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Waist Circumference Cut-off Points in Iraqi People

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Abstract

Background: Central obesity is a critical predictor of cardiometabolic risk, yet universally applicable waist circumference cut-offs are confounded by ethnic discrepancies
Objectives: To determine the optimal WC cut-off points for identifying central obesity in the Iraqi population and evaluate associated sociodemographic risk factors.
Methods: A retrospective record review was conducted utilizing data from 3,924 participants (1,600 males, 2,324 females) who underwent anthropometric assessment in the National Iraqi STEPWISE Survey of non-communicable disease risk factors. Central obesity was referenced against the WHO Body Mass Index criteria, BMI (30kg/m2). Receiver Operating Characteristic (ROC) curves and the Youden index determined optimal Waist Circumference cut-offs. Multivariable logistic regression identified independent sociodemographic predictors.
Results: The optimal Waist Circumference cut-off points were established at> 91.75 cm for males (AUC: 0.900, 95% CI: 0.884–0.916; prevalence: 56.3%) and> 91.05 cm for females (AUC: 0.882, 95% CI: 0.865–0.899; prevalence: 60.8%). Multivariable analysis revealed that the 18–39 age group had significantly lower odds of having central obesity in both males (OR: 0.404, 95% CI: 0.222–0.735) and females (OR: 0.287, 95% CI: 0.177–0.464). Conversely, central obesity was independently elevated in males who were government employees (OR: 2.581, 95% CI: 1.447–4.604) or unemployed with an income (OR: 2.431, 95% CI: 1.341–4.407), and in females with no formal schooling (OR: 1.892, 95% CI: 1.062–3.373).
Conclusions: The Iraqi population exhibits distinct Waist Circumference thresholds that differ substantially from traditional international metrics, with the odds of central obesity significantly influenced by specific sociodemographic characteristics.

Keywords: Anthropometry; Cut-off values; Iraq; Obesity; Waist circumference.

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Introduction:

Excessive weight gain is considered a leading cause of morbidity and mortality worldwide, with an exponential increase (1,2). As a global health problem, obesity, worryingly, is growing more rapidly in developing countries (3,4). Central obesity- in particular –is an important predictor of cardiovascular events and metabolic diseases even among individuals with normal Body Mass Index (BMI), (5,6,7).

Anthropometric measures to assess central obesity include waist circumference, waist–hip ratio, and waist – height ratio (8). Among these, waist circumference appears to be a convenient and strongly correlated measure of intra-abdominal adiposity and cardiometabolic risk (9-12). Many published articles describe waist circumference cutoff points for different ethnic groups, most of which reveal discrepant measures even in the same population (13,14).

Setting cutoff points for waist circumference is of great importance for the prevention, management, and prognosis of obesity, metabolic syndrome, diabetes, and cardiovascular diseases (15).

Waist circumference > 102 cm or 88 cm for men and women, respectively, is associated with a substantial increase in the risk of cardio-metabolic complications (16).

Europeans use 94 cm (men) and 80 cm (women) (17). In comparison to Caucasians, Asians are more prone to obesity-associated diseases (18); they use lower cutoffs (90 cm for men and 80 cm for women) (19). Japan uses a cutoff of 85 cm (for men) and 90 cm (for women) (20). For Arabs, the use of European data until more specific data are available has been recommended (21).

This study aimed to determine the waist circumference cut-off points for the Iraqi population.

Patients and methods

Type of study

Retrospective record reviews of the National Iraqi STEPWISE survey of non-communicable disease risk factors 2015.

Study population

Data of the participants in the Iraqi STEPWISE survey 2015.

Data collection

Survey data were available from the non-communicable disease prevention and control department in Iraq. Only persons who had their anthropometric parameters measured in the second step of the survey (3924) were included in the current study.

Data were accessed with formal permission from the Non-Communicable Diseases Prevention and Control Department.

Study variables

The weight and height of each subject were used to identify the body mass index (BMI) as a measure of obesity (BMI ≥30 kg/m2) according to the World Health Organization (WHO) (3). Waist circumference was measured in the survey according to the WHO STEPWISE approach.

Statistical analysis

Receiver operating characteristic (ROC) curves were used to plot true positives (sensitivity) against false positives (1-specificity) rates. The Youden index was calculated to determine the optimal cutoff values for Waist Circumference.

