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Cardiovascular Risk and Anthropometric Indices: A Study among Premenopausal Married Women in Assam

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Abstract

Northeast India is renowned for its rich cultural diversity and vibrant ethnic populations. The region is home to numerous indigenous communities, each with its own distinct social structures, languages, customs, and traditions. Cardiovascular disease continues to hold its position as the foremost cause of death among both men and women in both developed and developing nations, a troubling trend that warrants serious concern. Northeast India is not exempt from this trend. It is crucial to unveil the various factors associated with cardiovascular diseases due to their significant impact. The current study focused on women from the Deori and Kalita populations living in Assam, Northeast India, aiming to illustrate cardiovascular risk factors through diverse anthropometric indices. Anthropometric and physiological data were collected from total of 871 premenopausal married women aged between 18 to 49 years as part of the study. The anthropometric indices were utilized to assess both general and abdominal obesity, which are known to be associated with cardiovascular diseases. General obesity, as determined by BMI, has been identified as a significant risk factor for cardiovascular health in both population groups. Among the Kalita population, WHR and WHtR were identified as effective cardiovascular risk screening tools, as evidenced by the elevated odds ratio for pre-hypertension. The study suggests that anthropometric indices could serve as useful markers for overall health status and effective screening tools for assessing cardiovascular risk among women.

Keywords: Cardiovascular, BMI, Deori, Women, North East India.

Introduction

The prevalence of cardiovascular diseases (CVD) is increasing worldwide both in developed and developing countries at an alarming rate (McKay et al., 2004, Roth et al., 2020). More than 75% of cardiovascular disease (CVD) fatalities occur in low- and middle-income countries. In 2019, approximately 17.9 million individuals lost their lives to cardiovascular diseases, representing 32% of global fatalities, with heart attacks and strokes contributing to 85% of these deaths (WHO, 2021).

Risk factors for cardiovascular disease (CVD) encompass conditions or behaviors that elevate the probability of developing heart disease or encountering cardiovascular events like heart attacks or strokes. The risk factors for cardiovascular disease (CVD) can be classified into two primary types: modifiable and non-modifiable. Modifiable risk factors are those that can be altered or controlled, whereas non-modifiable risk factors are inherent characteristics that cannot be changed. Obesity, recognized for its association with various CVD risk factors such as hypertension, dyslipidemia, and diabetes (Kopelman, 2000; Yusuf et al., 2005; Hossain et al., 2007) which are modifiable in nature. Anthropometric indices such as BMI (body mass index), WHR (waist hip ratio), WHtR (waist height ratio) and WC (waist circumference) are the supreme techniques for defining obesity with relative ease and accuracy which can be serve as an important prognosticator for cardiovascular risk (Dhall et al., 2011). The present study attempted to predict the cardiovascular risk from anthropometric indices among the premenopausal married women of Assam, North East India.

Materials and Methods

North East India is famous for its several ethnic populations having diverse social structures and cultural heritages. The population of North East India are conventionally divided in to two broad groups namely ‘Indid’ and ‘Mongoloid’ by considering the ethnic point of view. Most of the Hindu castes and Muslims comprises of ‘Indid’ groups, which are considered as Caucasoid in origin. The Mongoloid groups comprises of various tribes of both hills and plains and some Mongoloid populations, which has not been considered as tribes. In the present study two distinct ethnic groups namely Kalita and Deori were selected. Kalita is a popular caste population of the state of Assam whereas Deori is a popular plain scheduled tribe of Assam. The primary occupation of the Kalita community is agriculture. Business and service in different sectors are also performed by most of the Kalita people. Rice is the staple food of the Kalita people. They are non-vegetarian in

their food habits. Like other caste groups, Kalita practise endogamy for marriage. Early days Kalita lived in joint family system. But now a day's most of the Kalita peoples prefer single family system. They speak Assamese, an Indo-Aryan language and use the script of Assamese. The Assamese script evolved from the ancient Indian script known as "Brahmi." Among the different forms of Brahmi, Assamese is thought to have originated from the "Gupta Brahmi" script. When showed Deori population, agriculture is the prime occupation. More than ninety percent of the population is involve in agriculture for their livelihood. Rice is also the staple food for Deori and they are also non-vegetarian in their food habits. Rice bear (Suje) is prepared in every household which is common and essential drink for all sections of people in their society. Deori follows some strict social rules in case of marriage. Clan exogamy is strictly followed. The Deori usually live in joint family system. They are lived in a common residence under a single head. They belong to Tibeto-Burman linguistic family and they use to speak both Deori and Assamese language.

