 | .5035 | 1.146 | 0.191 | 0.817 | .5323 | 1.252 | 0.354 |
| Wealth Index |  |  |  |  |  |  |  |  |
| Poor( Reference) |  |  |  |  |  |  |  |  |
| Poor Middle | 1.073 | .6038 | 1.906 | 0.810 | 1.067 | .5933 | 1.917 | 0.829 |
| Middle | 1.257 | .7154 | 2.208 | 0.426 | 1.327 | .7483 | 2.352 | 0.333 |
| Upper Middle | 1.929 | 1.090 | 3.413 | 0.024 | 1.868 | 1.036 | 3.368 | 0.038 |
| Upper | 2.081 | 1.148 | 3.769 | 0.016 | 2.030 | 1.103 | 3.733 | 0.023 |

Crude odd ratio ${ }^{1}$ was calculated by logistic regression analysis
Adjusted odd ratio ${ }^{2}$ was calculated by multiple logistic regression analysis after adjusting for hypertension, physical activity, drinking alcohol and smoking.

In table-4 unadjusted and mutually adjusted odds ratios and $95 \%$ confidence intervals from logistic regression analyses with high waist hip ratio as the dependent variable in sample population Adjusted for the confounding effects of hypertension, physical activity, drinking alcohol and smoking, males with high risk (odds ratio 0.778; 95\% confidence interval: . 5016 1.206). Literate participants with graduation and above were at high risk (odds ratio: 1.448; $95 \%$ confidence interval: . 6050 3.466), the participants with moderate physical activity (odds ratio: $0.541 ; 95 \%$ confidence interval: . 3585 .8168), heavy physical activity (odd ratio: 2.593 , $95 \%$ confidence interval: 3180 21.138), upper socioeconomic group (odd ratio: 2.030; $95 \%$ confidence interval: 1.103 3.733). P-value is significant for middle, upper middle and upper.

## Discussion:

The present study was designed to determine the prevalence of overweight, obesity, hypertension at the study population of Birbhum district, West Bengal according to age group, sex. It is important to determine valid anthropometric measurements which may be useful for predicting obesity-related cardiovascular disease risk in adult population. In this study we have demonstrated three anthropometric measurements (BMI, Waist hip ratio and hypertension) were more consistent in predicting cardiovascular risk in study population by presence of education, physical activity and wealth quintile. The findings of this study revealed that a large number of women in sample population were having any of the NCDs. The present study also revealed that smoking and consuming of tobacco products and alcohol consumption were associated with an increased prevalence of NCDs among women.

Urbanization and adoption of unhealthy lifestyles that contribute to inappropriate food choices such as increased intake of sugar and fat led to an increase in body weight and high waist hip ratio in the general population and women in particular [Yaya $S$ et al. 2018]. Consistently, the current analysis shows that women who were overweight or obese were more likely to have NCDs.

The current study depicts that the chances of having NCDs were higher among women with higher household economic status which was also observed in previous studies [Bista B et al. 2020, Yaya S, 2018, Dalal S et al 2011]. This however, could be attributed to the lower levels of healthcare utilization in rural or periurban areas and less likelihood of women from poor socioeconomic background to be diagnosed and report medical conditions.

The findings about these risk factors for hypertension are not surprising and are in agreement with several other studies where age, obesity, and sedentary lifestyle were significant factors for hypertension.

Our study has several limitations. First, we conducted our survey only on small sample population. Secondly, we do not consider the dietary questionnaire and are therefore unable to comprehensively characterize the diet style for this community and relate the diet style with presence of hypertension.
Despite the several limitations, our study has an important strength. We conducted this study in a periurban location, an area that clearly is at high risk for non-communicable diseases due to changes in diet and physical activity.

## Conclusion:

Sedentary activities had increased high risk waist hip ratio and hypertension in periurban study population. This shows the importance of weight control in preventing chronic diseases, especially hypertension. Obesity is an
nt issue and needs urgent attention. Changing diet and having regular physical activity along with social support is an important strategy to prevent obesity and the subsequent hypertension.

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## Conflict of interest:

The authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

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