Results

In this study of the records of (3924) subjects, the waist circumference of males and females was linked with body mass, and the cut-off points of waist circumference for each gender were established using the ROC curve; (91.75) cm for males and (91.05) cm for females **(Figure 1and Table 1)**.

Table (1) Cut-off points of waist circumference for male and female participants

Gender	Central Obesity	Total	Cut-off	AUC	Prevalence
Male	1059	1600	>91.75 cm	0.9 (0.884-0.916)	56.3%(52.7%-9.8%)
Female	1586	2324	>91.05 cm	0.882 (0.865-0.899)	60.8%(57.8%-3.7%)

The ROC curves for waist circumference as a measure of central obesity in Iraqi men and women are shown in **Figure (1)**. Both male and female lines are above the reference line in the curves that plot sensitivity against 1−specificity, indicating good accuracy in identifying central obesity in both sexes. Waist circumference was confirmed as a valid anthropometric measure for the population under study by the overlap of the curves, which indicates comparable predictive performance with slightly higher sensitivity for men at lower false-positive rates **(Figure 1)**.

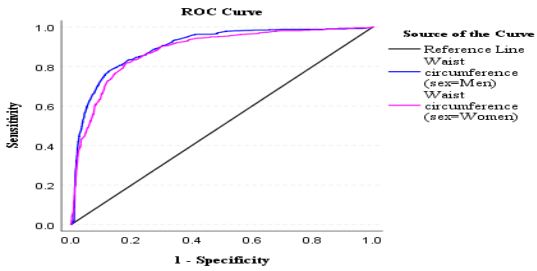

Figure (1) ROC curve showing cut-off points of waist circumference for male and female participants.

Using univariate analysis, associations between the study participants' sociodemographic factors and central obesity (according to the waist circumference cut-offs calculated in this study) were established by calculating the odds ratio (OR) and confidence interval (CI) to interpret an odds ratio not spanning the null value.

For males, age group of 18-39, being single, intermediate school education level, very low income per capita, and meeting the WHO recommendation for physical activity per week were associated with statistically significant lower odds of having central obesity (OR (95% CI): 0.211(0.141-0.315), 0.32(0.111-0.923), 0.467(0.279-0.782), 0.568(0.368-0.878) and 0.648(0.471-0.892) respectively), while being ex-smoker, governmental or nongovernmental employee, and unemployed with income were associated with statistically significant higher odds (OR (95% CI): 2.725(1. 687-4.03), 1.939(1.222-3.076), 5.166(3.054-8.737) and 2.636(1.665-4.173) respectively) (Table 2).

Using multivariate analysis in males only, the age group of 18-39 (OR 0.404, (95% CI) (0.222-0.735) was associated with statistically significant lower odds of central obesity, and governmental or nongovernmental employees and unemployed with income were associated with significantly higher odds (OR 2.581 (95%CI): 2.581(1.447–4.604), 2.291(1.313-3.996) and 2.431(1.341-4.07), respectively **(Table 2)**.

Table (2) Sociodemographic factors associated with central obesity in males using univariate and multivariate analyses

