Research Article

BMI is the Best Anthropometric Index to Predict Cardiovascular Disease Risks in Young Adult Females

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ABSTRACT

Obesity predisposes to premature cardiovascular disease (CVD) and diabetes mellitus. Lipid profile and blood pressure are customarily used to predict the CVD risk in obese population. The techniques of anthropometry, however, are non-invasive, simple and are good predictors of medical complications of obesity. They include body mass index (BMI), waist circumference (WC), waist hip ratio (WHR), and waist height ratio (WHtR). Detecting CVD risk at an early age may help to prevent complications at a later stage. Studies of anthropometric indices in predicting CVD risk among young adult females is meagre and inconclusive. To find the best anthropometric index to predict CVD risk in young adult females by correlating with lipid profile and blood pressure values. A cross sectional study was carried out involving 70 female subjects aged between 18 to 21years. Height, weight, waist circumference, hip circumference were measured and BMI, WHR, WHtR were calculated. Blood pressure was recorded. Lipid profile parameters were estimated. Regression analysis and Receiver Operating Characteristic (ROC) analysis was done with areas under curve (AUC) to determine the best anthropometric index. Of all the anthropometric indices, AUC of BMI was the highest for most of the risk factors (0.8 and above). Regression analysis showed BMI as the best anthropometric index for CVD (regression coefficient of 71.2%). In this study we found that BMI was the best anthropometric index for predicting risk for CVD in young adult females.

Keywords: Anthropometric indices, CVD risk, Young adult females, Body mass index, Obesity.

INTRODUCTION

Obesity is known to cause metabolic syndrome which comprises dyslipidemia, hypertension, and increased insulin resistance in addition to other components. And these in turn are known to cause cardiovascular disease (CVD) and type 2 diabetes mellitus.[1] Obesity is a major health problem today and is recognised by World Health Organization (WHO) as a global epidemic.[2] Globally, overweight and obesity are the fifth leading risk for deaths. It is shown that women are likely to be more obese than men, and hence at greater risk of diabetes and cardiovascular disease all over the world.[3]

Younger population are more at risk for obesity as a result of sedentary behaviour encouraged by television viewing and computer usage.[4] Obesity in childhood and young often persists into adulthood.[5] Obesity in childhood and young is on the rise in both the developed and developing countries.[6,7] Some studies have reported a high prevalence of CVD risk factors in the adolescents and the young.[8]

The measurement of anthropometric indices are simplest, give a fair measurement of fat cell mass and are the best predictors of medical complications of obesity. They include body mass index (BMI), waist circumference (WC), waist hip ratio (WHR) and waist height ratio (WHtR). WC, WHR, WHtR and BMI have been used to assess body fat distribution and abdominal obesity.[9,10] Simple anthropometric measurements have been extensively used over the invasive techniques of blood investigations and have more practical value both in clinical practice and for large scale epidemiological studies.

There is considerable debate in the literature as to which anthropometric indices are superior for predicting cardiovascular and diabetic risks. BMI is recommended index of adiposity for epidemiological studies as well as clinical practice (Dietz and Bellizzi 1999).[11] Some studies have showed that WC and WHR as a good measure of metabolically active intra abdominal fat that is associated with insulin resistance, hypertension and atherogenic dyslipidemia. Certain other studies indicated that WHtR was the best screening tool for dyslipidemia compared to WHR, WC or BMI. But confusion still exists as to which anthropometric index best predicts CVD. And it is critical to determine accurate screening tools to identify younger subjects at risk for cardiovascular disease because of the need of prevention of disease risk from a young age. And such study in younger population especially females is meagre. Some studies have shown gender related differences in accumulation of fat and risk for CVD. Therefore the purpose of the present study was to examine which of these indices could better predict dyslipidemia and hence cardiovascular disease in young adult females. Age group of 18 to 21 years was focussed as it represents a change from stage of adolescence to adult stage.

Objectives

To determine the best anthropometric index or indices with cut off points for predicting CVD risk factors in young adult female population.

MATERIALS AND METHODS

Subjects

The study involved 70 female students in the age group of 18-21yrs. Permission for conduction of this study was obtained from the Ethical Committee of our Institution (Yenepoya University). Informed consent was taken from the subjects who participated in the study after explaining the aim of the study and the kind of measurements. All the subjects selected were nulliparous with no history of diabetes, hypertension, endocrinal disorders or menstrual irregularities. The subjects were advised to come after 10 hrs of overnight fast.

Anthropometry

Body weight, height, waist circumference and hip circumference were recorded by the same observer. Subjects were weighed on a weighing scale barefooted. Height was measured barefooted with head in horizontal plane to the nearest 0.5cm. Waist circumference (midway between the lower rib margin and the iliac crest at the end of normal expiration) and hip circumference (widest diameter over the greater trochanter) were measured to the nearest 0.1cm in standing position using a tape. BMI was calculated as weight (kg) divided by height in meter squared (m^2). Waist to hip ratio (WHR) was also calculated as WC divide by HC. Waist to height ratio calculated as WC divided by height. Blood pressure was recorded in the right arm using sphygmomanometer after the subject has rested for 5min and in upright position. Two readings at 5 min intervals were taken from each participant. The lower of 2 readings was recorded as subject's blood pressure.

