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A Study on Obesity and Cardiovascular Risk Assessment among the Bengali Hindu Caste Population and Tribal Population of Birbhum District, West Bengal, India

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Abstract

Obesity has been considered a complex and multifactorial disease that has almost affected one-third of the total world?s population. The present trend related to obesity has revealed that nearly 38

Index terms— cardiovascular, prevalence, tribal, west bengal, socio-economic, non-communicable diseases, population.

Introduction n today's era, the majority of the population is suffering from a double health burden of diseases, which mainly occurs due to infection and nutrition along with the occurrence of chronic non-communicable diseases (NCDs). The increasing modernization has evolved changes in the lifestyles of the people along with changing diets, which results in the happening of non-communicable diseases such as diabetes, cardiovascular diseases, etc. The reports have revealed that the substantial proportion of death has been caused due to the impact. It can be said that almost 50% of the end of life and approximately 62% of the total disease burden has been attributed to suffering from NCDs in India . Hence, the emergence of cardiovascular diseases is the NCDs, which have been considered as an utmost concern towards public health (Bhagyalaxmi et al., 2013).

Obesity has been known as developing excess body fat mass, causing adverse effects on healthy metabolism such as the increased risk of morbidity and reduction in life expectancy (Schwartz et al., 2017;Zhang et al., 2014). The health records concerning obesity reveal that roughly 1.9 million adults suffered from the issues of overweight in the year 2016 and approximately 650 million population have the occurrence of obesity (WHO, 2018). The development of obesity is considered multifactorial, affecting the lifestyle and environment of living, and is associated with comorbidities involving cardiovascular diseases, hypertension, sleep disorders, etc. (Zhang et al., 2014;Leite et al., 2009).

Obesity is known as an independent risk factor for the occurrence of cardiovascular diseases (CVDs). The primary cause of occurrence of this disease involves insulin resistance, hypertension, dyslipidaemia among adults and children (Barroso et al., 2017;Akil & Ahmad, 2011). Several studies have shown a correlation between obesity and cardiovascular diseases that majorly involves coronary disease, cardiac arrhythmias, heart failure, and cardiac arrest. The rapid increase in cardiovascular diseases has been observed due to the correlation of obesity with other diseases such as sleep syndrome, diabetes, hypertension, etc. (Poirier et al., 2006). Hence, CVD has been estimated to be a vital cause for prevalence of disability and death by the year 2020 (Lavanya et al., 2014). Overweight and obesity are the vital factors correlated with the various cardiovascular risk diseases (Srinivasan et al., 2009). Obesity has also been found to show a correlation with hyperuricemia in the cross-sectional studies which have been conducted recently **??**Zhang et al., 2017;Duan et al., 2015).

The severity of obesity is assessed by measuring the body mass index (BMI).Still, it does not provide any information concerning the distribution of fat, which is majorly responsible for showing high risk towards cardiovascular risk (Zeller et al., 2008). To fulfil this, clinical measurements such as the calculation of waist/hip ratio, abdominal circumference, etc., are introduced for assessing the obesity in the vital body parts. The studies have revealed that the measurement of the abdominal circumference of above 102 cm among men and above 88cm among women has been considered as central obesity, which leads to the development of increased cardiovascular risks (Yusuf et al., 2004). The measurement concerning the waist/hip ratio above 0.9 among men and above 0.85 among women represents central obesity (Ashwell & Hsieh, 2005).

The modern world has shown progression in developing medication towards curative and preventive health measures. Still, many dwelling in isolation and non-polluted regions are considered to be unaware of modern civilization following their traditional values and beliefs. These are the tribals who are more prevalent towards the non-communicable diseases. The reports have revealed that approximately 4,99,638 cases of noncommunicable diseases occurred in 2011 in the regions of West Bengal involving obesity and cardiovascular risks resulting in 11,787 deaths. Hence, various studies have been carried out concerning obesity and cardiovascular risks by analysing the sedentary lifestyle. In consequence, the present study has aims to analyse the inquiry on obesity and cardiovascular risk assessment among the Bengali Hindu Caste Population and Tribal Population of Birbhum, West Bengal.