Sociodemographic factor	Central Obesity	Total	Weighted %	Univariate OR (95% CI)	Multivariate OR (95% CI)
Age group(year)					
18-39	366	736	43.7%	0.211 (0.141-0.315)	0.404(0.222-0.735)
40-59	457	571	82.3%	1.259 (0.817-1.941)	1.551(0.877-2.742)
60+	236	293	78.7%	1	1
Residency					
Urban	843	1248	56.8%	1.087(0.757-1.562)	-
Rural	216	352	54.7%	1	-
Marital status					
Single	104	287	33.0%	0.32 (0.111-0.923)	0.535(0.203-1.411)
Married	917	1264	67.4%	1.343 (0.453-3.981)	1.363 (0.547-3.398)
Previously married	38	49	60.6%	1	1
Education					
No formal schooling	119	176	62.3%	0.908(0.521-1.584)	0.871(0.399-1.903)
Less than primary school	189	295	55.9%	0.697 (0.433-1.121)	0.989(0.551-1.775)
Primary school	305	451	57.8%	0.752 (0.482-1.174)	0.884(0.51-1.532)
Intermediate school	126	215	45.9%	0.467 (0.279-0.782)	0.688(0.369-1.281)
High/Secondary school	121	192	52.5%	0.607 (0.358-1.028)	0.929(0.479-1.803)
University/Higher education	199	271	64.5%	1	1
Occupation					
Governmental employee	292	407	66.2%	2.725 (1.687-4.403)	2.581(1.447-4.604)
Non-gov. employee	373	574	58.2%	1.939 (1.222-3.076)	2.291(1.313-3.996)
Students	39	118	31.1%	0.631(0.339-1.174)	1.687(0.778-3.658)
Unemployed with income	235	290	78.7%	5.166 (3.054-8.737)	2.431 (1.341-4.407)
Housewives					
Unemployed without income	118	208	41.8%	1	1
Income/month					
Very low (<50000 ID/month)	165	278	48.8%	0.568(0.368-0.878)	0.605(0.359-1.021)
Low (50000-83333 ID/month)	212	324	55.2%	0.735 (0.475-1.136)	0.68 (0.412-1.121)
Moderate (83333-125000 ID/month)	162	237	59.3%	0.868 (0.533-1.411)	0.958(0.55-1.669)
High (125000-200000 ID/month)	199	296	57.5%	0.807 (0.535-1.217)	0.91 (0.555-1.494)
Very high (>200000 ID/month)	251	348	62.6%	1	1
Smoking					
Current smoker	369	595	52.5%	0.92 (0.671-1.261)	0.789 (0.543-1.146)
X-smoker	197	249	76.0%	2.636 (1.665-4.173)	1.76 (0.997-3.106)
Never smoke	493	756	54.6%	1	1
Meeting WHO recommendation for physical activity per week					
Meet	613	973	52.4%	0.648 (0.471-0.892)	0.776 (0.549-1.097)
Not meet	446	627	63.0%	1	1

OR: odds ratio, CI: Confidence interval.

For females, age group of 18-39 years, being single, married, having high school education, and being students were associated with significantly lower odds of having central obesity (OR (95%CI): 0.195(0.126-0.301), 0.142(0.09-0.225), 0.641(0.45-0.912), 0.471(0.272-0.817) and 0.098(0.035-0.273) respectively), while having no formal schooling, less than primary schooling, primary school education, and being current smokers and ex–smokers were associated with significantly higher odds (OR (95%CI): 2.828(1.808-4.423), 1.835(1.171-2.877), 1.575(1.007-2.464), 2.361(1.297-4.299) and 3.648(1.663-8.003),respectively.

Multivariate analysis in females shows that age group of 18-39 years and being single were associated with lower odds of having central obesity OR(95%CI), 0.287 (0.177-0.464), 0.591(0.353-0.989), respectively and only having no formal schooling was associated with statistically significant higher odds of central obesity OR (95%CI): 1.892(1.062-3.373), **(Table 3)**.

Table (3) Sociodemographic factors association with central obesity using univariate and multivariate analysis in female gender

