Cut-off measurement of waist circumference for the diagnosis of abdominal obesity in a population of Erbil City, Iraq

Sangar Muhammad Ahmed[1] and Sherzad A. Ismail[2]

[1]Community Medicine Department, College of Medicine, Hawler Medical University, Erbil, Iraq.
[2]Community Medicine, Kurdistan Board of Medical Specialties, Erbil, Iraq.

Abstract. Waist circumference has been commonly used as a simple and clinically useful representative marker for central adiposity. The aim of this study was to investigate the optimal cut-off measurement of waist circumference of an Erbil population for diagnosing abdominal obesity. A cross sectional study was conducted in Erbil city. A total of 800 adult men and women (≥18year) of 800 different families were selected using a stratified multistage probability random sampling. Central obesity was defined according to the International Diabetes Federation criteria. Data was analyzed by using the statistical package for the social science, version 22. Receiver Operating Characteristic curves is designed to determine the cut-off point for waist circumference for both genders. A p value ≤ 0.05 was regarded as statistically significant. The cut-off value for male using the Receiver Operating Characteristic ROC curve was 94.7cm (sensitivity 82%, specificity 32%).The cut-off vale for female using the ROC curve was 97cm (sensitivity 55%, specificity 67%). We report a high prevalence of metabolic syndrome and abdominal obesity, especially in women, among the Erbil population. We recommend that these WC cut-off values be integrated into local preventive policies for public health, as the local criteria for diagnosing abdominal obesity, metabolic syndrome and related diseases.

Corresponding author: Sangar Muhammad Ahmed, Community Medicine Department, College of Medicine, Hawler Medical University, Erbil, Iraq. Email; sangarahmed44@gmail.com

Medida de corte de la circunferencia de la cintura para el diagnóstico de obesidad abdominal de una población en la ciudad de Erbil, Irak.

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Resumen. La circunferencia de la cintura se ha usado comúnmente como un marcador representativo simple y clínicamente útil para la adiposidad central. El objetivo de este estudio fue investigar la medida de corte óptima de la circunferencia de la cintura de la población de Erbil para diagnosticar la obesidad abdominal. Se realizó un estudio transversal en la ciudad de Erbil. Un total de 800 hombres y mujeres adultos (≥18 años) de 800 familias diferentes se seleccionaron mediante un muestreo aleatorio estratificado de múltiples etapas de probabilidad. La obesidad central se definió de acuerdo con los criterios de la Federación Internacional de Diabetes. Los datos se analizaron utilizando el paquete estadístico para las ciencias sociales, versión 22. Las curvas de características operativas del receptor están diseñadas para determinar el punto de corte para la circunferencia de la cintura para ambos sexos. Un valor de p ≤ 0,05 fue considerado como estadísticamente significativo. El valor de corte para hombres que utilizan la curva ROC de características de funcionamiento del receptor fue de 94,7 cm (sensibilidad del 82%, especificidad del 32%). El valor de corte para mujeres que utilizan la curva ROC fue de 97 cm (sensibilidad del 55%, especificidad del 67%). Se reporta una alta prevalencia de síndrome metabólico y obesidad abdominal, especialmente en mujeres, entre la población de Erbil. Recomendamos que estos valores de corte de WC se integren en las políticas preventivas locales para la salud pública como los criterios locales para diagnosticar la obesidad abdominal, el síndrome metabólico y las enfermedades relacionadas.

INTRODUCTION

Metabolic syndrome characterizes a group of metabolic abnormalities (central obesity, hypertension, high triglycerides and glucose intolerance, hyperinsulinaemia and low HDL) [1]. One of the indicators for the diagnosis of metabolic syndrome (MetS) is central obesity or waist circumference (WC) [2]. Waist circumference has been commonly used as a simple and clinically useful representative marker for central adiposity, waist circumference a more exact estimation of the distribution of body fat, has been shown to be more strongly associated with morbidity and mortality [3]. The main focus in this new definition is central obesity (IDF, 2005). To have the metabolic syndrome, a person must have central adiposity defined on the basis of waist circumference and

two or more of the following four factors: elevated concentrations of triglycerides, reduced concentrations of HDL cholesterol, elevated blood pressure, and dysglycemia (4,5). However, despite the American Heart Association's recent approval of both BMI and waist circumference as primary tools for assessing adiposity, waist circumference is less commonly used than the BMI in both research and clinical settings (6). Increased BMI and waist circumference have both been associated with decreased cardiorespiratory fitness and with obesity related metabolic abnormalities (7). Waist circumference cut-off values is essential in the prevention and treatment of such health problems like obesity, diabetes type ll and cardiovascular disease (1). 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 (8). Among Indians the cut off point of waist circumference is 78–90 cm in men and 72–80 cm in women (9), in the Japanese it is 85 and 78 in men and women respectively (10), in the Chinese it is 85 and 80 cm in men and women respectively (11), and in Taiwan it is 80 cm in men and 71.5 in women (11), Suitable cut off point for central obesity in Koreans is 90 cm for men and 85 for women (12). In addition, suitable cut off point for adults in Thailand for both men and women is 84 cm (13). Data collected in rural areas in Iraq shows cut off point of waist circumference is 97 in men and 99 in women (14).