The present study has been conducted on premenopausal married women aged ranging from 18 to 49 years and the sample under study comprises of 871 individuals (Kalita: 410 and Deori: 461). Both qualitative and quantitative approaches have been used for the collection of primary data. Personal interview has been involved by using well structured schedules which containing both close and open ended questions. A door- to- door, cross sectional survey was conducted among Kalita and Deori women of Assam, North East India.

In the present study anthropometric measurements were obtained by using standard techniques (Weiner et. al., 1981; Singh et. al., 2004). Before conducting physiological measurements, each subject underwent a 30-minute period of rest. Present study was conducted in accordance with the ethical standards. Care was taken to include only apparently healthy women. Pregnant women, postmenopausal women, physically and mentally challenged subjects were excluded from the study. Each consented individual were explained the purpose and techniques of the present study.

Results and Discussions

Table 1 displays mean and standard deviation of various anthropometric and physiological characteristics. The mean height vertex among Kalita women (154.68±5.40 cm) was found to be higher than the Deori women (153.82±4.61 cm) and differences have been found to be statistically significant. The mean value of body weight has also been found significantly different ($p<0.001$) among Kalita (54.50±7.98 kg) and Deori (51.66±7.48 kg) population. The mean value of minimum waist circumference and maximum hip circumference among Kalita women was

observed to be greater than that of the Deori women. The mean value of maximum hip circumference was statistically different among them. When showed the mean value of BMI significant different have been found among Kalita (22.78±3.23 kg/m²) and Deori (21.83±3.04 kg/m²) women. The mean value of WHR and WHtR were found to be equal among both of the population. The current study reveals that Kalita women were taller, had higher body weight, larger hips, elevated BMI, and exhibited higher values of both systolic and diastolic blood pressure in comparison to the Deori women. It may be due to ethnic variation (Satwanti et al., 1977 and Kapoor et al., 1999), increasing sedentary lifestyle (Warburton et al., 2006; Ng et al., 2014; Biddle et al., 2016) and changing the nature of diet (Mozaffarian et al., 2011; Malik et al., 2011).

Table 1: Basic Characteristics among Kalita and Deori Women of Assam

Variables	Kalita	Deori	t-values
	Mean±SD	Mean±SD	
Height vertex (cm)	154.68±5.40	153.82±4.61	2.51*
Body Weight (kg)	54.50±7.98	51.66±7.48	5.40***
Minimum Waist Circumference (cm)	71.06±9.23	70.45±6.74	1.09
Maximum Hip Circumference (cm)	86.95±9.52	85.88±5.42	2.00*
Body Mass Index (kg/m²)	22.78±3.23	21.83±3.04	4.44***
Waist Hip Ratio	0.82±0.09	0.82±0.06	0.14
Waist Height Ratio	0.46±0.06	0.46±0.04	0.38
Heart Rate (b/min)	74.67±10.311	81.34±8.086	10.53***
Pulse Rate (p/min)	73.23±10.104	81.17±7.272	13.17***
Systolic blood pressure (mmHg)	123.58±16.90	111.62±13.26	11.517***
Diastolic blood pressure (mmHg)	77.89±11.38	73.76±9.90	5.675***

*p<0.05, ** and ***p<0.001

Table 2 illustrates the correlation between anthropometric indices and cardiovascular factors among Kalita and Deori women. Suman et al. (2000) identified a significant positive correlation between BMI and blood pressure among affluent Punjabi girls in Delhi, a finding consistent with the results of the present study. Another study conducted by Hu et al. (2007) underscored the significance of anthropometric measures in predicting cardiovascular outcomes. They uncovered a significant positive correlation between anthropometric indices such as BMI, WC,

