Anthropometric Indicators as Predictor of Hypertension in Immigrant Tamil Women

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Abstract

The purpose of this study was to evaluate the abilities of WC, WHR, BMI and WSR as anthropometric indices to assess and predict hypertension in immigrant Tamil women. A total of one hundred adult immigrant Tamil women from Kolkata, West Bengal, India were evaluated in the present cross-sectional study. Bio-social data (age and ethnicity), anthropometry (stature, weight, minimum waist circumference and hip circumference)and blood pressure (systolic blood pressure and diastolic blood pressure) measurements were obtained. Body mass index (BMI), waist hip ratio (WHR) and waist stature ratio (WSR) were subsequently derived. Statistical analysis includes receiver operating characteristics curve and logistic regression. The results revealed that apart from the WHR and BMI, area under the ROC curves of waist circumference (WC) and WSR were significantly higher. However, area under the ROC curve for WSR (AUC 0.630, 95% CI 0.515 to 0.745, p<0.05) was slightly larger than WC (AUC 0.629, 95% CI 0.516 to 0.742, p<0.05) in assessing hypertension. Odd ratios of BMI and WHR were also lower than that of WC and WSR. Odd ratio associated with a 1 cm increase in WC was 1.80 (95% CI: 1.09 to 2.98, p<0.05) and a 0.1 unit increase in WSR was also 1.80 (95% CI: 1.07 to 3.03, p<0.05). The result of the present study showed that both WC and WSR had similar efficacy and were superior to both BMI and WHR. Among different anthropometric indicators of obesity WSR could be a useful screening tool for predicting hypertension.

Keywords: Anthropometry; Obesity; Hypertension; Immigrant; Tamil; Waist Stature Ratio.

Introduction

Hypertension is currently the leading risk factor for death and disability worldwide and accounted for 9.4 million deaths and 7 per cent of disability adjusted life years (DALYs) in 2010 [1]. According to World Health Organization (WHO) by 2025 the global burden of hypertension will increase by 60%, including 1.56 billion individuals [2]. It is ranked third most important risk factor for attributable burden of disease in south Asia [3]. Hypertension is directly responsible for 57% of stroke deaths and 24% of all coronary disease deaths in India. A rough estimate shows that there are 31.5 million hypertensive in rural and 34 million in urban Indian population [4,5].

It is well known that both general and central obesity are positively associated with hypertension risk [6,7]. However, controversy remains regarding the best predictor of hypertension [6,8]. There are different ways of measuring obesity. Anthropometrically derived measurements like body mass index (BMI), waist circumference (WC), waist hip ratio (WHR), waist stature ratio (WSR) are widely used in epidemiological studies [6-8], as they can be determined easily at low cost and also can be used in a larger sample [9].

In India, large number of studies has been done to

understand the association of obesity measures with hypertension in native, but in general, studies in immigrant are scarce [7, 10]. Studies among emigrant populations demonstrated higher prevalence of obesity and other cardio vascular disease (CVD) risk factors including hypertension [10,11]. It has been recently suggested that the rising burden of hypertension, associated CVD and non-communicable diseases (NCD) in India needs to be addressed as a public health priority [12]. In view of the above, the purpose of this study was to evaluate the abilities of WC, WHR, BMI and WSR as anthropometric indices to assess and predict hypertension in immigrant Tamil women.

Materials and Methods

The present cross-sectional study was conducted at Kolkata, West Bengal, India. A total of one hundred nineteen adult Tamil women were measured, out of them nineteen women were excluded because of missing data. Thus, the final sample size was one hundred adult Tamil women. Informed consent was obtained from all participants before the work commenced. All participants were asked to complete a questionnaire that included specific information on age and ethnicity. Anthropometric measurements viz. stature (ST), weight (WT), WC, hip circumference (HC) was taken following standard techniques [13]. In brief, all measurements were taken with little clothing and barefooted. During the measurement of ST, the subject stands on a flat surface with the head in Frankfurt Horizontal Plane. WT was measured with the subject stands still over the center of the platform of weighing machine with body weight evenly distributed between both feet. WC was measured at the level of the natural waist, which was the narrowest part of the torso. HC was measured at the level of maximum extension of the hip. WHR, BMI and WSR were calculated subsequently. ST was measured to the nearest 0.1 cm using moveable anthropometer. Circumference measurements were made to the nearest 0.1 cm using inelastic steel tape. WT was measured to the nearest 0.5 kg using weighing machine. Systolic blood pressure (SBP) and diastolic blood pressure (DBP) measurements were taken following standard procedure [14]. Hypertension (SBP $\geq$ 140 mmHg and/or DBP $\geq$ 90 mmHg) was defined according to the Seventh Report of the Joint National Committee (JNC-7) recommendation [15].

Descriptive statistics were performed by mean and standard deviation (SD). Areas under the receiver operating characteristic (ROC) curves were calculated to understand the ability of anthropometric measures to assess hypertension. To understand the association of anthropometric measures with hypertension, we calculated odd ratios (ORs) for each measurement in simple logistic regression analysis. Statistical analysis was performed using the SPSS (version,20.0). A p-value of < 0.05 was considered as significant.

