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Cut-off Point of Waist-circumference for Metabolic Syndrome Components among Turkman and Non-Turkman Ethnic Adults in the North of Iran

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Abstract

The MetS (metabolic syndrome) is one of the main risk factors for cardiovascular disease and obesity is one of the major markers of its progression. The aim of this study was to know the comparative differences of waist circumference while predicting the relevant optimal cut-off in Turkman and non-Turkman people in the north of Iran. In our study 248 subjects aged 25-70 years have been chosen from 25 clusters with 10 cases. ATP-III method was used for diagnosis of MetS. The optimal cut-off and the corresponding sensitivity and specificity for age have estimated in the threshold that maximizes the sum of sensitivity and specificity or equivalently maximizes in ROC (receiver operating characteristic) curve operating points. The statistical differences were significant between Turkman and non-Turkman groups in almost all the parameters such as HDLc, LDLc, cholesterol, TG, and FBS. In non-Turkman group, the association between WC and TG, LDLc and FBS showed a positive relationship but it was negative with HDLc. The association between WC and cholesterol level was not significant. The cut-off values of WC for hyper TG, HDLc low and diabetes was respectively higher 6.0, 7.25 and 8.25 cm in non-Turkman group than in Turkman group, however; based on hypercholesterolemia and LDLc it was lower in non-Turkman than in Turkman group. The differences in the above parameters while comparing separately between male and females is also found interesting. Conclusively, the gene has a protective role based on the cholesterol in Turkman people.

Introduction:

The MetS (metabolic syndrome) as the most risk factor raised CVD (Cardiovascular disease) twice as compared to the other indicators and is also helpful in predicting the occurrence of coronary heart disease (Vishram, 2014). The risk related to MetS is greater than the sum of the risks resulting from its component features (van Herpt *et al.*, 2016). There are some reports that advocate the impact of ethnicity on the MetS components. Interethnic differences in the distribution of serum lipids were seen in African Americans people and the role of some genetic determinants differ due to ethnicity (Bentley *et al.*, 2014). In the Chinese rural areas, the ethnicity and female gender were identified as the cardiometabolic risk factors (Guo *et*

al., 2014). The prevalence of obesity and MetS depends on ethnicity and gender in Russians was more common than in the Chuvashes population (Markova *et al.*, 2014). In the eastern Slovakia the MetS components were differently prevalent between Roma and non-Roma subjects (Fedacko *et al.*, 2014). Previous studies in the north of Iran reported the obesity in Turkman ethnic group less than in Fars-native subjects (Veghari *et al.*, 2010; Veghari & Mansurian, 2007).

In the recent years, changing of lifestyle and feeding behaviours extensively increases the cardiovascular disease, diabetes mellitus, and other MetS indices in worldwide, especially in developing countries (Alwan, 2010). Blood pressure, diabetes mellitus, lipid and fasting

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blood glucose levels are all related with central adiposity level (Shah *et al.*, 2014).

In some studies, WC (Waist Circumference) has been reported as a better predictor of CVD risk factor (Ali *et al.*, 2014), whereas others had recommended the WHR (Waist-hip ratio) and WHtR (WC-to-height ratio) indices (Ko *et al.*, 1999). In the other hand, WC is well known as a better predictor of CVD than BMI (Body Mass Index) and WHR (Lin *et al.*, 2002). Visceral adiposity is also helpful in assessing cardiovascular risk, not considering of age, race, or BMI, and can serve as an indicator and target of therapy in cardiometabolic disease (Shah *et al.*, 2014).

Area under the ROC (receiver operating characteristic curve) is useful in evaluating the discriminatory ability of a test to properly select positive and negative disease subjects; detection optimal cut-off point to the minimum amount misclassify diseased or non-diseased subjects; comparing the efficacy of two or more tests for assessing the same disease and comparing two or more observers measuring the same test (Kumar & Indrayan, 2011).

Golestan province located in the north of Iran (South-east of Caspian sea) and 1,7 million people live in this area, 43.9% live in rural areas and whose main job is agriculture. In addition, three huge ethnic groups; Fars-native, Turkman and Sisstani are inhabiting in the north of Iran (SCI, 2012).

