Research Article

Comparative study of metabolic profile of women presenting with polycystic ovary syndrome in relation to body mass index

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ABSTRACT

Background: Polycystic ovary syndrome (PCOS) is characterized by hyperandrogenism, ovulatory dysfunction and polycystic ovaries (PCO). The objective was to study and compare the metabolic effects of PCOS in lean PCOS (BMI <23) and obese PCOS (BMI >23).
Methods: Fifty healthy women who were euthyroid with age range 15-38 years who presented to gynecology OPD and diagnosed to have PCOS according to ESHRE/ASRM criteria were included in the study. BMI (body mass index) was calculated by the formula weight in kg/height in meter square. BMI were calculated were divided into 2 groups. Lean PCOS found in patients with BMI <23 kg/m^2 and overweight/obese PCOS found in patients with BMI >23 kg/m^2.
Results: Hypertension, deranged lipid profile, insulin resistances were frequently seen in obese PCOS than in lean PCOS. Deranged GTT (glucose tolerance test) was not statistically significant in these two groups p=0.15.
Conclusions: The study concludes that obese PCOS were at higher risk of developing hypertension, deranged lipid profile and insulin resistance than lean PCOS as obesity is significant contributor to metabolic syndrome. Glucose intolerance was present in both obese and lean PCOS.

Keywords: PCOS, Hypertension, Lipid profile, Insulin resistance, GTT, MBS

INTRODUCTION

Polycystic ovary syndrome (PCOS) was first reported in modern medical literature by Stein and Leventhal who, in 1935, described seven women suffering from amenorrhea, hirsutism, and enlarged ovaries with multiple cysts. It is now recognized as a common heterogeneous, heritable disorder affecting women throughout their lifetime.[1] The consequences of PCOS extend beyond the reproductive axis; as women with this syndrome are at substantial risk of developing metabolic syndrome.[1] "Metabolic syndrome" (MBS) is a constellation of cardiovascular disease risk factors associated with insulin resistance, glucose intolerance, dyslipidemia, hypertension and central obesity.[2,3] Although much remains unknown regarding the underlying pathophysiology of PCOS, a form of insulin resistance intrinsic to the syndrome appears to play a central role in its development. Among many women with PCOS, the observed insulin resistance is partially explained by excess adiposity; however it is increasingly recognized that even lean women PCOS have increased insulin resistance compared to normal controls.[4] Considering the relationship between insulin resistance and obesity, the relative contribution of these two parameters to the endocrinometabolic disturbances of PCOS and their impacts on hyperandrogenism and chronic anovulation are pivotal in understanding of this complex syndrome, which has not been clearly elucidated. It is recognized that BMI could be an important determinant. Nevertheless, the differential impact of insulin resistance and obesity on the disorders of the syndrome needs to be highlighted.[5]

The objective was to study and compare the metabolic effects of PCOS in lean PCOS (BMI <23) and obese PCOS (BMI >23).

METHODS

This observational cross sectional study was conducted in the department of gynaecology at Kasturba hospital Delhi, India. Total fifty patients who attended gynecology OPD and met the inclusion criteria were enrolled in the study. BMI were calculated were divided into 2 groups.

Group A (lean PCOS): Patients with BMI<23 kg/m^2

Group B (overweight/obese PCOS): Patients with BMI >23 kg/m^2

Women of age range 15-38 years diagnosed to have PCOS according to ESHRE/ASRM criteria were included in the study after obtaining a written informed consent.

Exclusion criteria

Other causes of hyperandrogenism, patient who have received any medication known to affect carbohydrate metabolism for at least 3 months before the study, Women using oral contraceptive pills, pregnancy and lactation and hypothyroidism.

Blood pressure was measured and lipid profile (HDL, LDL, triglycerides, total cholesterol), 75 g oral glucose tolerance test (fasting blood sugar and 2nd hour post prandial), insulin resistance by HOMA-IR were done in all patients.