Central obesity, as assessed by WC, based on IDF and national cholesterol education program's adult treatment (NCEP III) definitions, is an important component of MetS (8,15). Determination of cut-off points for WC is accepted as the best anthropometric indicator of abdominal adiposity, which reflects increased abdominal fat or visceral fat, which has an essential role in pathogenesis of MetS(16,17). Waist circumference has been shown to be more correlated with MetS

components better than fat percentage(18). So much evidence shows a link between WC and other criteria of MetS and cardiovascular disease (19). Waist circumference is a simple valid, cost effective clinical anthropometric measure predictor for detection of MetS (20). The use of WC is preferred to BMI for evaluation of abdominal adiposity (21), but the cut-off values of WC vary according to ethnicity, gender and lifestyle; therefore, population-specific cutoff points were incorporated into the definition (8, 22).

Different criteria are now available for measuring and indicating the range of wait circumference. The current criteria was that of the International Diabetic Federation used in this study (23). There is no previous study concerning the normal WC values for the Erbil population and not available local criteria for diagnosing metabolic syndrome. The aim of this study was to investigate the optimal cut-off measurement of waist circumference of Erbil population for abdominal obesity

MATERIAL AND METHODS

This was a cross sectional study conducted in Erbil city. A total 800 adult men and women (≥18 year) from 800 different families were randomly selected using a random sampling. The population frame of household of Erbil population based on all 12 offices of Family ID card in Erbil city.

Subjects with the following diseases and health related issues were excluded in the study: hypertension, diabetes mellitus, hyperlipidemia, heart disease, malignant disease, rheumatoid arthritis, chronic skin disease and those surgically operated (in the last month).

A written informed consent was taken from each subject prior to the study. Each subject was interviewed using a modified questionnaire of the World Health Organization which included questions on socio-demographic, medical and surgical history, physical behavior, dietary behavior and anthropometric measurements (24).

According to the IDF criteria, the presence of a waist circumference ≥ 94cm (men) ≥ 80cm (women), plus two of the following: raised blood glucose ≥ 100 mg/dL, triglycerides ≥ 150mg/dL, systolic and diastolic blood pressure ≥ 130/85 mmHg, and low HDL for (men) < 40 mg/dL and for (women) <50mg/dL were considered as MetS (25).

Waist circumference was measured midway above umbilical between the distal border of the lowest rib and the superior border of the iliac crest at the end of a normal expiration. Measurements were done with the subject in an upright position, without clothes, both feet touching the ground, and arms hanging freely. A non-elastic tape measure was placed directly on the skin on the waist line without putting pressure on the abdominal wall (26).

Weight was measured to the nearest 0.1kg using an electronic weight scale (model 770:seca, Germany), with the respondents lightly clothed. Height was measured to the nearest 0.5cm with a measuring tape while the respondent stood still without shoes. BMI was calculated by the formula, BMI = weight (kg) / height (m²) (27).

Receiver operating characteristic (ROC) curves for waist circumference was used to compare the actual data regarding waist circumference with the IDF criteria measurements out the appropriate standard of Erbil people waist circumference. Using coordinates for drawing the ROC curve, the cut-off point for WC that had optimal values for sensitivity and specificity was calculated. Data were analyzed using the statistical package for the social sciences SPSS version 22.

RESULTS

The overall prevalence of MetS among adult participants was 327(40.9%), 103(28.8%) in men and 224 (50.7%) in women, statistically high significance was found between MetS and gender, p value<0.001 (Table I).

The cut-off of WC for male using the ROC curve was 94.7cm (sensitivity 82%, specificity 32%) (Fig. 1). The cut-off of WC for female using the ROC curve was 97cm (sensitivity 55%, specificity 67 %) (Fig. 2).
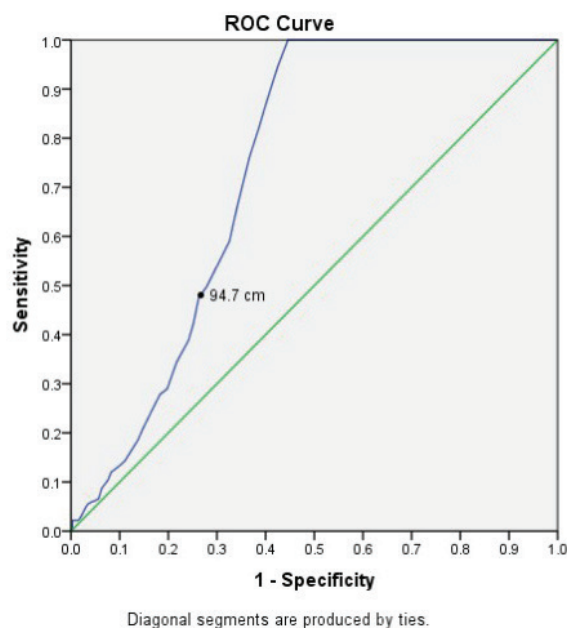

Fig 1. ROC curve for cut-off value of waist circumference for males.

