The association between anthropometric parameters and cardiovascular risk indicators in women with polycystic ovarian syndrome

Ahmad Mirdamadi[(1)](ID), Soheila Riahinejad[(2)], Samane Varnaseri[(3)]

Short Communication

Abstract

BACKGROUND: In patients with polycystic ovarian syndrome (PCOS), this is now hypothesized that whether increased risk for cardiovascular disorders is related more to obesity than PCOS per se. This study aimed to compare cardiovascular risk factors between the lean and obese women with PCOS.

METHODS: This case-control study was conducted on 86 (43 obese and 43 lean) women with PCOS. The presence of overweight and obesity was defined based on the body mass index (BMI) (> 25 kg/m²). The study objectives were first to compare mean levels of cardiovascular laboratory parameters between lean and obese patients with PCOS and then to assess the relationship between obesity indices and these laboratory parameters.

RESULTS: Compared to the lean group, the obese group had significantly higher mean fasting blood sugar (FBS) (89.40 ± 10.73 versus 84.09 ± 7.87 mg/dl, P = 0.011), higher mean serum triglyceride (TG) (119.09 ± 60.66 versus 96.86 ± 27.23 mg/dl, P = 0.032), higher mean total cholesterol (147.70 ± 57.38 versus 126.79 ± 35.95 mg/dl, P = 0.045), and also higher mean low-density lipoprotein (LDL) (92.30 ± 13.53 versus 83.77 ± 17.61 mg/dl, P = 0.014). Using the Pearson's correlation test, positive correlations were found between BMI and waist circumference (WC) indices and study parameters including FBS, serum TG, serum total cholesterol, serum LDL, and also blood pressure (BP).

CONCLUSION: Because of higher concentrations of FBS and lipid profiles in obese patients with PCOS and considering obesity as a more important risk factor for coronary artery disease (CAD) than PCOS, it is recommended to assess and monitor cardiovascular risk factors in these population to reduce the risk for cardiovascular disorders and metabolic syndrome. Also, by reducing body weight and normalizing BMI value, the cardiovascular and metabolic risk factors can be modified and prevented.

Keywords: Obesity; Cardiac; Risk Factors; Polycystic Ovarian Syndrome

Introduction

In addition to inherited pattern of polycystic ovarian syndrome (PCOS), its related endocrinological aspects have been also well determined. Even, this syndrome has been identified as the most common endocrinopathy in women within the childbearing period with an overall prevalence range of 4% to 12%.[1,2] The metabolic aspect of PCOS is frequently based on the reduced insulin sensitivity, leading to increased risk for progressive diabetes mellitus (DM) and its complications. Furthermore, obesity, hyperlipidemia, and systolic hypertension (HTN) are well-known comorbidities among women with PCOS with higher prevalence than the general population.[3]

In fact, higher prevalence of these risk components predisposes patients with PCOS to coronary atherosclerosis and thus coronary atherogenesis is an early event predictable in these patients.[3]

1- Associate Professor, Department of Cardiology, Najafabad Branch, Islamic Azad University, Najafabad, Isfahan, Iran
2- Assistant Professor, Department of Gynecology, Najafabad Branch, Islamic Azad University, Najafabad, Isfahan, Iran
3- General Practitioner, Najafabad Branch, Islamic Azad University, Najafabad, Isfahan, Iran
Address for correspondence: Ahmad Mirdamadi; Associate Professor, Department of Cardiology, Najafabad Branch, Islamic Azad University, Najafabad, Isfahan, Iran; Email: drsamirdamadi@yahoo.com

In total, various studies could demonstrate lower high-density lipoprotein (HDL) cholesterol, as well as higher serum levels of triglycerides (TGs), low-density lipoprotein (LDL) cholesterol, and homocysteine.[4] Moreover, endothelial dysfunction and also increased carotid intima-media thickness (CIMT) are more prevalent in patients with PCOS compared to age-matched controls.[5-8] All of these risk profiles increase the risk for myocardial infarction (MI) in patients with PCOS.[9-11]

As previously pointed, special metabolic manifestations of PCOS include fasting hyperinsulinemia, peripheral insulin resistance, and dyslipidemia. In fact, this syndrome is now identified as a major cause of DM, so the prevalence of glucose tolerance test and diabetes in obese women with PCOS is 11% and 38%, respectively,[12] and thus, it seems that the occurrence of metabolic disturbances and also cardiovascular risk factors can be associated with the simultaneous presence of obesity in these patients.

