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Relation between anthropometric indicators and serum lipid profiles as cardiovascular risk factors personals of Iranian Azarbayjan University of ShahidMadani

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ABSTRACT

One of the best non-invasive methods for measure of anthropometric indicators is bioelectrical impedance analysis (BIA). This method is able present a lot of information about body tissue composition in minimum time with high accuracy. To verify the relation between anthropometric measures and lipid profiles as important trisk factor for cardiovascular diseases. This study carried out with 110 subjects(65 males and 45 females)23-59 yearwith mean age 39.65±7.42 years old. Body mass index (BMI), body fat percentage (%BF), waist-to-hip ratio (WHR), lipid profile and glycaemia were the variables assessed. BMI, BP% and WHR were higher among females, and BMI, %BF were higher among males. The most evident correlation was verified between BF% and WHR for men (r=0.824; p<0.001) as much as for women (r=0.914; p<0.001). Among females, %BF and WHR was more strongly related to BMI(r=0.89; r=0.866;p<0.001) than among men. In the analysis between anthropometric variables and lipid profile, it was observed that the most evident correlation happened in males, between BMI and TC, LDL-c, LDL-c/HDL-c ,C/HDL-c (r=0.912; r=0.913; r=0.875; r= 0.798;p<0.001 respectively),BF% and LDL-c(r=0.855; p<0.001), WHR and TC , LDL-c (r=0.817; r=0.792; p<0.001 respectively),and in females between BMI and TG, TG/HDL-c, LDL-c(r=0.89; r=0.866; r=0.855; p<0.001respectively), BF% with TG ,TG/HDL-c and VLDL(r=0.78; r=0.811; r=0.716; p<0.001 respectively),and WHR with TG/HDL-c (r=0.790; p<0.001).Glycaemia was not correlated to any anthropometric indicators. It is concluded thatanthropometric indicators in particular BMI, compared with BF% and WHR is the best screening measure for cardiovascular risk factorsin staff personnel of Iranian Azarbayjan University of Shahid Madani.

Key words: BF%, BMI, WHR, lipid profile, BIA

INTRODUCTION

The prevalence of obesity and cardiovascular disease (CVD) has increased dramatically inIran[1,2]and other countries[3,4]. According to world health organization (WHO), there are about 1.6 billion overweight adults, and at least 400 million of them are obese[5,4]. A positive relation have been established between obesity and cardiovascular manifestations with genetic, environmental and lifestyle factors. With the Framingham study, the first risk factors for cardiovascular disease were identified: arterial hypertension, high cholesterol levels or reduced HDL-cholesterol levels, smoking, *diabetes mellitus* and aging [24].

Obesity is defined as a condition where there is an excess of body fat [7].Many attempts have been made as to identify the best anthropometric predictor of chronic diseases in different populations. Overall adiposity usually measured by body mass index (BMI), and abdominal adiposity, usually assessed by waist-to-hip ratio (WHR)[8,9,10,11,12].BMI calculated from height and weight has been commonly used as easy index for body composition in clinical setting and epidemiological studies[25]. However, in recent years, BMI has been criticized as a measure of body composition because it reflects both fat and lean mass and because it does not identify fat distribution[13]. There is a growing body of evidence suggesting that abdominal adiposity is a more important risk

factor for cardiovascular and metabolic disease than is general adiposity[14]. The mechanisms through which abdominal fat contributes to the risk of these diseases are not fully understood, although one of the components of abdominal fat visceral adipose tissue, which is highly metabolically active, is believed to play a key role[15].

Cumulative evidence indicates that there are ethnic differences in the relationship between BMI and body composition, and between indicators of abdominal adiposity and the actual amount of visceral fat[16,17,18].Therefore, estimates of disease risk for a given level of an anthropometric indicator may differ in different study populations.