TABLE I
PREVALENCE OF METABOLIC SYNDROME BY GENDER

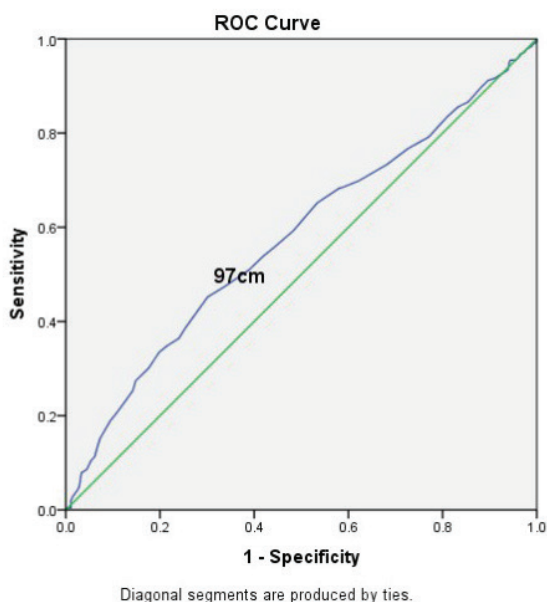| Gender	No MetS No.(%)	MetS No.(%)	P-value
Male	255 (71.2%)	103 (28.8%)	
Female	218 (49.3%)	224 (50.7%)	<0.001

Fig 2. ROC curve for cut-off value of waist circumference for females.

DISCUSSION

The findings of this study indicated a high prevalence rate of MetS at 40.9% in a population of Erbil city. The prevalence was significantly higher in females compared to males. The higher prevalence of MetS found in females is probably related to higher central obesity, elevated triglycerides and higher blood pressure rates in female than in males. Although the prevalence of MetS of an Erbil city population was high, it is higher than the prevalence of MetS of the Baghdad population of Iraq (40.6%); again higher in females 42.8% than in males 36.5 (28).

Generally, the prevalence of MetS among Gulf countries ranged from 29.6% to 36.2% for men and 36.1% to 45.9% for women (29). The prevalence of MetS is high in Jordan 51% (46.4% in men and 55.3% for women) (30). The prevalence varies by country and time of the study. For example: the prevalence of MetS was 22–44% in Turkish, 16–41% in Saudi-Arabia, 14–63 in Pakistan, 26–33 in Qatar, 9–36 in Kuwait, 22–50 in Emirates, 6–42 in Iran, and up to 23 in Yemen (31).

The prevalence of MetS and cut-off value of waist circumference were identified for both genders. The International Diabetes Federation (IDF) estimates that one-quarter of the world's adult population has MetS (32). Central obesity is regarded as one of the most important predictors of cardio vascular risk and it acts in insulin resistance (33). The IDF proposed that waist circumference, also known as a central obesity, is compulsory for diagnosing metabolic syndrome (25). The most common abnormality in metabolic syndrome was related to increased WC, it is thought that the sedentary life style and unhealthy foods lie behind abdominal obesity and dyslipidemia (30).

The IDF has used a waist circumference cut-off value of 94cm and 80cm for women as its diagnostic criteria of metabolic syndrome for European countries. The optimal cut-off value for WC of Erbil population more than exceeds the IDF criteria. For this result, we re-revaluated the cu-off values of WC for the diagnosing MetS using ROC analyses (Table II).

TABLE II
COMPARISON BETWEEN CUT-OFF OF WC OF CURRENT STUDY AND THE IDF

Gender	Current study WC cut-off value	IDF WC cut-off value
Male	94.7	94
Female	97	80

Several studies that have been carried out in Middle East countries showed that the cut-off values of waist circumference of participant for both genders, were more than the range mentioned in the IDF criteria. In regard to the finding of these studies from Middle East countries, are likely to obtain special criteria for diagnosing metabolic syndrome and optimal cut-off value for WC in more in accordance with the population in this region (Table III). We report a high prevalence of metabolic syndrome, especially in women, among the Erbil population. WC of 94.7 cm in males and 97 cm in females

TABLE III
COMPARISON OF OPTIMAL CUT-OFF VALUES OF WAIST CIRUMFERENCE
IN MIDDLE EAST COUNTRIES

Country (reference number)	No. Subjects	Cut-off point for men	Cut-off point for women
Turkey (34)	1039	83cm	93cm
Tunisian (35)	3435	85cm	85cm
Iraq (14)	1000	97cm	99cm
Erbil	800	94.7cm	97cm
Egypt (36)	3209	100.5cm	96.25cm
Iran (37)	3024	91cm	89cm
Qatar (38)	2496	102cm	94cm
Omani Arabs (39)	2000	80cm	84.5cm

are probably more appropriate thresholds for abdominal obesity. We recommend that these WC cut-off values be integrated into local preventive policies for public health as the local criteria for diagnosing abdominal obesity, metabolic syndrome and related diseases.

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