Statistical evaluation

Statistical evaluation was done by using SPSS (statistical package of the social sciences). Qualitative variables were expressed as numbers and percentages while quantitative variables were expressed as means. P-value less than 0.05 was considered as significant.

RESULTS

Out of 50 women were diagnosed to have PCOS according to ESHRE/ASRM criteria, there were more obese or overweight women (56%) with BMI >23 and mean BMI of 29.52±2.43. There were 44% who were lean with BMI <23 and mean BMI of lean 21.87±1.19 (Table 1).

Table 1: Distribution of women with PCOS according to BMI.

BMI	Total		Lean PCOS BMI<23kg/m^2 (Group A)		Obese PCOS BMI≥23kg/m^2 (Group B)	
	No	%	No	%	No	%
18-23 kg	22	44%	22	44%	0	0%
23.1-28 kg	10	20%	0	0%	10	20%
>28 kg	18	36%	0	0%	18	36%
Number of patients	50	100%	22	44%	28	56%
Mean BMI	25.90±4.58		21.87±1.19		29.52±2.43	

The women in obese group were of older age, belonging to higher socioeconomic status than the lean. The mean age of all PCOS women of our study was 24.98 years. The mean age group of lean PCOS and obese PCOS women was 23.32±3.14 years and 26.28±4.18 years respectively.

Blood pressure

9 (18%) PCOS women had systolic B.P >130 mmHg out of whom 9 (32.1%) were all obese PCOS. 10 (20%) PCOS women had diastolic B.P >85 mmHg out of whom 10 (35.7%) were all obese PCOS.

The mean systolic B.P of all the PCOS women was 120.76±8.95 mmHg. The mean systolic BP of lean PCOS and obese PCOS was 116.36±1.92 mmHg and 124.21±10.70 mmHg respectively. The difference of systolic BP was statistically significant between the two groups. P-value=0.001(statistically significant).

The mean diastolic B.P was 75.48±6.41 mm Hg. The mean diastolic BP of lean PCOS and obese PCOS was 73± 3.07 mmHg and 77.43±7.64 mmHg respectively. The difference of diastolic BP was statistically significant between the two groups. P-value=0.014 (statistically significant). 12 (24%) PCOS women had mild hypertension and all the 12 (42.9%) were obese PCOS. (Table 2, 3).

Lipid profile

14 (28%) PCOS women had deranged lipid profile out of whom 3 (13.6%) were lean PCOS and 11 (39.3%) were obese PCOS.

The difference of deranged lipid profile was statistically significant between the two groups. P-value=0.045(statistically significant) (Table 4).

35 (70%) of PCOS women had normal GTT out of which 18 (81.8%) were lean and 17 (60.8%) were obese PCOS.

12 (24%) of PCOS women had impaired GTT out of which 4 (18.2%) were lean and 8 (28.6%) were obese. 3 (6%) of PCOS women were diabetic and these 3 (10.7%) were all obese. The difference of deranged glucose tolerance test was not statistically significant. P value=0.15 (statistically not significant).

Table 2: Profile of blood pressure in women with PCOS.

Blood pressure	Total		Group A (lean PCOS)		Group B (obese PCOS)		
	Number	%	Number	%	Number	%	
SBP (mmHg)							
<120	41	82%	22	100%	19	67.9%	P-value=0.001
120-130	0	0%	0	0%	0	0%	
>130	9	18%	0	0%	9	32.1%	
Mean SBP	**120.76±8.95**		**116.36±1.92**		**124.21±10.70**		
DBP (mmHg)							
<80	39	78%	21	95.5%	18	64.3%	P-value=0.014
80-85	1	2%	1	4.5%	0	0%	
>85	10	20%	0	0%	10	35.7%	
Mean DBP	**75.48±6.41**		**73.00±3.07**		**77.43±7.64**		

Table 3: Degree of hypertension in women with PCOS.

