Research Paper: The Relationship Between Physical Activity, Lipid Profile, and Two New Anthropometric Cardiovascular Risk Factors Among Men

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ABSTRACT

Background: Cardiovascular diseases are among the most prevalent causes of morbidity and mortality. This research investigated the relationship between physical activity, lipid profile, and new anthropometric cardiovascular risk factors among men.

Methods: This cross-sectional study was conducted on 155 adult men (30-50 years old) who were selected randomly from 250 men called by public announcement. Standard methods were used to measure their anthropometric indices and then they were asked to complete the Baecke questionnaire. ANOVA was used to compare basic anthropometric and clinical characteristics in different age groups followed by Tukey's posthoc test. A correlation of anthropometric measurements with glucose and lipid parameters was determined by the Pearson correlation coefficient. P<0.05 was considered as a significant level.

Results: The Mean ±SD age of the participants was 39.8±0.5 years. Their Mean±SD Body Mass Index (BMI) was 25.6±0.3 kg/m^2 with a Mean±SD Neck Circumference (NC) of 38.4±0.1 cm, and Mean±SD Wrist Circumference (WRC) of 17.4±0.0 cm. There was a statistically significant difference between age groups concerning height, BMI, WRC, and Fasting Blood Glucose (FBG). The NC showed statistically significant correlation with weight (r=0.7, P<0.001), triglyceride (r=0.1, P=0.033), High-Density Lipoprotein (HDL) (r=-0.2, P=0.007) and Physical Activity (PA) (r=-0.1, P=0.020). Also the WRC had statistically significant correlation with weight (r=0.7, P<0.001), height (r=0.1, P=0.021) and HDL (r=-0.1, P=0.024).

Conclusion: Measuring NC like other methods was a potential assessment tool of cardiovascular risk factors and can be used for epidemiological studies. Also, WRC had no significant relation. However, WRC's negative correlation with HDL was very important and can indicate the health status of individuals.

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1. Introduction

Cardiovascular diseases are among the most common causes of morbidity and mortality around the world. Inactivity, unhealthy diet, smoking, high-risk lifestyle, obesity, etc., can be the major risk factors for cardiovascular diseases [1]. Measuring Body Mass Index (BMI) and obesity are common and comprehensive approaches to evaluate and screen the health of the population. Therefore, several methods have been developed to measure body fat. However, laboratory methods are often costly and time-consuming and require advanced equipment and experiences [2].

Waist Circumference (WC), Waist-Hip Ratio (WHR), and BMI are low-cost evaluation factors that are related to dyslipidemia as cardiovascular risk factors [3-5]. Studies indicate that cardiovascular disease risk factors are dyslipidemia (75%), overweight and obesity (53%), and hypertension (16.5%) [6, 7]. Also, one of the most important risk factors for cardiovascular diseases is dyslipidemia. It can be determined by other indices such as high levels of cholesterol, triglyceride, and Low-Density Lipoprotein (LDL) and low level of High-Density Lipoprotein (HDL) [7].

Circumferences of neck and wrist are considered as anthropometric indices in addition to WC, WHR, and BMI [8-12]. Many studies have been performed to investigate an accurate relationship between these two indices and cardiovascular disease risk factors [13]. Ben-Noun et al. demonstrated that the circumference of the neck can be used to predict cardiovascular risk factors [14]. Moreover, Tatar et al. reported that neck and wrist circumferences are reliable indicators to predict the metabolic syndrome and cardiovascular diseases [10]. Other studies revealed that wrist circumference is an appropriate predictor for cardiovascular disease [9, 11, 15].

It is necessary to evaluate the relationship between new indices and physical activity levels to have a better understanding of new anthropometric indices (neck and wrist circumferences) because few studies have been done in this regard. Tibana et al. showed that physical exercise can be effective in preventing cardiovascular diseases by improving the neck muscle strength [12]. This research aimed to investigate the relationship between physical activity, lipid profile, and two new anthropometric cardiovascular risk factors among men.