Debate over the value of BMI for the estimation of body fat has led some investigators to recommend the use of new technology for the direct measurement of body fat[19].For epidemiological studies with large samples, bioelectrical impedance analysis (BIA) has been recently used to estimate body fat. Based on the principles governing the electrical impedance of body tissues, BIA provides a rapid, noninvasive, and relatively accurate estimation of total body water, from which body composition is derived[20,19]. Impedance is the frequency-dependent opposition of a conductor to the flow of an alternating electric current. Resistance is the pure opposition of the conductor to the alternating current, and reactance is the dielectric component of impedance[20]. Estimates of total body water (TBW), fat-free mass (FFM) and fat mass (FM) can be made using predictive equations that include impedance values[21]. The percentage of body fat (PBF) can then be calculated using FM and body weight.

The present study was designed to verify the relation between anthropometric measures and risk factors (lipid profile) for cardiovascular disease by BAI in staff personnel of Iranian Azarbayjan University of Shahid Madani

MATERIALS AND METHODS

Subjects

This study was conducted inAzarbayjan University ofShahidMadani(AUSM) with the aim of determining the prevalence of non-communicable disease risk factors and developing a healthy lifestyle to curtail these risk factors [21].110 subjects(personnel of AUSM)23 to59 years include 65 male and 45 femalewere free of any previous systemic diseases or medications related to body weight change or affecting blood pressure, glucose and lipid levels, volunteered in this research.

Measurement of anthropometric indexes

Anthropometric indexes were measured by appropriately trained medical care providers at physical education laboratory of ASMU. All subjects wore light clothing and stood in the upright position without shoes during the measurement. Height, waist circumference and hip circumference were measured to an accuracy of 0.1 cm and body weight to an accuracy of 0.1 kg. Total body fat, BMI and waist-hip ratio (WHR) wereestimated from body composition analyzer (zeros 9.9, South Korea). Before measurement, all subjects underwent an overnight fast and were prohibited from vigorous activities within 12 h of measurement. The measurements were performed strictly according to manufacturer instructions.

All BMI (according to NHLBI[1]criteria), BF% and WHR (according to WHO[2] criteria) were categorized in 3 groups: normal BMI (BMI <25 kg/m²), overweight BMI (BMI25-29.9 kg/m²), and high BMI or obesity BMI (BMI≥ 30kg/m²) [26] and low BF%(BF ≤20% for men, BF% ≤30% for women) , intermediate BF %(BF20%-25% for men, 30%-35% for women) and high BF %(BF>25% for men, BF%>35% for women)[27], and low WHR with low risk(WHR≤ 0.95 for men, WHR≤0.80 for women), intermediate WHR with moderate risk(WHR0.96-1.0 for men, 0.81- 0.85 for women), high WHR with risk(WHR≥1for men, WHR ≥0.85 for women)[28].

Measurement ofbiochemical variables

Fasting blood samples were obtained in the early morning *via* the antecubital vein, preserved in a pre-chilled EDTA anticoagulation tube, and submitted to the Clinical Laboratory of Tabriz Alzahra General Hospital for analysis. Fasting plasma glucose (FPG) was measured by an enzymatic colorimetric method using glucose oxidase. Total cholesterol (TC) and triglycerides (TG) were assayed by enzymatic colorimetric tests with cholesterol esterase and cholesterol oxidase and glycerol phosphate oxidase, respectively, using kits from Pars Azmoon Inc. High-density lipoprotein cholesterol (HDL-C) was measured after precipitation of the apo lipoprotein B-containing lipoproteins with phosphotungstic acid. Low-density lipoprotein cholesterol (LDL-C) was calculated from serum TC, TG and HDL-C using the Friedewald formula [29]

[1] -National Health, Lung, Blood Institute
[2] -World Health Organization

Statistical analysis

The data were expressed as mean±SD or %.The statistical analysis were performed with SPSS software for windows(version 16). Comparison of age, anthropometric indicators, biochemical indices was performed using Student's *t*-test. spearman correlations were used to assess relationship between variables.