Sociodemographic factor	Central obesity	Total	Weighted %	Univariate OR (95% CI)	Multivariate OR (95% CI)
Age group(year)					
18-39	614	1135	45.8%	0.195 (0.126-0.301)	0.287 (0.177-0.464)
40-59	682	832	82.5%	1.09 (0.676-1.758)	1.177 (0.718-1.931)
60+	290	357	81.3%	1	1
Residence					
Urban	1272	1840	60.9%	1.013 (0.731-1.402)	-
Rural	314	484	60.6%	1	-
Marital status					
Single	95	268	31.0%	0.142 (0.09-0.225)	0.591 (0.353-0.989)
Married	1176	1653	66.9%	0.641 (0.45-0.912)	1.245 (0.867-1.787)
Previously married	314	402	75.9%	1	1
Education					
No formal schooling	481	641	74.3%	2.828 (1.808-4.423)	1.892 (1.062-3.373)
Less than primary school	423	577	65.3%	1.835 (1.171-2.877)	1.653 (0.944-2.895)
Primary school	366	538	61.7%	1.575 (1.007-2.464)	1.306 (0.748-2.281)
Intermediate school	127	215	48.3%	0.914 (0.541-1.545)	1.115 (0.597-2.081)
High/Secondary school	72	153	32.6%	0.471 (0.272-0.817)	0.861 (0.417-1.778)
University/Higher education	116	199	50.6%	1	1
Occupation					
Governmental employee	73	110	66.9%	1.323 (0.52-3.37)	1.684 (0.487-5.832)
Non-gov. employee	32	41	72.4%	1.717 (0.555-5.306)	1.931 (0.525-7.103)
Students	12	82	13.0%	0.098 (0.035-0.273)	0.382 (0.105-1.383)
Unemployed with income	53	76	57.1%	0.871 (0.331-2.293)	0.682 (0.225-2.066)
Housewives	1382	1967	64.6%	1.194 (0.564-2.526)	1.048 (0.394-2.788)
Unemployed without income	33	46	60.5%	1	1
Income/ month					
Very low (<50000 ID/month)	247	368	59.0%	0.96 (0.624-1.477)	-
Low (50000-83333 ID/month)	333	491	58.5%	0.941 (0.616-1.436)	-
Moderate (83333-125000 ID/month)	265	381	63.7%	1.172 (0.782-1.754)	-
High (125000-200000 ID/month)	285	413	64.3%	1.201 (0.803-1.797)	-
Very high (>200000 ID/month)	293	430	60.0%	1	-
Smoking status					
Current smoker	42	59	77.9%	2.361 (1.297-4.299)	1.599 (0.572-4.474)
X-smokers	59	69	84.5%	3.648 (1.663-8.003)	2.142 (0.936-4.899)
Never smoke	1485	2196	59.9%	1	1
Meeting WHO recommendation for physical activity per week					
Meet	642	950	60.7%	0.995 (0.779-1.271)	-
Not meet	944	1374	60.9%	1	-

OR: odds ratio, CI: Confidence interval.

Discussion

Many studies have reported different cutoff values for waist circumference and recommend establishing a country-specific cutoff point (22). There is no universally accepted cutoff value for waist circumference (23).

In our study, linking waist circumference (WC) with overall body size (body mass index grades), we found that the cutoff points of waist circumference of Iraqi people yielding the maximum sensitivity and specificity were 94.4 cm and 91 cm for men and women, respectively. These results were in accordance with a study in Saudi Arabia that reported WC cut-off values of 99.5 cm in men and 91 cm in women (24). Comparing these results with those of the Asian population (in whom mean body mass index levels are relatively low) (25) in Japan, the cutoffs were 85 cm (for men) and 90 cm (for women) (20). In China, the cut-offs of WC were 85 cm in men and 80 to 85 cm in

women (26) and in Malaysia, WC of 81 cm for men and 80 cm for women were the optimal cutoffs (27).

For Europeans (in whom mean body mass index levels are higher than those of Asians (25). In England, according to the National Institute for Health and Care Excellence, waist circumferences of 94–102 cm in men and 80–88 cm in women are associated with a high risk (28). In Spain, the optimal WC cut-offs were 93.5 cm in males and 89 cm in females (29).
In Venezuela (a country in South America), the optimal waist circumference cutoffs were 90 cm in men and 86 cm in women (30).
Males and females in the younger age group (18-39 years were having less odds of central obesity, which could be due to being more physically and socially active. As well, single females were less likely to be centrally obese, and that can be explained by a higher level of physical activity and younger age as compared to married women; these results were comparable to previous studies (31,32).
Men with governmental or nongovernmental jobs and those who had income were more likely to have central obesity, and this may be due to a sedentary lifestyle and being older (for instance, than students). Women with no formal schooling were more centrally obese than others, which could be explained by older age and little knowledge concerning healthy behaviors; these findings were in line with previous studies (33,34).

Limitation:

It is a retrospective records review design based on 2015 survey data.

Conclusions

The waist circumference cutoff for Iraqi males in this study was (91.75) cm, and for Iraqi females (91.05) cm. In both genders, being younger is associated with less likelihood of central obesity as well as being single females. While employment or having income without employment in males and having no formal schooling in females were associated with more central obesity. Further studies in Iraq are needed to determine the association between waist circumference and cardiometabolic risk.