2. Methods

This cross-sectional study was conducted on men (30-50 years old) in Birjand City, Iran. In one of the clinics in Birjand, 151 men (out of 250 participants) were volunteered for participation in this study. Based on the exclusion criteria, 4 people excluded because of their physical disabilities in the wrist (1 person), in the waist and hips (2 people), and neck (1 person). After choosing the samples, permission and written consent were obtained from them. The subjects were asked to complete the Baecke Questionnaire for physical activity [16]. It has three parts: the level of physical activity at work, the level of individual sports activities, and leisure activity. Questions were rated on a 5-point Likert-type scale and physical activity score was obtained by calculation of these three-part scores. Standard methods were used to measure the anthropometric indices. Height and weight were measured by weighing scale and measuring tape, respectively and then BMI was calculated by dividing weight (kg) over squared height (m^2).

Circumference of the widest part of the hip (WH) was evaluated while the samples were standing on a smooth and flat place. Waist circumference was measured while the samples were standing without clothes and the tape measure was placed between the last rib and the iliac crest. Neck circumference was measured while the samples were standing erect with their head positioning in Frankfort horizontal level and the tape measure was placed right under laryngeal prominence [10, 12, 17]. Wrist circumference was measured with subjects in a seated position using tape measuring right and left wrists. Twelve hours of fasting blood samples were taken by skilled technicians.

The samples were transported to the lab immediately and stored in a freezer at –10° C. The level of Total Cholesterol (TC), Triglycerides (TG), Low-Density Lipoprotein (LDL), High-Density Lipoprotein (HDL), and Fasting Blood Glucose (FBG) were measured by using the enzymatic colorimetric method [18]. Dyslipidemia was defined as the presence of at least one criteria such as high cholesterol (>240) or non-HDL-C (>160) or high TG (>200) or high LDL (>130) or low HDL (<40 for men) [19].

The test results and medical recommendations were given to the participants and after surveying the information and ensuring that they were correctly entered into SPSS V. 22. Descriptive information was presented by using mean and standard error. The normality test was performed by the Kolmogorov-Smirnov test. Levene's test was performed to evaluate the homogeneity of variances. ANOVA was used to compare basic anthropometric and clinical characteristics in different age groups followed by Tukey's post-hoc test. A correlation of anthropometric measurements with glucose and lipid parameters was evaluated by the Pearson correlation coefficient. P<0.05 was considered as a significant level.

3. Results

The results showed that the Mean±SD age of all men was 39.8±0.5 years. Their Mean±SD BMI was 25.6±0.3 kg/m^2 with a Mean±SD waist circumference of 95.5±0.9 cm. Also, their Mean±SD HC was 102.3±0.6 cm, WHR

Table 1. Basic anthropometric characteristics of participants

Parameters	Mean±SD				ANOVA	
	Age Group (Y)				Statistics	P
	30-35	35-40	40-45	45-50		
Weight (kg)	77.9±1.8	81.8±2.0	79.9±2.1	80.8±2.2	0.5	0.702
Height (cm)	180.3±0.9	178.7±0.8	174.5±1.3[ab]	173.4±0.9[abc]	9.1	<0.001*
BMI (kg/m^2)	24.1±0.6	25.5±0.5	26.2±0.7	27.1±0.7[a]	2.7	0.014*
WC (cm)	91.7±1.6	97.1±1.6	98.7±1.6[a]	99.6±1.8[a]	3.2	0.006*
HC (cm)	100.0±1.0	102.9±1.2	103.1±1.2	103.0±1.3	0.6	0.624
NC (cm)	38.0±0.3	38.6±0.3	38.3±0.2	38.7±0.4	0.8	0.497
WRC (cm)	17.2±0.1	17.4±0.1	17.5±0.1	17.7±0.1	1.8	0.100
PA	7.0±0.1	7.0±0.1	1.0±0.3	7.2±0.1	0.5	0.675

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BMI: Body Mass Index; WC: Waist Circumference; HC: Hip Circumference; NC: Neck Circumference; WRC: Wrist Circumference; PA: Physical Activity;

[a] Significant difference with age 30-35; [b] Significant difference with age 35-40; [c] Significant difference with 40-45.

