Original Article

Determination of most suitable cut off point of waist circumference for diagnosis of metabolic syndrome in Kerman

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ABSTRACT

Objectives: Metabolic syndrome is a determining indicator of cardiovascular diseases and diabetes. Abdominal obesity, determined by measuring waist circumference, is one of the most important criteria for diagnosing this syndrome. This criterion varies between men and women and among different races. The present study aims at the assessment of the sensitivity and specificity of the commonly used cut off point of waist circumference, and the estimation of the most suitable cut off point of waist circumference for the diagnosis of metabolic syndrome in the urban society of Kerman.

Methods: 5332 subjects consisting of 2966 women and 2366 men, 20 years old and above were studied in a population based, cross sectional study. Waist circumference, blood pressure, blood sugar, and blood lipids were measured. People with at least two of the NCEP ATP III criteria – high blood pressure (BP > 130/80), high triglycerides (TG > 150), high glucose (FBG > 100) and low HDL (HDL < 40 in men and <50 in women) – were taken as population at risk. ROC analysis was used for determining the most suitable cut off point of waist circumference. The prevalence of metabolic syndrome was then assessed based on IDF, NCEP criteria and the proposed criterion, and agreement among the three methods in diagnosing people suffering from metabolic syndrome was examined.

Results: The average ± standard deviation of waist circumference in women and in men was 83.90 ± 12.55 and 87.99 ± 11.94 cm respectively. The most suitable cut off point of waist circumference for metabolic syndrome diagnosis was 86 in women and 89 in men. These circumferences had the highest specificity and sensitivity. The prevalence of metabolic syndrome in IDF, NCPE, and the proposed criterion was 30.4%, 27.7%, and 35.2% respectively. The new criterion and the NCEP criterion achieved the highest agreement (kappa factor = 83%).

Conclusion: The cuts off point of waist circumference in men and women are close. It is possible, then, to determine a common cut off point of waist circumference for both in Iran. Therefore, the cut point of 90-cm of waist circumference proposed by the National Obesity Committee seems to be appropriate for the Iranian society. These clinical findings should nevertheless be verified by simulation.

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1. Introduction

Metabolic syndrome refers to a state in which a number of metabolic disorders (abdominal obesity, hypertension, high blood sugar, and blood lipid disorder) exist simultaneously [1]. The prevalence of metabolic syndrome, a determining factor in cardiovascular diseases and diabetes, is reported to be 33% in the Iranian adult population and 10–11% in the adult population with normal weight [2,3]. Unlike developed countries, fatalities caused by cardiovascular diseases have risen by 20–45% in the past

20 years in Iran, and metabolic syndrome is an important reason for this rise [4–6]. In addition, metabolic syndrome triples the risk of diabetes [7]. The diagnosis of metabolic syndrome is, therefore, of high importance, as identifying people who are in risk enables us to prevent cardiovascular diseases through long term planning.

The prevalence of metabolic syndrome has been different in different studies, one of the reasons of which is the application of different definitions of this syndrome in diagnosis [8]. The World Health Organization defined indices including abnormal waist circumference, high fasting blood sugar, high triglyceride, high systolic and diastolic blood pressure, and low HDL for metabolic syndrome diagnosis in 1998 and 2001 [9,10]. According to NCEP ATP III criteria (Adults Therapeutic Panel III of the National Cholesterol Educational Program) at least 3 criteria must be met for

metabolic syndrome diagnosis [8]. On the other hand, according to the IDF (International Diabetes Foundation) definition of metabolic syndrome, published in 2005, meeting the waist circumference criterion in addition to two other criteria is essential [11]. The main difference among most criteria above is in the size of waist circumference for metabolic syndrome diagnosis [8,11]. All the aforementioned metabolic disorders are common in abdominally obese people [12]. Considering that the measurement of other metabolic syndrome criteria requires taking blood samples, measuring waist circumference is a convenient and clinically useful method [13]. According to IDF criteria waist circumference is different in different races. This criterion is defined equally in Middle Eastern and European countries, as equal to or greater than 94 cm in men, and equal to or greater than 80 cm in women [11]. Among Indians the cut off point of waist circumference is 78–90 cm in men and 72–80 cm in women [14], in the Japanese it is 85 and 78 in men and women respectively [15], in the Chinese it is 85 and 80 cm in men and women respectively [16], and in Taiwan it is 80 cm in men and 71.5 in women [17]. Suitable cut off point for central obesity in Koreans is 90 cm for men and 85 for women [18]. In addition, suitable cut off point for adults in Thailand for both men and women is 84 cm [19]. Data collected in rural areas in Iraq shows cut off point of waist circumference is 97 in men and 99 in women [20].