Results and Discussion

The study participants included one hundred adult immigrant Tamil women aged between 21-70 years and the mean age was 46.59 years (SD±13.17 years). The mean and standard deviation of anthropometric and blood pressure variables are presented in Table 1. The prevalence of hypertension in the studied population was 36.97%. Similar to the present study, high prevalence of hypertension was also observed in an urban North Indian study [16]. However, in the present study we analyzed the usefulness of anthropometric indices as predictors of hypertension. The result (Table 2) revealed that apart from the WHR (AUC 0.557, 95%CI 0.440 to 0.673, p>0.05) and BMI (AUC 0.607, 95%CI 0.493 to 0.721, p>0.05), area under the ROC curves (Figure 1) of WC and WSR were significantly higher than the non-effect value 0.5. Thus, suggesting that anthropometric indices that reflect central obesity are better for predicting hypertension than general obesity measure.However, the area under the ROC curve for WSR (AUC 0.630, 95% CI 0.515 to 0.745, p<0.05) was slightly larger than WC(AUC 0.629, 95% CI 0.516 to 0.742, p<0.05) in assessing hypertension. A recent study [8] in Korean population also observed smaller area under the ROC curve for BMI than central obesity measures like WC and WSR. Similar to area under the ROC curves, OR of BMI (OR 1.45, 95% CI 0.88 to 2.38, p>0.05) was also lower than those for central obesity measures like WC and WSR (Table 3). The odd ratio associated with a 1 cm increase in WC was 1.80 (95% CI: 1.09 to 2.98, p<0.05) and a 0.1 unit increase in WSR was also 1.80 (95% CI: 1.07 to 3.03, p<0.05). This finding is in accordance with a previous comparative study[8] on the association between obesity measures and hypertension. Like in the present study, other studies in Asian Indians also revealed that BMI was not a useful measure for cardiovascular disease risk factors [17,18]. The lack of association between BMI and hypertension in the present study might be due to the fact that, BMI takes into account the overall adiposity andAsian Indians have a tendency towards more abdominal adipose

tissue deposition [19]. Though, WHR is a widely used measure of central obesity, no significant association was observed with hypertension in the present study. Recent study in North Indian population [20] and Taiwanese population [21] also observed comparatively weaker assessment ability of WHR for hypertension among different anthropometric indices. Studies demonstrated that WHR was largely influenced by skeletal structure and correlated poorly with central adiposity [22,23]. WHR do not reflect the height of the subject and accurately identifying the point of maximal protrusion of the buttocks in obese people is demanding [8]. Moreover, HC changes reflected changes in the bones and muscles more than changes in fat [24,25]. The result of the present study showed that both WC and WSR had similar efficacy and were superior to both BMI and WHR. Similar association was also observed by Tseng et al [21]. Though, the discrimination ability of WSR was similar to that of WC, WSR has some

Table 1: Characteristics of the studied population

Variables	Mean	SD
Age (year)	46.59	13.17
HT (cm)	151.41	6.72
WT (kg)	53.27	11.45
WC (cm)	79.23	9.38
HC (cm)	94.56	9.28
WHR	0.83	0.06
WSR	0.52	0.06
BMI (kg/m^2)	23.11	4.09
SBP (mm/hg)	134.52	7.96
DBP (mm/hg)	86.40	9.07

Table 2: Area under the ROC curves of anthropometric measures in assessing hypertension
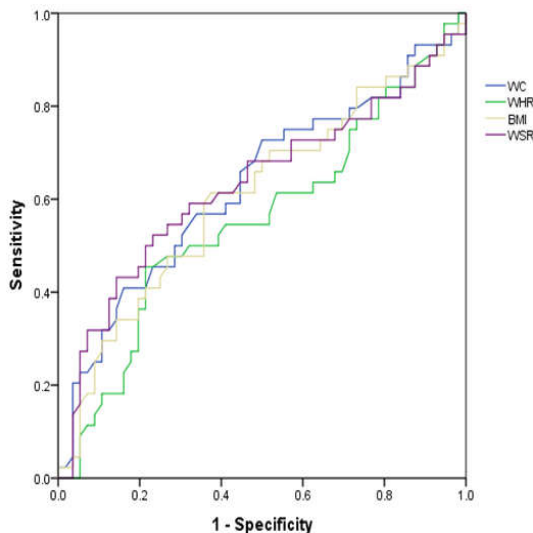
Variables	AUC[#]	95% CI		p
		Lower Bound	Upper Bound	
WC (cm)	0.629	0.516	0.742	0.027
WHR	0.557	0.440	0.673	0.333
BMI (kg/m²)	0.607	0.493	0.721	0.066
WSR	0.630	0.515	0.745	0.026

[#]Area under the curve

Table 3: Odd ratios of anthropometric measures for hypertension

Variables	OR[#]	95% CI		p
		Lower bound	Upper bound	
WC (cm)	1.80	1.09	2.98	0.02
WHR	1.26	0.79	2.02	0.33
BMI (kg/m²)	1.45	0.88	2.38	0.14
WSR	1.80	1.07	3.03	0.03

[#]Odd ratio

Fig. 1: Area under the ROC curves assessing hypertension

extra benefits like, unisex cutoff within a narrow range [21], user-friendly, consider stature of the subject and can be used in children also [8].

Thus in conclusion, among different anthropometric indicators of obesity WSR could be a useful screening tool for predicting hypertension. Since the present study is cross-sectional in nature and restricted to females, further investigations considering all obesity measures on the males as well as in other ethnic groups are necessary for effective prevention and management of hypertension.

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