1 II.

2 Aims and Objectives

This section will include the objectives to be studied in the paper which are illustrated as: Literature Review a) Impact of obesity and cardiovascular disease among the population of rural India India is a developing country, that is majorly suffering from the impact of undernutrition due to poverty. The reports have revealed that approximately more than 135 million of the population are suffering from obesity. The risk of cardiovascular diseases is widespread in the lower levels of rural India and more frequent in rural South India (Ramachandran et al., 2004). The most prone areas that are affected by the risk of obesity and CVDs are the rural regions. The modernization and developmental activities at a larger scale have brought changes in the lifestyle, occupational patterns, and dietary habits of the people dwelling in the rural sectors of India, mainly the tribal communities. This has evolved as considerable health issues among the infants and elderly population of tribal communities progressing the issues such as obesity, CVDs, diabetes, etc. Obesity has been known to be a complex disorder with paramount health risks related to the emergence of CVDs, cancer, stroke, and early death **??**IIPS, 2007). One of the studies has revealed that approximately 2-3% of the population in rural India are suffering from overweight, mainly the tribal communities (NNMB, 2009). Undernutrition has been considered as the vital factor that affects the health of the individuals dwelling in the rural regions. The studies have revealed that the rate of morbidity and mortality are increasing among the rural zones of the Asian population showing, lower body mass index (BMI), and further accumulation of intra-abdominal fat is developed. Hypertension has been the major indicator for the increasing prevalence of obesity (Flegal et al., 2013). Hypertension has been known as the third most significant risk factor in the South Asian region. India has been found to have 29.8% in rural India (Rizwan et al., 2014). The occurrence of cardiovascular disease is prevalent among 4-5% of adults in rural India. The risk factors of CVDs change the lifestyle that is more prevalent in rural India (Chow et al., 2007).

3 b) Health and demographic profile of Bengali Hindu caste population and Birbhum tribal population of West Bengal

Several research studies have been carried out on the demographic processes concerning the population health of the individuals. The primary issues evolving the public health and human development in India has been analysed, providing analytical and interventional aspects. The Society for Health and Demographic Surveillance (SHDS) analyses the primary ownership of the Birbhum population. The funds are provided by the Department of Health and Family Welfare (DoH&FW) of the Government of West Bengal (Ghosh et al., 2015). The demographic process evaluation involves the analysis of fertility transition, migration, and its impact on the health of the population. The scrutiny concerning the access, equality, and utilization of healthcare services, health insurance, and health expenditure are involved in the demographic profile by the healthcare system. The district of Birbhum is situated in the western region of West Bengal and the eastern part of India. This district is often characterized by undulating geographical topography. This district has been reported with a population of 3 502 387, involving 771 inhabitants per square kilometer (RGI, 2013). The population growth rate has been estimated as 16.15% during the year 2001-2011. The females comprise 956 for every 1000 males in this district. The census of 2011 has revealed that almost 29.5% of the population belongs to scheduled castes and 6.9% of them belong to the scheduled tribes. The tribal health in this district was found to be improved by the National Rural Health Mission (Sharma, 2014). The traditional system of medicines and medical pluralism has been implemented for tribal healthcare (Babu & Mishra, 2014).

The Census of 2011 has revealed that the growth rate of population in West Bengal has decreased for the whole population along with the Hindu Muslim community. The decadal growth rate of the Hindu population in West Bengal was found to be 1.1% in (1981-91); 14.2% in (1991-2001); and 10.8 % in **??**2001) **??**2002) **??**2003) **??**2004) **??**2005) **??**2006) **??**2007) **??**2008) **??**2009) **??**2010) **??**2011). The increased literacy rate among the females and women empowerment are the factors responsible for the steady decrease in population growth rate in West Bengal. Also, the total fertility rate has been found to decline **??**Ghosh, 2018; **??**aq& Patil, 2016).