WHR and the risk of total stroke, ischemic stroke, and hemorrhagic stroke. Larsson et al. (1984) demonstrated that waist-hip ratio (WHR) was among the most frequently employed anthropometric measures to signify central obesity patterns and an elevated risk of cardiovascular disease. In the current study conducted among both populations, BMI and WC exhibited a positive correlation with both SBP and DBP ($p < 0.001$), while WHR was significantly correlated with SBP ($p < 0.001$). A notable finding in the study was the positive significant correlation observed between WHtR and both SBP and DBP ($p < 0.001$). This correlation suggests a potential impact on cardiovascular diseases, underscoring the importance of WHtR as a predictor of cardiovascular risk (Hsieh et al., 2003; Janssen et al., 2004; Zhang et al., 2008; Ashwell et al., 2012; Kuciene and Dulskiene, 2019).

Table 2: Association of anthropometric indices and cardiovascular risk factors among Kalita and Deori Women

Measurements	Kalita				Deori			
	SBP	**DBP**	**HR**	**PR**	**SBP**	**DBP**	**HR**	**PR**
Body Mass Index (kg/m²)	0.181**	0.160**	-0.034	-0.014	0.283**	0.216**	-0.002	-0.038
Minimum Waist Circumference (cm)	0.257**	0.241**	0.076	0.093	0.238**	0.152**	0.004	-0.048
Waist Hip Ratio	0.145**	0.125*	0.035	0.054	0.128**	0.076	-0.015	-0.004
Waist Height Ratio	0.239**	0.236**	0.088	0.113*	0.221**	0.132**	-0.007	-0.018

*p<0.05 and **p<0.01

BMI serves as a primary indicator for assessing overweight, obesity, and chronic energy deficiency (Kapoor et al., 2009). Additionally, elevated BMI has been identified as a significant risk factor for cardiovascular diseases (McGee et al., 2005). The risk (odds ratio) of having cardiovascular diseases from general obesity which is measured by BMI showed in Table 3. The overweight, obese (categories of BMI) and pre- hypertension, hypertensions (categories of SBP and DBP) have been pooled together for this analysis. The overweight Kalita women have 2.153 and 1.793 times more chance to becoming pre- hypertensive for SBP and DBP respectively. On the contrary, overweight Deori women have risk of being pre-

hypertensive was 3.125 and 2.206 times more for SBP and DBP respectively. It has been found that among both of the population women who were found overweight were more prone to becoming pre- hypertensive (for SBP and DBP) which may be the risk factor for cardiovascular diseases. Similar various findings indicated that individuals with higher BMI values are more prone to developing cardiovascular diseases, including conditions such as coronary artery disease, stroke, and heart failure (McGee et al., 2005; Katzmarzyk et al., 2012; Powell-Wiley et al., 2021).

Table 3: General obesity (measured by BMI) as risk factor for pre- hypertension among Kalita and Deori Women of Assam

Variables	Name of the Population	Category	Systolic Blood Pressure			Diastolic Blood Pressure		
			Exp(B)	95% Confidence Interval for Exp(B)		Exp(B)	95% Confidence Interval for Exp(B)	
				Lower Bound	Upper Bound		Lower Bound	Upper Bound
BMI	Kalita	Underweight	0.971	0.510	1.851	1.127	0.577	2.198
		Overweight/ Obese	2.153**	1.325	3.498	1.793**	1.130	2.848
		Normal®	0	0	0	0	0	0
	Deori	Underweight	0.101*	0.014	0.749	0.649	0.265	1.592
		Overweight/ Obese	3.125***	1.761	5.546	2.206**	1.212	4.012
		Normal®	0	0	0	0	0	0