RESULTS

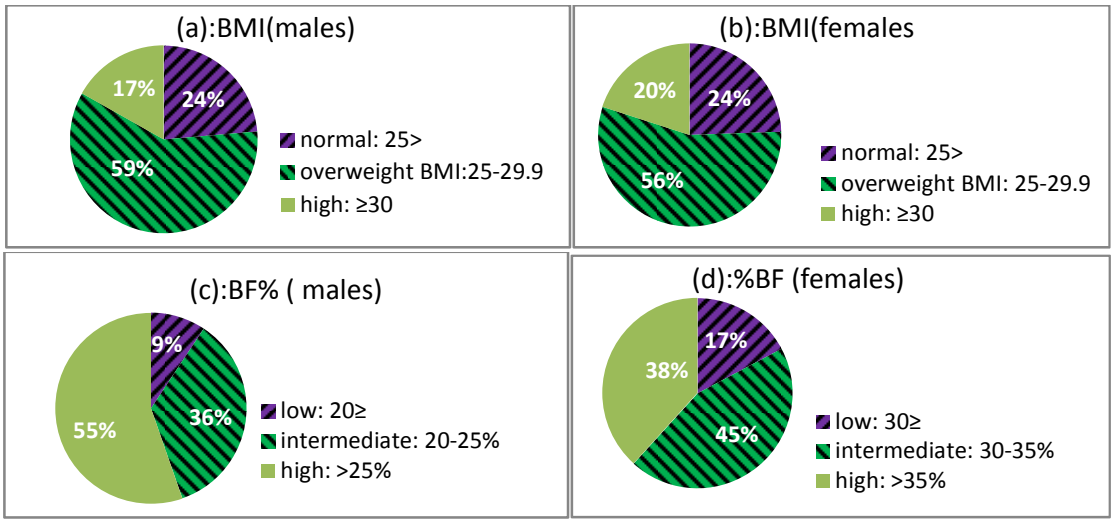
The sample gathered 110 subjects (65 males and 45females) with mean age 39.65 ± 7.42 years old. According to the Table 1, there was a significant difference between sexes for the following variables: height, weight, LBM, BF%, WHR, HDL-c, LDL-c/HDL-c ratio, CT/HDL-c ratio and VLDL ($p<0.05$).

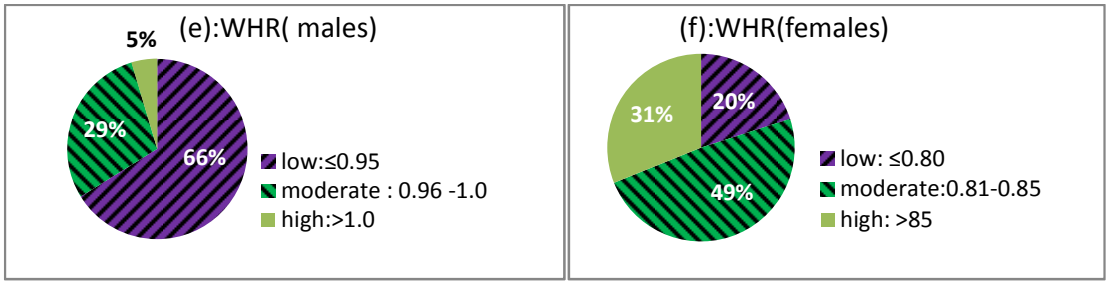
Table1: Anthropometric and biochemical variables of subjects according to sex