4 c) Risk factors involved for obesity and cardiovascular disease

The increasing body weight has been considered as a principal risk factor causing mortality and morbidity from the impact of cardiovascular diseases. Several studies have revealed the fact that the increase in adiposity has

affected a large number of populations, which has been measured by evaluating the body mass index (BMI). Hence, being overweight has been considered as one of the vital risk factors for the occurrence of obesity and cardiovascular diseases. The impact of coronary heart disease has been caused due to the primary risk factors involving total cholesterol, blood pressure, prevalence of smoking, and physical activities (Capewell et al., 2010). Other major risk factors for CVDs include the prevalence and intensity of smoking habits among individuals. Obesity among individuals is mainly caused by the major risk factor of smoking prevalence (Stewart et al., 2009). Hypertension and dyslipidaemia are other significant risk factors that have adverse health impact (Chobanian, 2010). The metabolic syndrome has also been determined among the individuals who are affected by obesity and cardiovascular risks. The risk factors majorly involved in the clustering of CVD involves insulin resistance, central adiposity, pro-inflammatory, and prothrombotic state, along hypertension and dyslipidaemia (Alberti et al., 2009). Obesity has been known as the independent predictor of CVD and majorly involves the risk factors such as a trial fibrillation, congenital heart disease, and pulmonary arterial hypertension **??**Badheka et

5 d) Physiological and behavioral risk factors of obesity and cardiovascular disease in rural India

The impact of obesity and cardiovascular diseases has been considered as the major cause of mortality in India **??**Prabhakaran et al., 2016). Most of the Indian population of age above 18 years and also some of the children are suffering from high blood pressure and high blood glucose level, which have been considered as the vital risk factors for obesity and CVD (WHO, 2014). The most prevalent behavioural risk factors for obesity and CVDs in rural India involve the lack of physical activities, use of tobacco, and more access to alcohol . These behavioral risk factors are most commonly found among individuals suffering from hypertension, glucose intolerance, and obesity. The physiological risk factors of obesity and CVDs involve the overweight, disposition of high levels of fats in the body, unhealthy diet, lack of physical activities, etc. (WHO, 2016; Siegel et al., 2008;Fb, 2011). A lower body mass index has been estimated in the population suffering from obesity and CVDs, which has been considered as physiological risk factors. The traditional dietary patterns are changing, which leads to the adaptation of the industrialized and urban food environment (Siegel et al., 2008). These dietary regimens result in increasing the risk by increasing the body weight and central adiposity. The accumulation of visceral adipose tissues has been observed among smokers induced by the sympathetic nervous system activity. Also, the high consumption of alcohol results in excessive calorie intake and obesity.

6 e) Risk assessment evidences for obesity and cardiovascular diseases

The identification, prevention, and reduction for the onset of risk factors need to be determined for the risk assessment of obesity and CVDs that leads to morbidity and mortality (Barroso et al., 2017). The risk factors of CVD involve metabolic syndrome (MetS) among obese individuals (Alberti et al., 2009). The early diagnosis of MetS has evolved early detection and increased the risk of CVD. The fall in blood pressure has yielded the chances of organ damage and increased cardiovascular complications (Agarwal et al., 2018). The mechanism of utmost importance lying under this complication includes the process of dipping that has been determined by the changes taking place in the sympathetic nervous system activity. It has been observed that the increase in the non-dipping among obese individuals implicates the requirement of reducing the BMI and improving the hemodynamic and lipid profiles, which further results in lowering the risk towards chances of organ damage (Badheka et al., 2010; **??**andhu et al., 2016). Several pieces of evidence have revealed that the pulse pressure shows a correlation for the morbidity and mortality due to cardiovascular diseases. One of the studies has revealed that an increase in the BMI results in decreasing the large arterial distensibility among obese men (Flegal et al.,2013). The evolving rise in the cases of obesity and CVDs has evolved the requirement of reducing obesity. It can be achieved by suggesting the pathways influencing obesity during the development of cardiovascular outcomes. The reduction of weight and progressing to more physical activities further helps in improving the components of the coronary heart disease risk profile. Appropriate diet and exercise programs help in the prevention of CVD and obesity.

IV.