In spite of high prevalence of MetS in the north of Iran (Veghari *et al.*, 2017) and positive association with MetS components, there are no regional optimal cut-off values of MetS components for predicting of MetS in this area. The information related to the capacity of MetS components are always useful for assessing of MetS. In this regard, the main aim of this study is to compare the discriminative capacity of MetS components in prediction of non-adipose components and to determine its relevant optimal cut-off in North Iranian adults based on ethnicity.

Methodology:

The study was approved by Ethical Research Committee and consent was received from all participants. This cross-sectional study has been carried out on 248 adult subjects aged between 25-70 years. The required sample size by the previous study with estimation of 20% MetS rate; a confidence level of 95% and a maximum marginal error 0.05, was calculated 246 cases (Sharifi *et al.*, 2009). Subjects were chosen randomly from 25 clusters and each cluster comprised 10 cases of two districts; Kordkoy and Kalaleh from Golestan province (north of Iran and south-east of Caspian Sea). The clusters were chosen randomly using systematic sampling technique based on postal code. A trained staff recorded the data continuously for the three months. Pregnant women and individuals who refused to participate were excluded from this study. The proportions of Turkman and non-Turkman ethnic groups were 88 (35.5%) and 160 (65.5%) cases, respectively.

Waist circumference (WC) was measured to the nearest 0.5 cm at the superior border of the iliac crest with the subject standing, at the end of normal breathing. Blood pressure was measured by a mercury sphygmomanometer for three times and 5 ml of venous blood drawn after 8-12 h fast in the morning for laboratory test. Biochemical analysis including fasting blood glucose, triglyceride and HDL-cholesterol was assessed using a commercially kit (ParsAzmoon, Karaj, Iran).

The considered ethnic groups consist of two types:

- 1) Turkman: The inter-marriage of this ethnic group with others was rare and this group can be distinguished by phenotype.
- 2) non-Turkman: Included all of the ethnic groups (except Turkman) living in this area.

ATP-III method was used for diagnosis of MetS (Singh & Sinha, 2016). According to this criteria, the presence of at least three of five the following criteria were included as MetS: (i) Abdominal obesity as measured by WC >102 cm in men and >88 cm in women; (ii) Triglycerides >150 mg/dl; (iii) HDL cholesterol <40 mg/dl in men and <50 mg/dl in women; (iv) SBP-systolic blood pressure $\geq$ 130 or DBP-diastolic blood pressure $\geq$ 85 mm/Hg; (v) fasting plasma glucose $\geq$ 110 mg/dl.

Statistical Analysis: SPSS 16.0 software (Chicago II, USA) was used for the statistical analysis using chi-square test and t-test for comparing frequencies and the means, respectively. P-value <0.05 considered as statistically significant. The optimal cut-offs and the corresponding sensitivity and specificity for age were estimated in the threshold that maximizes the sum of specificity and sensitivity or equivalently maximizes in ROC curve operating points.

Results:

Demographic characteristics of the subjects have been present in Table-1 and the comparison of MetS components between Turkman and non-Turkman based on gender has been present in Tables-2 & 3. Both in men and women, the mean of HPLc was seen to be more in Turkman group, however; the mean of WC, FBS, LDLc and Cholesterol level significantly more in women non-Turkman group. Following the way, the significant difference was seen more in non-Turkman group only based on WC index in men ($p < 0.05$ for all).