Variables	Total	Males	females	p-value
Age(years)	39.65±7.42	40.52±6.25	38.40±8.76	0.141
Height(cm)	166.57±9.81	173.18±5.70	157.02±5.80	0.000*
Weight(kg)	76.14±14.12	81.89±11.96	67.84±12.92	0.000*
MBF(kg)	22.31±6.57	21.38±6.04	23.66±7.12	0.073
LBM(kg)	53.83±10.59	60.51±7.33	44.18±6.22	0.000*
BMI(kg/m²)	27.34±3.89	27.26±3.34	27.47±4.61	0.784
%BF	29.23±6.05	25.72±4.44	34.29±4.21	0.000*
WHR	0.893±0.066	0.92±0.05	0.84±0.04	0.000*
TC(mg/dl)	190 .88±40.05	192.89±43.66	187.98±34.46	0.529
LDL-c(mg/dl)	124.16±28.16	125.94±28.43	123.31±28.01	0.633
HDL-C(mg/dl)	36.73±8.34	30.63±6.52	38.11±8.14	0.000*
VLDL(mg/dl)	29.62±17.53	35.99±27.5	26.49±15.89	0.041**
LDL/HDL-c	3.88±1.19	4.25±1.16	3.36±1.04	0.000*
TG(mg/dl)	158.91±119.4	177.22±138.30	132.47±79.45	0.053
TC/HDL-c	5.98±1.87	6.54±1.90	5.17±1.51	0.000*
TG/HDL	5.29±4.6	6.35±5.38	7.42±24.33	0.732
FG(mg/dl)	87.13±14.99	87.52±17.77	86.57±9.86	0.747

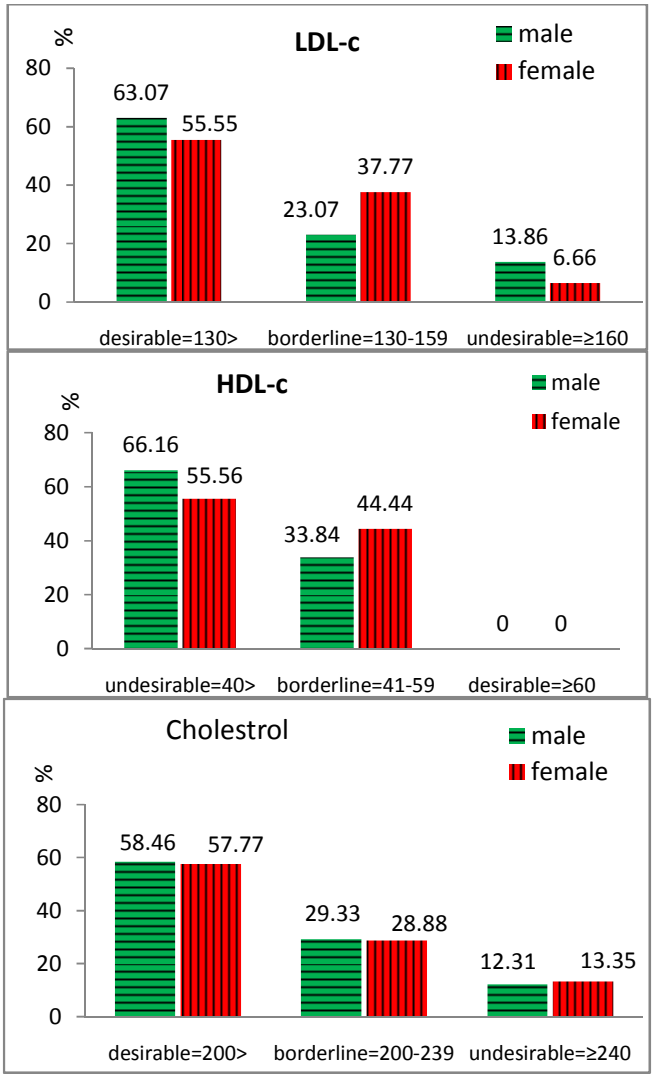
Values expressed by mean and standard deviation(X±SD); Significant difference: p=0.000 ; p=0.041** ; BMI: body mass index; %BF: percentage of body fat; WHR: waist-to-hip ratio; TC: total cholesterol; TG: triglycerides; LDL-c : low density lipoprotein cholesterol; HDL-C:- high- density lipoprotein cholesterol ;FG: fasting glucose.*