7 Methodology

The research work followed for this study was quantitative and descriptive.

from the Birbhum district of West Bengal. Anthropometer (Martin's) was used to measure height; Rod compass was used to measure WC and HC, Weighing machine was used to measure weight, OMRON body scanner was used to measure FM and PBF, Sphygmomanometer was used to measure BP, Skinfold calliper was used to measure BSF, TSF, SSSF, SISF. CVD risk score was estimated as a routine risk assessment. A pretested questionnaire was used to record the unalterable risk factors like age, sex, family history of CVD and alterable risk factors like BMI, blood pressure and obesity indices. Data were initially analysed using Microsoft Excel 2007. Men and women of having ?23 BMI were considered over-weight obese (Aziz et al., 2014). Men and women with >90 and >80 WC were considered obese (WHO, 2018). Men and women of having >0.90 and >0.85 WHR were regarded obese (WHO, 2018). Men and women with >0.53 and >0.49 WSR were viewed Overweight obese

(Ashwell et al., 2005). Men and women having >1. 25 ? Data Analysis: Data was analysed using a descriptive statistical tool, the SPSS software, 2018 version. Chi-squared test, Independent t-test, and Pearson's correlation was used to find the associations. The Chi-squared test was used to study the relationship between discrete variables, the independent t-test was used to compare between means and Pearson's correlation was used to find an association between continuous variables. A P-value of ? 0.05 was considered to be statistically significant.

V.

8 Results and Discussion

The results of the present study is determined by analysing the collected data, which has been represented in table 1 to 10 in appendices. Table 1 shows that the Weight of the Caste population is significantly higher (60.77±13.24) than the Tribal population (54.75±12. 19). BMI of the Caste population (24±4.5) is relatively higher than the Tribal population (22.59±3.67), but the difference is not significant (p>0.05). On the other hand, the SBP of the Caste population is 148.87±26.63 & Tribal population is 130.37±25.46, and the DBP of the Caste population is 96.03±17.02 & the Tribal population is 84.92, both are significantly higher in case of Caste population than Tribal population. Eventually, the MAP of the Caste population (113±19.24) is slightly higher than the Tribal population (100.04±17.12) and the difference is considered to be significant (p<0.05). Whereas WC and WHR are also higher in the Caste population than the Tribal population but the difference is considered to be not significant (p>0.05).WSR is slightly higher in tribal population than caste population but considered to be not significant. Conicity Index is relatively higher in the Caste population (1.25±0.19) than the Tribal population (1.13±0.22), and also the difference is considered to be significant (p<0.05). Table 2 revealed that the BMI between Hindu caste and tribal population has no significant difference. Table 3 revealed that the WC between Hindu caste and tribal population has no significant difference. Table 4 revealed that the WHR between Hindu caste and tribal population has no significant difference. Table 5 revealed that the WSR between Hindu caste and tribal population has not much significant difference. Table 6 revealed that the Conicity Index between Hindu caste and tribal population has significant differences. Table 7 shows that SBP and BMI are positively correlated for both caste(r = 0.252) and tribal(r = 0.303) populations. Still it is significant only for the caste population (p<0.05) and 6.03 % SBP can be predicted by BMI of the Caste But WSR, both are positively correlated for caste and tribal populations, but not significant (p>0.05). Whereas SBP and WC are positively correlated for both caste(r = 0.209) and tribal(r = 0.29) populations, but it is significant only for the caste population (p<0.05), and 4.36 % SBP can be predicted by WC of the Caste population. On the other hand, CI shows positive correlation for both caste(r = -0.078) and tribal(r = -0.14) populations and not significant (p>0.05). Table 8 shows that DBP and BMI were positively correlated for both caste(r = 0.22) and tribal(r = 0.33) populations, but it is significant only for the caste population (p<0.05) and 4.84 % DBP can be predicted by BMI of the Caste population. But WHR and WSR, both are positively correlated for caste and tribal populations, but not significant (p>0.05). Whereas DBP and WC are positively correlated for both caste(r = 0.26) and tribal(r = 0.32) populations, but it is significant only for the caste population (p<0.05), and 6.76 % DBP can be predicted by WC of the Caste population. On the other hand, CI shows positive correlation for both caste(r = -0.023) and tribal(r = -0.16) populations and not significant (p>0.05). Table 9 shows that MAP and BMI are positively correlated for both caste(r = 0.24) and tribal(r = 0.32) populations. Still it is significant only for the caste population (p<0.05) and 5.76 % MAP can be predicted by BMI of the Caste population. But WHR and WSR, both are positively correlated for caste and tribal populations, but not significant (p>0.05). Whereas MAP and WC are positively correlated for both caste (r = 0.25) and tribal(r = 0.31) populations, but it is significant only for the caste population (p<0.05), and 6.25 % MAP can be predicted by WC of the Caste population. On the other hand, CI shows positive correlation for both caste(r = -0.14) and tribal(r = -0.16) populations and not significant (p>0.05). Table 10 shows that the unalterable risk score is significantly higher in the Caste population (6.16±1.28) than in the Tribal population (5.37±1.44). The alterable risk score is also higher in the Caste population (14.74±1.96) than the Tribal population (13.96±1.82), but the difference is considered to be not significant (p>0.05). Whereas the total risk score of the Caste population (20.9±2.51) is significantly higher than the Tribal population (19.33±2.86).