*p<0.05, **p<0.01 and ***p<0.001, ® is reference categories

Table 4 shows the risk (odds ratio) of having cardiovascular diseases from regional obesity (measured by WC, WHR and WHtR). In the present study, Kalita who were being at the risk category of WHR and WHtR were 1.829 and 2.391 times more prone to becoming pre-hypertensive for SBP and 1.285 and 3.105 times for DBP respectively. On the other hand among Deori, women who were found at the risk category of WC, WHR and WHtR were 1.034, 1.714 and 1.878 times more prone to becoming pre- hypertensive for SBP and 0.609, 1.697 and 2.046 times for DBP respectively. In this table when showed WHR, it has been found that Kalita women have more chance to becoming pre- hypertensive (SBP) as compared to Deori women. When showed WHtR, Kalita women also more prone to

becoming pre- hypertensive as compared to Deori women both for SBP and DBP. Similar study highlighted the importance of WC, WHR and WHtR ratio as reliable predictors of cardiovascular events (Koning et al., 2007; Park et al., 2009; Bacopoulou et al., 2015; Bojanic et al., 2020).

Table 4: Regional obesity (measured by WC, WHR and WHtR) as risk factor for pre-hypertension among Kalita and Deori Women of Assam

Variables	Name of the Population	Category	Systolic Blood Pressure			Diastolic Blood Pressure		
			Exp(B)	95% Confidence Interval for Exp(B)		Exp(B)	95% Confidence Interval for Exp(B)	
				Lower Bound	Upper Bound		Lower Bound	Upper Bound
WC	Kalita	Risk	0.776	0.297	2.028	0.519	0.212	1.269
		Normal®	0	0	0	0	0	0
	Deori	Risk	1.034	0.370	2.894	0.609	0.208	1.784
		Normal®	0	0	0	0	0	0
WHR	Kalita	Risk	1.829**	1.106	3.024	1.285	0.789	2.094
		Normal®	0	0	0	0	0	0
	Deori	Risk	1.714	0.960	3.061	1.697	0.953	3.022
		Normal®	0	0	0	0	0	0
WHtR	Kalita	Risk	2.391*	1.002	5.708	3.105**	1.370	7.038
		Normal®	0	0	0	0	0	0
	Deori	Risk	1.878	0.752	4.692	2.046	0.825	5.074
		Normal®	0	0	0	0	0	0

*p<0.05 and **p<0.01, ® is reference categories

Conclusions

The increase in BMI levels has been identified as a significant risk factor for cardiovascular health among both Kalita and Deori women. This is supported by a strong correlation between elevated BMI levels and high systolic and diastolic blood pressure. Furthermore, overweight women exhibit high odds ratios for pre-hypertension, further emphasizing the impact of BMI on cardiovascular risk. Similar findings have been reported in numerous earlier studies (Gupta et al., 2002; Poirier et al., 2006; Berrington et al., 2010). These studies offer compelling evidence

affirming the link between BMI and the risk of cardiovascular disease, underscoring the critical importance of maintaining a healthy weight to mitigate the likelihood of developing CVD. In the current study, waist circumference (WC) exhibited a weak association with cardiovascular variables among both Kalita and Deori women. Conversely, waist-hip ratio (WHR) was identified as a good screening tool for systolic blood pressure (SBP) among Kalita women. Additionally, waist-to-height ratio (WHtR) emerged as an effective cardiovascular risk screening tool among Kalita women, with elevated odds ratios observed for pre-hypertension in both systolic and diastolic blood pressure. A similar study conducted on Singaporean adult females showed that waist-to-height ratio (WHtR) can serve as the best screening tool for cardiovascular risk (Pua et al., 2005). This finding aligns with the results of the present study, highlighting the universal applicability of WHtR as an effective indicator of cardiovascular health across different populations.

The present study suggests that anthropometric indices can serve as markers for health status and effective screening tools for assessing cardiovascular risk among women. Through the implementation of lifestyle changes and medical interventions aimed at managing and reducing these risk factors, individuals can significantly lower their chances of developing cardiovascular disease (CVD) and enhance their overall cardiovascular well-being. Routine screening and vigilant monitoring of risk factors are essential for early detection and timely intervention, thus promoting better cardiovascular health outcomes.

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