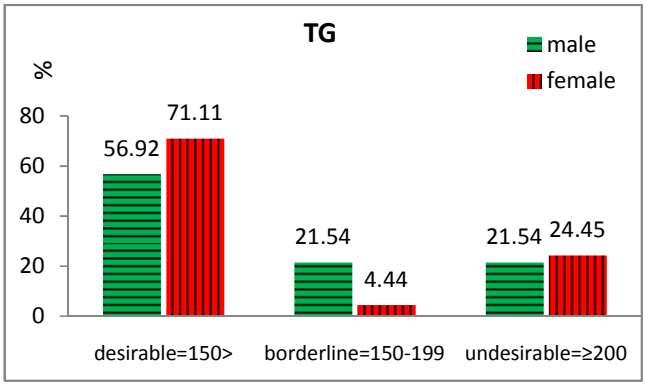
As shown in figure1 according to NHLBI criteria, BMI of %76 males and %80 females higher than the normal. Also according to WHO criteria, BF% of% 55 males and %38 females were higher (figures c and d), and in relative to WHR , according to WHO criteria, %6 of males and %31of females were in high risk category. In relative to lipid profiles as shown in figure 2, LDL-c of %6.66 and %13.86, HDL-c of %66.16 and %55.56, TG of %12.31 and %13.35 and TC of %21.54 and %24.45 of males and females weren't desirable respectively.





Figures (1): The situation of subjects in BMI, BF% and WHR





Figures (2): The situation of subjects in LDL-c, HDL-c, TG and TC

Table 2 shows the correlation of anthropometric indicators between each other, to lipid profile and glycaemia according to sex. The most evident correlation was verified between BF% and WHR for men (r=0.824; p<0.001) as much as for women (r=0.914; p<0.001). Among females, %BF and WHR was more strongly related to BMI(r=0.89; r=0.866; p<0.001) than among men.

Table 2: Correlation between anthropometric variables, lipid profile and glycaemia according to sex

Males	BMI(KG/m²)	WHR	%BF
%BF	r=0.785 *	r=0.824*	----------
WHR	r=0.559 *	----------	r=0.824 *
TC(mg/dl)	r=0.912 *	r=0.817*	r=0.240 ; p=0.54
LDL-c(mg/dl)	r=0.913*	r=0.792*	r=0.855*
HDL-C(mg/dl)	r=-.177 ; p=0.159	r=0.-051 ; p=0.686	r=- 0.118 ; p=0.349
LDL-c/HDL-c	r=0.875*	r=0.124; p=0.323	r=0.215 ; p=0.085
TG(mg/dl)	r=0.077 ; p=0.544	r=0.109; p=0.388	r=0.075 ; p=0.554
C/HDL-c(mg/dl)	r= 0.798 *	r=0.167; p=0.184	r=0.202 ; p=0.106
TG/HDL-c	r=0.081 ; p=0.522	r=0.071; p=0.576	r=0.069 ; p=0.586
FG(mg/dl)	r=0.092 ; p=0.467	r=0.089; p=0.481	r=0.015 ; p=0.906
VLDL(mg/dl)	r=0.145 ; p=0.251	r=0.126; p=0.319	r=0.184 ; p=0.143
Females			
%BF	r=0.89 *	r=0.914*	----------
WHR	r=0.866*		----------
TC(mg/dl)	r=0.141 ; p=0.356	r=0.213 ; p=0.16	r=0.211 ; p=0.164
LDL-c(mg/dl)	r=0.015 ; p=0.924	r=0.128 ; p=0.403	r=0.105 ; p=0.492
HDL-C(mg/dl)	r= - 0.225 ; p=0.137	r=- 0.86 ; p=0.575	r=- 0.093 ; p=0.544
LDL/HDL-c	r=0.169 ; p=0.266	r=0.15 ; p=0.325	r=0.125 ; p=0.412
TG(mg/dl)	r=0.89*	r=0.277 ; p=0.066	r=0.78*
C/HDL-c	r=0.274 ; p=0.069	r=0.212 ; p=0.162	r=0. 205 ; p=0.176
TG/HDL	r=0.866*	r=0.790*	r=0.811 *
FG(mg/dl)	r=0.072 ; p=0.638	r=0.075 ; p=0.623	r=- 0.005 ; p=0.974
VLDL (mg/dl)	r=0.855*	r=0.277 ; p=0.066	r=0.716 *