Rising obesity prevalence in India needs appropriate measures for prevention and management. Obesity characteristics (including ectopic fat) are more adverse in Asian Indians and lead to morbidities at lower BMI levels than white Caucasians. Lifestyle management should be advised at lower limits of BMI and waist circumference according to Indian guidelines (Behl et al, 2017). Pasco et al., 2014, reported that the prevalence of obesity using a BMI threshold might underestimate the true extent of obesity in the white population, particularly among young and older men. They also suggested that optimal sex-and age-specific origins be implemented for defining underweight and obesity in terms of body fat and recognize that such definitions will depend on risk assessment for disease, morbidity, and mortality. Dalvand et al., showed the differences between obesity and WC in urban and rural people of Iran. They reported that Waist circumference (WC) is an indicator of the visceral adipose tissue (VAT). A substantial amount of VAT is related to metabolic syndrome, diabetes, and cardiovascular diseases. According to Czernichow et al., 2011, positive, linear and continuous associations were observed in WC and WHR and cardiovascular outcomes. Tran et al., 2018, found that WC or an index based on WC was more strongly associated with BP, glucose, and TC for Vietnamese men and with glucose for Vietnamese women and provided better discrimination of hypertension. WC is an indicator of central fat accumulation and the amount of

intra-abdominal adipose tissue (IAAT), high levels of which confer an increased risk of cardio-metabolic disease. The study of Janssen et al., 2019, provided compelling evidence that BMI coupled with WC did not predict obesity-related health risk better than did WC alone when these two anthropometric measures were examined on a continuous scale, indicating that WC, and not BMI, explains obesity-related health risk.

About the earlier works, the present study reveals that 55.55% of the Caste population (n=127) is obese, whereas 25.19% Tribal population (n=27) is obese based on Conicity Index, and the difference is significant($p<0.05$). Based on BMI, 58.26% of the Caste population is obese, and 62.96% Tribal population is obese, but the difference is not significant ($p>0.05$).

On the other hand, the Caste population is more obese **??**38.58%)

9 VI. Conclusion and Recommendation

According to the present study, it can be concluded that the Caste population tends more to obesity than Tribal population WC and WHR as waist circumference is a more measure of the distribution of body fat, and WHR is strongly associated with obesity. The present study also suggests that the overall weight is significantly higher in the Caste population than the Tribal population, which entails that the Caste population is prone to be overweight hence obesity. Though WC and WHR have continuous associations with Cardio-Vascular disease and WC is strongly associated with BP, the present study also reveals that SBP, DBP, and MAP are significantly higher in the Caste population than the Tribal population. Consequently, Caste population is more under threat in CVD than Tribal population.

Although this study is limited in identifying the contextual factors to obesity and CVD at the macrolevel, the results highlight the need for a targeted approach like community-based lifestyle programs to incorporate the socio-cultural related factors on overweight-obesity control policy implementation. In the present circumstances when India is undergoing a reasonable economic growth and urbanization, there is a massive transition in nutrition patterns and the growing sedentary lifestyle. Both obesity and CVD pose as vital public health challenges for the Indian Government (Siddiqui et al., 2016). There is a need to translate evidence into policy, integrate various policymakers, develop effective policies and modify healthcare systems for effective delivery of preventive care for overweight-obesity and CVD preventive care. Understanding the causal factors that are driving the overweight/obesity pattern and the inter-relationship with CVD risk factors at the individual and large scale, it is critical to implement the appropriate policy strategies.