In this regard, it is now hypothesized that the increased risk for cardiovascular disorders may be related to obesity in the patients with PCOS. Therefore, the present study aimed to compare cardiovascular risk factors between the lean and obese women with PCOS.

Materials and Methods

This case-control study was conducted on 86 women with PCOS (43 obese and 43 lean women) who referred to Shariati Hospital in Isfahan, Iran, in 2014. The presence of PCOS in the subjects was confirmed based on the meeting two of the following three criteria: presence of oligo-ovulation or anovulation, clinical or biochemical signs of hyperandrogenism (not due to pituitary, adrenal, or tumor-related causes), and presence of polycystic ovaries by ultrasound.[13]

The presence of overweight and obesity was defined based on the body mass index (BMI) measures as BMI higher than 25 kg/m². Patient selection was based on their reference to our clinic and then everybody who met inclusion criteria was included and obese and lean patients, based on criteria, were divided to two groups.

The two groups were matched for three parameters of age, present medication, and history of smoking. The exclusion criteria were unwillingness to participate in the project, history of kidney disease, DM type I, and BMI lower than 19 kg/m².

This study was approved by the Research and Ethics Committees of Islamic Azad University, Najafabad Branch, Isfahan, Iran.

After explaining the study aims to participants and also receiving written informed consent, baseline characteristics and medical data were collected by reviewing.

In all participants, body weight was measured using the same calibrated digital scale and height was also measured by a standard stadiometer with the participant wearing no shoes. BMI was calculated using the most recent weight (kilograms) documented in the medical record divided by the height (meters squared).[13] Waist circumference (WC) was measured using flexible tapes on a horizontal plane, midway between the lower border of the ribs and the iliac crest. Blood pressure (BP) was measured by a physician in all participants. Laboratory parameters including fasting blood sugar (FBS) and lipid profiles were also measured by especial laboratory techniques. The study objectives were first to compare mean levels of cardiovascular laboratory parameters between lean and obese patients with PCOS and then to assess the relationship between obesity indices (BMI and WC) and these laboratory parameters.

For the statistical analysis, SPSS statistical software (version 16, SPSS Inc., Chicago, IL, USA) was used. Kolmogorov–Smirnov test (K-S test) was used for checking normality of distribution of variables. Data were expressed as mean ± standard deviation (SD) and absolute number by percent for quantitative and categorical variables, respectively.

Categorical variables were compared using chi-square test or Fisher's exact test when more than 20% of cells with expected count of less than 5 were observed.

Quantitative variables were also compared using t-test or Mann-Whitney U test. The correlation between quantitative variables was assessed using the Pearson's correlation coefficient test.

P-value of less than 0.050 was considered statistically significant.

Results

In total, 43 patients in obese group and 43 in lean group were included into the study.

The mean age of the participants in obese and lean groups was 24.26 ± 3.32 and 25.21 ± 2.23 years, respectively, with no difference (P = 0.122).

The mean BMI was 28.27 ± 2.41 kg/m² in the obese and 21.99 ± 1.89 kg/m² in the lean group (P < 0.001) with the mean WC of 95.23 ± 5.91 and 82.37 ± 6.68 cm, respectively (P < 0.001).

Table 1. Clinical and laboratory parameters in obese and lean groups

Item	Lean group (n = 43)	Obese group (n = 43)	P
FBS (mg/dl)	84.09 ± 7.87	89.40 ± 10.73	0.011
TG (mg/dl)	96.86 ± 27.23	119.09 ± 60.66	0.032
Cholesterol (mg/dl)	126.79 ± 35.95	147.70 ± 57.38	0.045
LDL (mg/dl)	83.77 ± 17.61	92.30 ± 13.53	0.014
HDL (mg/dl)	41.37 ± 12.04	34.49 ± 12.64	0.429
SBP (mmHg)	112.56 ± 11.20	116.05 ± 12.56	0.178
DBP (mmHg)	72.09 ± 7.89	74.42 ± 6.29	0.134

P-value < 0.050 is significant

Statistical analysis is based on dependent t-test

FBS: Fasting blood sugar; TG: Triglyceride; LDL: Low-density lipoprotein; HDL: High-density lipoprotein; SBP: Systolic blood pressure; DBP: Diastolic blood pressure