Biochemical parameters

Five ml of overnight fasting blood samples were obtained from each subject. The blood was collected in vacutainers with no added anticoagulant and serum separated within 1 hour. Total cholesterol (TC), HDL-cholesterol (HDL-C), Triglycerides (TG), direct LDL-cholesterol (LDL-C) were determined using commercially available kits (SPAN Diagnostics). Non-HDL-cholesterol (non-HDL-C) was calculated by subtracting HDL-C from total cholesterol as non-HDL-C is increasingly being used in clinical research as an index of CVD risk.[12,13] The atherogenic indices such as LDL-C/HDL-C and non-HDL-C/HDL-C were calculated.

Statistical analysis

Regression analysis and receiving operating curve (ROC) were the statistical methods used to compare anthropometric indices to predict CVD risks. ROC was used to find the cut off values for anthropometric indices. The optimal cut off value for each index was indicated by the value that showed the largest sum of sensitivity and specificity (>80%). Measures of sensitivity and 1—specificity were used for plotting the ROC curve for each anthropometry cut off value. Area under curve (AUC) was used to evaluate the overall performance of each ROC curve, which is a measure to identify subjects with risk factors.

RESULTS AND DISCUSSION

Both regression analysis and ROC analysis indicated that BMI by far is the best index for predicting dyslipidemia (table 1). The AUC of anthropometric indices are shown in table 2. The cut off points that maximised sensitivity and specificity for dyslipidemia is given in table 3.

Table 1: Regression coefficients to indicate the best anthropometric index for CVD risk factors

Anthropometric Indices	Regression Coefficient
BMI	71.2%
WC	42.6%
WHR	13.7%
WHtR	45.2%

BMI- Body mass index, WC - Waist circumference, WHR- Waist hip ratio, WHtR – Waist height ratio

Table 2: AUC for best anthropometric index for CVD risk factors

Risk Factor	AUC				Best Anthropometric Index
	BMI	WC	WHR	WHtR	
LDL-C	0.890	0.774	0.594	0.764	BMI
HDL-C	0.981	0.864	0.646	0.881	BMI
NON-HDL-C	0.735	0.610	0.547	0.592	BMI
TG	0.838	0.783	0.664	0.839	BMI & WHtR
Non-HDL-C/HDL-C	0.799	0.707	0.588	0.696	BMI
LDL-C/HDL-C	0.929	0.862	0.770	0.871	BMI

LDL-C – Low density lipoprotein-cholesterol, HDL-C- High density lipoprotein-cholesterol, TG – Triglycerides

Table 3: Cut off values of anthropometric indices for CVD risk factors

Risk Factor	Cut-Off Values			
	BMI	WC	WHR	WHtR
LDL-C	24.93	82.5	0.86	0.52
HDL-C	25.1	83.5	0.86	0.54
NON-HDL-C	24.9	82.5	0.85	0.52
TG	23.2	82.5	0.85	0.54
Non-HDL-C/HDL-C	23.3	82.5	0.85	0.54
LDL-C/HDL-C	23.4	83.5	0.85	0.55

BMI- Body mass index, WC - Waist circumference, WHR- Waist hip ratio, WHtR – Waist height ratio, LDL-C – Low density lipoprotein-cholesterol, HDL-C- High density lipoprotein-cholesterol, TG – Triglycerides

Different studies have given varying conclusions about which anthropometric measure has the best predictive capacity for CVD risk factors. It has been shown that age modifies the discriminative ability of anthropometric indices to identify subjects with CVD risk factors. Also studies have shown that anthropometric measures

perform differently for the prediction of disease risk in diverse ethnic and geographic populations[14-16]. Therefore, it has been suggested that using anthropometric indices for CVD risk screening needs specific studies in different ages and in populations of varied ethnic backgrounds. The Iowa's Women Health Study reported that overweight and obese women with a high WC (>88cms) face a greater risk of CVD related deaths when compared with overweight and obese women with a normal WC (<88cm)[17].

However the study evaluated only postmenopausal women, unlike our study where we evaluated only young adult females of 18-20 years. Although WC, WHR are considered to be measures of identifying subjects at increased risk for metabolic syndrome, because of central fat distribution, only small amounts of intra-abdominal fat are physiologically present before adulthood[18]. And also, waist circumference has not yet been validated as an index of intra-abdominal fat during puberty. Further, some studies suggest gender related differences in the rate of accumulation of abdominal adiposity with advancing age[19].

Thus a given increment in BMI in a young population has more negative implications for future disease risk than a similar increment among older individuals, indicating BMI as an important index in the young. Our present study also clearly indicated that BMI was the best anthropometric index to predict dyslipidemia and hence CVD risk in young adult females. The cut off values for BMI in this study corresponded to that recommended by the WHO.

CONCLUSION

The measurement of anthropometric indices is non-invasive and simple; and the indices are good predictors of medical complications of obesity. These anthropometric indices have been extensively used over the invasive techniques of blood investigations and allow medical and public health practitioners to identify those at highest risk and reduce the burden of chronic disease at a later age, by allowing individuals to undergo dietary and lifestyle changes. This early screening could provide benefit to the individuals to avoid CVD at later ages.

Our present study clearly showed that BMI was the best anthropometric index among others to predict dyslipidemia and hence CVD risk in young adult females.

Further Research

BMI may be the best screening tool for Indian young females but such a conclusion awaits further verification in longitudinal epidemiological studies on morbidity and mortality.

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