As different cuts off point of waist circumference have been reported for the connection between obesity and cardiovascular disease risk factors for different races, it is strongly advised that before any specific clinical activity, the cut off point for every race and nationality be studied [21]. The cut off point for the Iranian population suggested in various studies shows that the cut off point suggested by the IDF is not suitable for the Iranian population. In these studies, the cut off point for diagnosis of cardiovascular diseases in the abdominally obese is between 82 and 95 in women, and between 86 and 95 in men [22]. Considering the difference between the cut off point of waist circumference suggested by the IDF and the one found in the Iranian population, and the different cuts off point found in different studies in Iran, the importance of the measurement of waist circumference for prognosis of metabolic syndrome is obvious. On the other hand, no exclusive study on this subject has been carried out in southeast Iran. Therefore, this study aims at finding the distinguishing waist circumference for the adult population of Kerman the most populated city in southeast Iran, and also comparing the prevalence of metabolic syndrome based on the IDF, NCEP, and proposed criteria.

2. Method

The present study is a cross sectional population based study carried out in association with KERCADRS (Kerman Coronary Artery Disease Risk factor Study) in the city of Kerman. The study was carried out on people over 15, between September 2009 and September 2011. 6000 people were recruited in the study randomly using single stage cluster sampling. Data was collected using questionnaires, physical, psychological and laboratory tests in face to face interviews. The interviews and physical tests were carried out by a team consisting of a physician and some nurses.

After acquiring informed consent, weight without shoes and extra clothing was measured (100 g error). Height was measured in standing position without shoes using tape measure (0.5 cm error) from heel to top of head. Waist circumference was measured in standing position with 20–30 cm distance between feet, between the last rib and pelvic crest. Blood pressure was taken according to World Health Organization standards after 10 min rest, twice using the right arm in sitting position, and the average was recorded. Venous blood sample was taken after 12–14 h fasting and was then centrifuged at room temperature. The serum was separated and the glucose, triglyceride, cholesterol, HDL-C were measured using enzymatic method. More detail on sample size and sampling method is published in another paper [23].

The data collected from 5332 people aged 20 and above were analyzed. Metabolic syndrome was diagnosed according to NCEP ATP III and IDF criteria. Those with at least to of the NCEP ATP III criteria were taken as people in risk of metabolic syndrome. These criteria consist of high blood pressure (BP > 130/8), high triglyceride (TG > 150), high glucose (FBG < 100, or those with diabetes), and low HDL (HDL < 40 in men and HDL < 50 in women). A new criterion was finally defined, all criteria of which resembled the NCEP diagnosis criteria, except for waist circumference; new limits were defined for waist circumference.

Statistical analysis was performed using SPSS16. Data were categorized according to sex and the measures were reported in Mean ± SD for quantitative and frequency, and percentages for the other data. Paired t test was used for comparing criteria in the two groups of men and women. The normal distribution of data was examined using Kolmogrov–Smirnov test. The ROC curve was used to determine cut point waist circumference for prognosis of metabolic syndrome (having at least two criteria of the NCEP). The suitable waist circumference for the Iranian population for men and women was determined separately as a point with maximum sensitivity and specificity. In order to verify the ROC curve, the area under the curve (AURC) was calculated. In all steps, the level of significance was considered as 0.05.

3. Results

The 5332 studied people consisted of 2966 women (55.6%) with 45.1 ± 14.7 average age and maximum age of 87, and 2366 men (44.4%) with average age of 47.0 ± 15.9 and maximum age of 85. Table 1 shows average age and standard deviation for demographic and laboratory indices for studied population based on sex. Moreover, the number of metabolic syndrome factors in the studied population according to the IDF and NCEP definitions based on sex is shown in Table 2.

Table 1
Average age and standard deviation for physical and laboratory indices for studied population, based on sex.

Variable	Group		
	Women (*n* = 2966)	Men (*n* = 2366)	Total (*n* = 5332)
BMI[*]	26.71 ± 4.88	24.78 ± 4.24	25.85 ± 4.71
Waist circumference[*]	83.90 ± 12.55	87.99 ± 11.94	85.72 ± 12.45
TG[*]	145.89 ± 92.28	157.76 ± 111.29	151.16 ± 103.37
FBS	104.10 ± 41.99	103.79 ± 35.50	103.96 ± 39.24
Systolic BP[*]	115.99 ± 21.29	120.87 ± 21.56	118.15 ± 21.54
Diastolic BP	79.17 ± 10.25	79.63 ± 10.31	77.76 ± 10.36
HDL[*]	40.33 ± 10.07	35.61 ± 10.40	38.24 ± 10.48

Notes: values are shown in Mean ± SD.
[*] Difference between men and women groups is statistically significant (*p* < 0.05).