*P<0.05.

Table 2. Basic clinical characteristics of participants

Parameters	Mean±SD				ANOVA	
	Age Group (Y)					
	30-35	35-40	40-45	45-50	Statistic	P
FBG (mg/dL)	85.5±1.5	86.6±1.6	86.8±2.1	105.5±5.7[a]	7.0	<0.001*
TC (mg/dL)	194.3±5.2	193.6±5.5	215.5±8.0	207.1±6.5	2.4	0.087
LDL (mg/dL)	119.8±4.3	125.1±5.0	137.7±6.4	131.1±5.0	2.1	0.077
HDL (mg/dL)	39.8±0.9	41.6±1.1	43.6±1.4	41.0±1.2	1.2	0.312
TG (mg/dL)	182.2±18.4	135.5±9.9	167.4±19.8	192.8±40.3	0.9	0.442

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PA: Physical Activity; FBG: Fasting Blood Glucose; TC: Total Cholesterol; TG: Total Triglycerides; LDL: Low-Density Lipoprotein; HDL: High-Density Lipoprotein;

[a] Significant difference with age 30-35; [b] Significant difference with age 35-40; [c] Significant difference with 40-45

*P<0.05.

Table 3. The correlations of anthropometric measurements with glucose and lipid parameters

Parameters		BMI	WC	HC	NC	WRC	WHR
Weight	R	0.8	0.9	0.8	0.7	0.7	0.6
	P	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
Height	R	-0.2	-0.08	0.03	-0.01	0.1	-0.2
	P	0.003*	0.300	0.681	0.814	0.021*	0.006*
FBG	R	0.1	0.05	-0.01	0.1	0.04	0.1
	P	0.226	0.483	0.826	0.247	0.572	0.999
TC	R	0.1	0.1	0.08	0.07	0.08	0.1
	P	0.095	0.106	0.292	0.340	0.337	0.110
TG	R	0.1	0.1	0.1	0.1	0.1	0.1
	P	0.070	0.089	0.227	0.033*	0.064	0.062
LDL	R	0.03	0.01	-0.01	-0.004	0.003	0.036
	P	0.691	0.843	0.853	0.957	0.968	0.663
HDL	R	-0.04	-0.08	-0.06	-0.2	-0.1	-0.1
	P	0.622	0.303	0.432	0.007*	0.024*	0.159
Non-HDL-C	R	0.1	0.1	0.1	0.1	0.1	0.1
	P	0.061	0.055	0.202	0.120	0.141	0.047*
PA	R	-0.1	-0.2	-0.2	-0.1	-0.1	-0.1
	P	0.115	0.019*	0.020*	0.020*	0.234	0.073

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BMI: Body Mass Index; WC: Waist Circumference; HC: Hip Circumference; WHR: Waist-Hip Ratio; NC: Neck Circumference; WRC: Wrist Circumference; PA: Physical Activity; FBG: Fasting Blood Glucose; TC: Total Cholesterol, TG: Total Triglycerides; LDL: Low-Density Lipoprotein; HDL: High-Density Lipoprotein

*P<0.05.

0.9±0.01 cm, NC 38.4±0.1 cm, and WRC 17.4±0.55 cm. The demographic features of subjects and their comparisons between age groups can be seen in Table 1. There were statistically significant differences between age groups concerning height, BMI, and WC. Post-hoc analysis showed that older men had shorter height, higher BMI, and WBC in comparison with young participants.

The Mean±SD FBG level of all men was 90.7±1.6, TC was 200 ±3.1, LDL was 126.9 ±2.5, HDL was 41.3±0.6, and TG was 167.8±11.9. There was a statistically significant increase in the mean FBG between older men and young participants (Table 2).