Authors' declaration:

We confirm that all the Figures and Tables in the manuscript belong to the current study.
Ethical consideration: Data were accessed with formal permission from the Non-Communicable Diseases Prevention and Control Department.

Conflict of Insert: None

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Data availability: Data supporting the findings of this study are available from the corresponding author upon reasonable request.

AI Declaration: No artificial intelligence tools were used in the design, analysis, or writing of this manuscript.

Authors' contributions:

Study conception & design: (Husham J. Abd Al-Badri, Sarah Maan Al-Bahrani& Ali Jalil Alwan). Literature search: (Sarah Maan Al-Bahrani). Data acquisition: (Husham J. Abd Al-Badri, Sarah Maan Al-Bahrani& Ali Jalil Alwan). Data analysis & interpretation: (Husham J. Abd Al-Badri, Sarah Maan Al-Bahrani& Ali Jalil Alwan). Manuscript preparation: (Sarah Maan Al-Bahrani). Manuscript editing & review: (Ali Jalil Alwan).

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النقاط الفاصلة لمحيط الخصر لدى العراقيين

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الخلاصة:

الخلفية:تُعدّ السمنة المركزية مؤشراً هاماً لمخاطر أمراض القلب والأيض، إلا أن تحديد القيم الحدية المثلى لمحيط الخصر، والتي يمكن تطبيقها عالمياً، يتأثر بالاختلافات العرقية.

الأهداف: تحديد القيم الحدية المثلى لمحيط الخصر لتشخيص السمنة المركزية لدى السكان العراقيين، وتقييم عوامل الخطر الاجتماعية والديموغرافية المرتبطة بها.

المنهجية: أُجريت مراجعة استرجاعية للسجلات باستخدام بيانات 3924 مشاركاً (1600 ذكر، 2324 أنثى) خضعوا لتقييمات قياسات الجسم في المسح الوطني العراقي STEPWISE لعوامل خطر الأمراض غير المعدية. تمت مقارنة السمنة المركزية بمعيار مؤشر كتلة الجسم لمنظمة الصحة العالمية (30 كجم/م^2). وتم تحديد القيم الحدية المثلى لمحيط الخصر باستخدام منحنيات خصائص التشغيل للمستقبل (ROC) ومؤشر يودن. كما تم تحديد المتغيرات الاجتماعية والديموغرافية المستقلة باستخدام تحليل الانحدار اللوجستي متعدد المتغيرات.

النتائج: تم تحديد القيم الحدية المثلى لمحيط الخصر عند >91.75 سم للذكور (مساحة تحت المنحنى: 0.900، فاصل الثقة 95%: 0.884-0.916؛ الانتشار: 56.3%) و>91.05 سم للإناث (مساحة تحت المنحنى: 0.882، فاصل الثقة 95%: 0.865-0.899؛ الانتشار: 60.8%). وكشف التحليل متعدد المتغيرات أن الفئة العمرية من 18 إلى 39 عامًا لديها احتمالية أقل بكثير للإصابة بالسمنة المركزية لدى كل من الذكور (نسبة الأرجحية: 0.404، فاصل الثقة 95%: 0.222-0.735) والإناث (نسبة الأرجحية: 0.287، فاصل الثقة 95%: 0.177-0.464). في المقابل، لوحظ ارتفاع مستقل في معدل السمنة المركزية لدى الذكور العاملين في القطاع الحكومي (نسبة الأرجحية: 2.581، فاصل الثقة 95%: 1.447-4.604) أو العاطلين عن العمل ممن لديهم دخل (نسبة الأرجحية: 2.431، فاصل الثقة 95%: 1.341-4.407)، ولدى الإناث غير المتعلمات (نسبة الأرجحية: 1.892، فاصل الثقة 95%: 1.062-3.373).

الاستنتاج: يُظهر المجتمع العراقي عتبات مميزة لمحيط الخصر تختلف اختلافًا كبيرًا عن المقاييس الدولية التقليدية، حيث تتأثر احتمالية الإصابة بالسمنة المركزية بشكل ملحوظ باختلافات اجتماعية ديموغرافية محددة.

الكلمات المفتاحية: القياسات الأنثروبومترية ، القيم الفاصلة ،العراق ، السمنة ، محيط الخصر.