Comparing clinical and laboratory parameters between the two study groups (Table 1) showed that compared to the lean group, the obese group had significantly higher mean FBS (P = 0.011), higher mean serum TG (P = 0.032), higher mean total cholesterol (P = 0.045), and also higher mean LDL (P = 0.014), but there was no difference between the two groups in terms of mean serum HDL level (P = 0.429) as well as in mean systolic BP (SBP) (P = 0.178) and diastolic BP (DBP) (P = 0.134). Using the Pearson's correlation test (Table 2), positive correlations were found between BMI index and all study laboratory parameters including FBS (P < 0.001), serum TG (P = 0.001), serum total cholesterol (P = 0.002), serum LDL (P = 0.002), and also SBP (P = 0.031) and DBP (P = 0.002). Also, the positive association was revealed between WC and the indicators of FBS (P = 0.001), serum TG (P = 0.001), serum total cholesterol (P = 0.011), serum LDL (P = 0.038), and also SBP (P = 0.003) and DBP (P = 0.001).

Discussion

The present study concluded important points. It was demonstrated that the obese women with PCOS had higher levels of lipid profiles, including serum TG (P = 0.032), total cholesterol (P = 0.045), and serum LDL (P = 0.014) as well as higher FBS (P = 0.011). In fact, these women were posed in higher risk for glucose and lipid metabolism impairment; however, these patients had similar SBP and DBP compared to those lean women with PCOS and therefore, obese women with PCOS may have normal BP and no increased risk for HTN.

In this regard, it seems that the PCOS patients with obesity may be more in danger of cardiovascular disorders as well as metabolic syndrome when compared to non-obese women with PCOS. A new viewpoint to PCOS that we recommend is: 'PCOS by itself is not an important risk factor for coronary artery disease (CAD)." Indeed, accompanying obesity is a strong risk factor for CAD and should be managed optimally which is concomitant with PCOS in these patients. In a similar study by Conway et al.,[13] obese women with PCOS were found to have higher SBP, serum TG, and plasma glucose concentration than lean women with PCOS group. In another study by Holte et al.,[14] plasma concentrations of free fatty acids and TGs, and also total and LDL cholesterol were markedly higher in obese than in non-obese women with PCOS. They also showed higher levels of fasting insulin levels than non-obese ones. Similar to our finding that was shown in patients with PCOS, obesity was associated with blood sugar and lipid profiles impairment. In fact, the mechanisms of occurring obesity in women with PCOS may be associated with the lipid metabolism pathways and vice versa.

Table 2. Correlation between anthropometric indices and laboratory parameters in obese and lean groups

Index	Pearson value	FBS	TG	Cholesterol	LDL	HDL	SBP	DBP
BMI	R coefficient	0.393	0.349	0.330	0.335	0.072	0.232	0.326
	P	< 0.001	< 0.001	< 0.001	< 0.001	0.509	0.031	< 0.001
WC	R coefficient	0.340	0.347	0.271	0.224	0.047	0.321	0.343
	P	< 0.001	< 0.001	0.011	0.038	0.667	0.003	< 0.001

BMI: Body mass index; WC: Waist circumference; FBS: Fasting blood sugar; TG: Triglyceride; LDL: Low-density lipoprotein; HDL: High-density lipoprotein; SBP: Systolic blood pressure; DBP: Diastolic blood pressure

Similarly, Pirwany et al.[15] showed an important relationship between lipids and lipoprotein subfractions and metabolic and endocrine parameters in women with PCOS; they figured out that independent predictor of plasma TG and lipase activity was fat distribution which was assessed by WC and fasting insulin concentration. In an important survey by Elting et al.,[16] not only FBS and lipid profiles were more impaired in obese women with PCOS than in non-obese ones, but also it was demonstrated that the influence of obesity on hyperinsulinemia, dyslipidemia, and HTN was stronger than major indicators including menstrual cycle pattern or follicle size. In another study by Roa et al.,[17] women with PCOS showed significantly higher values of the TG/HDL ratio which is closely related to WC and insulin resistance and sensitivity indexes, with the highest values being observed in obese patients.

Conclusion

The findings in the present study lead to two final conclusion. First, because of higher concentrations of FBS and lipid profiles in obese patients with PCOS, the assessing and monitoring of cardiovascular risk factors is advisable in these population to reduce the risk of cardiovascular disorders and metabolic syndrome. Second, because of the association between overweight and obesity and these risk factors, it seems that by reducing body weight and normalizing BMI value, the cardiovascular and metabolic risk factors can be modified and their risks will be prevented.

Acknowledgments

Conflict of Interests

Authors have no conflict of interests.

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