Table 3 shows that NC has statistically significant positive correlations with anthropometric and clinical parameters as weight (r=0.7, P<0.001) and TG (r=0.1, P=0.033), negative correlation with HDL (r=-0.2, P=0.007) and Physical Activity (PA) (r=-0.1, P=0.020). WRC also showed statistically significant positive correlation with weight (r=0.7, P<0.001) and height (r=0.1, P=0.021), and negative correlation with HDL (r=-0.1, P=0.024). Also, physical activity showed a negative relationship with WC (r=-0.2, P=0.019), HC (r=-0.2, P=0.020), and NC (r=-0.1, P=0.020).

4. Discussion

To the best of our knowledge, the relationship between physical activity with two new indices (e.g. NC and WRC) has rarely been studied which makes it difficult to interpret the content and conclusions. Tibana et al. reported that risk factors of cardiovascular diseases can be reduced by the improvement of muscular strength of the neck [12]. Reduction in NC, indicating the more active the person is that is probably related to the regular exercise and increased energy expenditure, and regulation of hormonal activity. Also, enhanced cellular enzymes involved in fat breakdown leads to the use of intracellular TG in the process of energy production in aerobic activities. As a result, the release of free fatty acids into the bloodstream would reduce the size of fat cells around the neck.

Based on the results, the mean values of WRC, NC, and PA were not statistically different in age groups. However, WC and BMI increase by age statistically alike FBG and height. Samson et al. and Lernmark showed that by increasing age, the height would be reduced, and also FBG and BMI would increase [20, 21]. Correlation analysis showed that NC had positive correlations with anthropometric and clinical parameters like weight and TG which was similar to Ben-Noun et al. [13, 14, 17] and Androutsos et al. [22] results. Also, a significant negative correlation between NC and HDL levels were found which was similar to Ben-Noun et al. [13] and Androutsos et al. [22] studies.

However, other research like Ben-Noun et al. indicated no significant relationship between HDL and NC [14, 17]. Moreover, LDL, TC, and non-HDL-C had no statistical relationship with NC which was similar to studies of Tatar et al. [10] and Androutsos et al [22]. Based on the results, an increase in NC could result from the accumulation of fat in the upper region of the body, an unhealthy condition for those with larger neck who should change their lifestyle, especially their diet and physical activity. Besides, a negative significant relationship between NC and PA indicated that physical activity could decrease NC as a cardiovascular risk factor.

WRC had a significant negative relationship with HDL, and no significant correlation with TC, TG, and LDL. Other studies have yielded different results [10, 11, 15, 23]. It can be stated that changes in the size of fat cells and the distribution of adipose tissue, can also cause changes in body composition [24]. Differences between the results of various studies may be due to differences in study populations. For example, some of the studies were conducted on metabolic syndrome and cardiovascular patients while this study was conducted on a healthy population.

A high blood sugar level due to impaired insulin secretion is associated with a high intake of sugar. High consumption of sugar and high energy intake create extra calories stored as fat in adipose tissue. In this study, FBG had no significant relationship with any of the anthropometric indices such as NC or WRC. Patil et al. reported a positive association between FBG and anthropometric indices such as BMI, WHR, and WC [25]. Also, Tatar et al. [10] and Ben-Noun et al. [14] showed a significant positive correlation between NC and WRC with FBG level among women.

This study includes some limitations. The causal associations cannot be inferred by a cross-sectional study. Further research on more potential risk factors is needed to understand more comprehensively the use of new indices to develop prevention and control measures for epidemiological studies. Also, we did not control the nutritional status of the subjects.

5. Conclusion

The results showed that NC along with other traditional methods is a potential assessment tool for physical activity and cardiovascular risk factors and can be used in epidemiological studies. WRC has no significant relationship with these variables, especially physical activity. However, its negative correlation with HDL was very important and can indicate the health status of individuals potentially.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Research Council Birjand University of Medical Sciences (Code:IR.BUMS.REC.1396.346).

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Authors' contributions

Study design, data collection, and manuscript preparation: All authors; Data analysis: Mojtaba Amirabadizadeh; Mohammad Esmaeil Afzalpour.

Conflict of interest

The authors declared no conflict of interest.

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