10 Appendices

Figure 1:

Figure 2:

1

Variables	Caste (n=127) Mean ± SD	Tribe (n=27) Mean ± SD
Height (cm)	158.81±8.97	154.98±8.01
Weight (kg)	60.77±13.24*	54.75±12.19*
BMI	24±4.5	22.59±3.67
WC (cm)	83.78±13.4	79.21±11.22
HC (cm)	90.69±12.06	89.08±8.43
WHR	0.92±0.13	0.88±0.06
WSR	0.5±0.05	0.52±0.08
PBF	26.42±9.18	26.41±6.4
FM	14.63±5.77	13.52±5.63
FFM	46.94±12.88	42.74±10.55
SBP (mmHg)	148.87±26.63*	130.37±25.46*
DBP (mmHg)	96.03±17.02*	84.92±13.81*
MAP	113.63±19.24*	100.04±17.12*
BSF (mm)	8.26±2.49	7.72±3.58
TSF (mm)	10.7±3.55	10.77±3.69
SSSF (mm)	18.94±7.26	17.3±5.52
SISF (mm)	14.7±5.1	12.59±5.55
Sum of 4 SF (mm)	51.97±18.54	48.4±15.13
Conicity Index	1.25±0.19*	1.13±0.22*
(*p<0.05)		
Degree of freedom -152		

Figure 3: Table 1 :

2

	Caste (n=127) [%]	Tribal (n=27) [%]
Obese	49 [38.58]	9 [33.33]
Non-obese	78 [61.41]	18 [66.66]

Figure 4: Table 2 :

3

	Caste (n=127) [%]	Tribal (n=27) [%]
Obese	79 [62.20]	16 [59.25]
Non-obese	48 [37.79]	11 [40.74]

Figure 5: Table 3 :

4

	Caste (n=127) [%]	Tribal (n=27) [%]
Obese	70 [55.11]	15 [55.55]
Non-obese	57 [44.88]	12 [44.44]

Figure 6: Table 4 :

5

	Caste (n=127) [%]	Tribal (n=27) [%]
Obese	70 [55.55]	7 [25.19]
Non-obese	56 [44.44]	20 [74.80]

Figure 7: Table 5 :

6

Correlation of SBP with	Caste population (n=127) r	Tribal population (n=27) r
BMI	0.252*	0.303
WC	0.209*	0.29
WHR	0.11	0.15
WSR	0.159	0.27
CI	-0.078	-0.14

Figure 8: Table 6 :

7

Correlation of DBP with	Caste population (n=127) r	Tribal population (n=27) r
BMI	0.22*	0.33
WC	0.26*	0.32
WHR	0.16	0.21
WSR	0.17	0.24
CI	-0.203	-0.16

Figure 9: Table 7 :

8

Correlation of MAP with	Caste population (n=127) r	Tribal population (n=27) r
BMI	0.24*	0.32
WC	0.25*	0.31
WHR	0.15	0.19
WSR	0.17	0.26
CI	-0.14	-0.16

Figure 10: Table 8 :

9

CVD risk score	Caste population (n=127) Mean ± SD	Tribal population (n=27) Mean ± SD
Unalterable risk score	6.16 ± 1.28*	5.37 ± 1.44*
Alterable risk score	14.74 ± 1.96	13.96 ± 1.82
Total risk score	± 2.51*	19.33 ± 2.86*

Figure 11: Table 9 :

10

Pretested Questionnaire
NAME:

Figure 12: Table 10 :

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.3 Conflict of interest

The authors state that the study was conducted for educational purpose only, in absence of any commercial or financial relationships that may give rise to a potential conflict of interest.

.4 Contribution of authors

AMS-Conceptualized and designed the study, literature search, interpreted the study, prepared first draft of the manuscript, critical revision of the manuscript;

DC-Conceptualized the study, Interpretation, critical revision of the manuscript; RG-Literature search, preparation of the manuscript.

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