The mean and standard deviation of biochemical profile and WC cut-off for them with regression quotient presented in Table-4. The statistical differences were significant between Turkman and non-Turkman groups based on the mean of HPLc ($p = < .006$), LDLc ($p < 0.028$), cholesterol ($p < 0.016$), TG ($p < 0.015$) and FBS ($p < 0.001$). The values profiles were reported to be high in non-Turkman than in Turkman except for the level of cholesterol. While analyzed the data separately for men

and women all such differences were evidenced mainly in women group. The men group alone shown the statistical differences only in HSLc ($p < 0.047$) and WC ($p < 0.005$). In pooled data, the positive and significant association was seen between TG, cholesterol, LDLc and FBS with WC ($p < 0.05$ for all), however; this association based on HDLc was negative but was not statistically significant. In non-Turkman group, the association between WC and TG, LDLc and FBS were positive significant ($p < 0.05$ for all) but it was negative with HDLc ($p < 0.001$). The association between WC and cholesterol level was not significant. The cut-off values of WC for hyper TG, HDLc low and diabetes was respectively higher 6.0, 7.25 and 8.25 cm in non-Turkman group than in Turkman group, however, based on hypercholesterolemia and LDLc it was lower in non-Turkman than in Turkman group.

The AUCs ranged from 0.731 in Turkman group to 0.811 for the non-Turkman group. The values for AUC tended to be higher in non-Turkman and in total subjects (Fig.-1).

Table 1: Demographic characteristics of subjects

Variable	Turkman(n=88)	Non-Turkman(n=160)	P-value
Sex			
Men	34(38.6)	67(41.9)	0.619*
N(%) Women	54(61.4)	93(58.1)	
Age (Year)	43.9±13.6	47.6±13.8	0.046**
WC (cm)	91.1±15.2	97.6±13.9	0.001**

WC=waist circumference *chi-square **T.test

Table 2. The comparison of Mets components (mean±SD) between Turkman and non-Turkman (male)

Subject	TG*	Chol*	LDLc*	HDLc*	FBS*	WC(cm)
Turkman (N=34)	126.8 ±72.7	162.19 ±38.69	96.53 ±29.48	49.8 ±11.9	91.1 ±15.5	89.5 ±16.1
Non-Turk (N=67)	158.3 ±103.5	170.21 ±37.91	100.19 ±21.41	45.2 ±11.7	107.6 ±50.4	97.9 ±12.9
p-value	0.116	0.324	0.478	0.047	0.064	0.005

*mg/dl

Table 3. The comparison of Mets components (mean±SD) between Turkman and non-Turkman (female)

Subject	TG*	Chol*	LDLc*	HDLc*	FBS*	WC(cm)
Turkman (N=54)	126.7 ±79.4	169.84 ±33.06	98.23 ±24.5	56.9 ±13.9	86.7 ±13.2	92.1 ±14.7
Non-Turk (N=93)	156.0 ±99.8	181.81 ±36.86	107.41 ±24.42	52.0 ±14.3	101.9 ±39.4	97.3 ±14.6
p-value	0.061	0.0498	0.0294	0.0449	0.007	0.0396

*mg/dl

Discussion :

As per our survey, there is no statistically significant relIn the present study, the WC cut-offs for MetS in non-Turkman is lower than in Turkman group. The prevalence rate of MetS is associated with some of the socio-demographic factors, lifestyle, and food behaviors besides it were varied worldwide (Alwan, 2010; Alberti *et al.*, 2005).

Some studies have already advocated the impact of ethnicity on the MetS components which have already been discussed in the introduction part. In nutshell, the differences in lifestyle and food behaviours among ethnic groups may influence significantly the cardiovascular risk factors varieties among them in the north of Iran. Establishing a comprehensive study is necessary to determine the MetS substantial factors among ethnic groups in this area.

The correlation between waist circumference and hypertension, blood glucose, and dyslipidemia as like as our study was seen in other studies (Verma *et al.*, 2016; Gupta & Kapoor, 2012; Zeng *et al.*, 2014). In another study,

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Table 4: The comparison of waist circumference cut-offs value for MetS components based on ethnicity