Significant values: P< 0.001; BMI: body mass index; %BF:percentage of body fat ;WHR: waist-to-hip ratio; TC: total cholesterol; TG: triglycerides; LDL-c: low density lipoprotein cholesterol; HDL-C: high- density lipoprotein cholesterol ;FG: fasting glucose

In the analysis correlation between anthropometric variables and lipid profile, it was observed that the most evident correlation happened in males, between BMI with TC, LDL-c, LDL-c/HDL-c and C/HDL-c (r=0.912; r=0.913; r=0.875;r= 0.798 ;p<0.001 respectively) , BF% with LDL-c (r=0.855; p<0.001), WHR with TC and LDL-c (r=0.817; r=0.792; p<0.001 respectively) , and in females between BMI with TG, TG/HDL-c and VLDL(r=0.89; r=0.866; r=0.855; p<0.001 respectively), BF% with TG ,TG/HDL-c and VLDL(r=0.78; r=0.811 ; r=0.716; p<0.001 respectively), and WHR with TG/HDL-c (r=0.790; p<0.001).The remaining correlations between anthropometric variables and lipid profile weren't significant. Glycaemia was not correlated to any anthropometric indicators.

DISCUSSION

BAI is a widely used technique available in clinic for body composition measurement due to its merits of safety, accuracy, reliability, and low cost as compared to other body composition methods. In the present study we measured BMI, BF% and WHR as anthropometric indicators by BIA for assessment of body composition and to assess relation of them with serum lipid profiles. In this study according to WHO and NHLBI criteria , Cut-off points of, BMI,BF% and WHR were considered as, 25 kg/ m^2, 20% and 0.95 for males, and 25 kg/ $m^{2,}$ 30% and 0.8

for females respectively. The results of this study were showed that in both groups, means of all three indexes (except male's WHR) higher than the Cut-off points of WHO and NHLBI criteria. These results similar withsome finding of other researches[31,32,33].These results are expresses that the prevalence of overweight and obesity are higher in both groups.
The present study also demonstrated that BMI, BF% and WHR were highly correlated with each other in both groups, that this similar with finding of gaeini& et al[34],nakanishi& et al[31] and oliveira& et al[32].

In relative to correlation of anthropometric indicators and lipid profiles , the results were showed that there were a significant correlation between BMI,BF% , WHR and LDL-c in males. It was similar with finding ofesmaelzadeh& et al[36],wangchen&et al[35],oliveira& et al[32] and nakanishi&et al[31].This resultsrevealed that there is a strong relationship between obesity and increasing of LDL-c as a lipid profile and a cardiovascular risk factor.

Also finding of this research were showed that there were a significant correlation between BMI and LDL-c/HDL-c, TC/HDL-c (in males) and TG, TG/HDL-c, VLDL(in females), and between WHR and TC(in males), TG/HDL-c(in females) Also between BF% and TG,TG/HDL-c ,VLDL(in females). These finding were agree with finding of oliveira& et al[32] and Dalton& et al[30].The relation between WHR as visceralfat indicator with TC and TG/HDL-c revealed that increasing of abdominal fat can lead to prevalence of cardiovasculardisease in both sex.

CONCLUSION

It is concluded thatanthropometric indicators in particular BMI, compared with BF% and WHR is the best screening measure for cardiovascular risk factors in staff personnel of Iranian Azarbayjan University of ShahidMadani.

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