	Variable	N	Mean±SD	WC Cut- off	RC (ß)	CC (r)	P-value	Sensitivity Specificity	RUC area	Lower-Upper
Non-Turkman	TG	88	126.7(76.5)	89.5	0.084	0.418	0.001	0.66-0.82	0.767	0.661-0.875
	Chol	88	164.5(34.2)	93.5	0.161	0.372	0.001	0.82-0.65	0.717	0.585-0.849
	LDLc	88	96.7(25.9)	93.5	0.171	0.295	0.001	0.75-0.61	0.621	0.462-0.779
	HDLc	88	54.1(13.6)	89.5	-0.057	-0.051	0.632	0.70-0.51	0.567	0.430-0.705
	FBS	88	88.4(14.2)	100.5	0.478	0.466	0.001	1.00-0.79	0.904	0.822-0.987
	MetS	88		89.5				0.37-0.92	0.811	0.710-0.912
Turkman	TG	160	157.0(101.1)	95.5	0.030	0.219	0.005	0.80-0.60	0.705	0.624-0.785
	Chol	160	176.3(37.6)	85.25	0.043	0.118	0.133	0.93-0.22	0.560	0.463-0.675
	LDLc	160	104.0(24.6)	85.25	0.098	0.175	0.025	0.92-0.19	0.459	0.341-0.577
	HDLc	160	49.2(13.7)	96.75	-0.307	-0.304	0.001	0.71-0.57	0.638	0.554-0.723
	FBS	160	104.3(44.3)	108.75	0.055	0.173	0.006	0.40-0.84	0.659	0.531-0.787
	MetS	160		90.5				0.54-0.94	0.731	0.654-0.807

WC=waist circumference, TG=Triglyceride, Chol= Cholesterol, FBS= Fasting blood glucose, MetS=Metabolicsyndrome

Result of t.test between two ethnic groups based on HDLc(P=0.006), LDLc(P=0.028), Chol(P=0.016), TG (P=0.015), FBS(P=0.001)

the association between abdominal obesity and hyperglycemia is stronger than in the presence of a parental history of diabetes (van Dam *et al.*, 2001). In our study, waist circumference cut-off values for hypercholesterolemia and low HDLc in Turkman was higher than in non-Turkman groups.

Among Iranian men, the WC cut-off values for hypertriglyceridemia, low HDLc and diabetes mellitus has been reported 94.5, 94.5 and 95.5 cm, respectively (Gharipour *et al.*, 2013). In India, the WC cut-off values for diabetes mellitus was <90 cm in Hindu Priests group (Sharma & Sarmah, 2015). In a study in Malaysia, the cut-off values of waist circumference for Malay, Chinese and Indians based on dyslipidemia were 87.0, 83.0 and 91.0 cm and based on diabetes mellitus were 88.0, 77.0 and 86.0 cm, respectively (Zaher *et al.*, 2009). Asian people are more disposed to obesity-related co-morbidities than Caucasians people even at lower BMI and smaller WC values (Snehalatha *et al.*, 2003). In Japan, optimal WC cut-offs was seen 89.5 cm for men and 82.3 cm for women (Oka *et al.*, 2008). In Indian adults, cut-offs 90 cm and 80 cm recommend for men and women, respectively (Misra *et al.*, 2005) nevertheless, the appropriate WC cut-off point for abdominal obesity in Koreans was determined to be 90 cm for men and 85 cm for women (Lee *et al.*, 2007). For Thai adults, the cut-off 84 cm is the most appropriate for both men and women (Aekplakorn *et al.*, 2006). Data from rural areas in Iraq suggests cut-offs 99 cm and 97 cm for women and men, respectively (Mansour *et al.*, 2007). Our cut-offs are closer to the Japanese and Korean data than to those from Iraq.

In a meta-analytic study, the combined AUC for predicting diabetes mellitus type2 in men was obtained 0.672 for BMI, 0.701 for WC, 0.721 for waist to hip ratio and 0.726 for waist-to-height ratio (Lee *et al.*, 2008).

The gender differences and a proper statistical test for considering of design effect caused by cluster sampling

have not used in present study. They are our limiting study factors.

Conclusively, the cut-off value of WC for MetS in Turkman group is higher than in non-Turkman group (90.5 vs 89.5). The WC cut-off values for all of MetS indices in Turkman group is higher than in non-Turkman group, but it is inverse based on cholesterol level. It seems the genetic has a protective role based on cholesterol in Turkman subjects. Well-designed and rigorous studies that employ large sample sizes are necessary to corroborate this finding.

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