Hypertension	Total	Group A (lean PCOS)	Group B (obese PCOS)
Normotensive	38 (76%)	22 (100%)	16 (57.1%)
Mild (BP>130/85)	12 (24%)	0	12 (42.9%)
Severe (BP>160/100)	0	0	0

1 (3.6%) of obese PCOS had FBS >125 mg/dl (diabetes) and none of the lean was diabetic. 2 (7.2%) of obese PCOS had 2nd hour pp >200 mg/dl and none of the lean was diabetic. The mean FBS of lean and obese PCOS women was 87.23±5.81 and 86.86±13.18 mg/dl respectively. The mean 2nd HR PP of lean and obese was 115.45±11.09 mg/dl and 120.93±18.78 mg/dl respectively. The difference of FBS and 2nd HR PP was not statistically significant between the two groups (Table 6).

Table 4: Deranged lipid profile in women with PCOS.

	Group A (lean PCOS)		Group B (obese PCOS)		p-value
	No	%	No	%	
Deranged lipid profile	3	13.6%	11	39.3%	0.45
Mean HDL (mg/dl)	56.27±5.17		52.89±7.65		0.082
Mean LDL (mg/dl)	128.22±14.03		141.43±24.12		0.027
Mean triglyceride (mg/dl)	123.18±14.73		139.93±28.17		0.015
Mean cholesterol (mg/dl)	176.50±16.92		201.46±36.91		0.005

Table 5: GTT profile in women with PCOS.

GTT	Total		Group A (lean PCOS)		Group B (obese PCOS)		P-value
	No	%	No	%	No	%	
Normal GTT	35	70	18	81.8	17	60.8	0.15
Impaired GTT	12	24	4	18.2	8	28.6	
Diabetes	3	6	0	0	3	10.7	

Table 6: FBS and 2nd HR PP in PCOS.

	Lean PCOS		Obese PCOS		p-value
	Number	%	Number	%	
FBS>125 mg/dl	0	0	1	3.6%	
2ND HR PP>200 mg/dl	0	0	2	7.2%	
Mean FBS	87.23±5.81		86.86±13.18		0.903
Mean 2nd HR	115.45±11.09		120.93±18.78		0.168

Independent of obesity per se, PCOS is associated with higher prevalence of insulin resistance, impaired glucose tolerance and type 2 diabetes as evident by a higher incidence of deranged GTT, high HOMA-IR score (> 2.5) and high HbA1c (>6.5) in both groups with comparable values. The fasting insulin level was higher in obese group (13.58 μIU/ml) than in lean group (11.3 μIU/ml). P-value ≤0.001 (statistically significant). 88% of all PCOS were insulin resistant (HOMA-IR>2.5) with a preponderance in obese women (Table 7).

Table 7: Insulin and other metabolic features of PCOS.

	Group A lean PCOS		Group B obese PCOS		p-value
Fasting insulin >10 Miu/ml	19	86.4	25	89.29	
Mean fasting insulin	11.30±1.91		13.58±2.15		<0.001
Fasting insulin:glucose ratio	0.13±0.02		0.15±0.03		0.001
HOMA-IR>2.5	19	86.4	25	89.3	0.009
Mean HOMA-IR	2.44±0.45		2.93±0.75		
Mean HbA1c	5.19±0.30		6.18±0.48		
HbA1c < 5.7	0		2		
HbA1c 5.7-6.5	18		21		0.363
HbA1c 6.5	4		5		

DISCUSSION

The manifestations of PCOS are not confined to the gynaecological sphere; women afflicted by this disease show an increased prevalence of several co-morbidities, including obesity, dyslipidemia, hypertension, metabolic syndrome and type 2 DM in comparison with women without PCOS. These features along with other alterations underlie the greater risk of developing cardiovascular disease and all-cause mortality observed in these subjects.[6]

The prevalence of obesity varies in these women, and in present study bit was more common as 56% were found to be obese/overweight with BMI >23 kg/m^{2} which is similar to study done by Saxena P et al (58%).[7] Asian Indians have higher percentage body fat, abdominal obesity at lower or similar levels of BMI levels as compared to white Caucasians. Asians are more predisposed to develop insulin resistance and cardiovascular risk factors at lower levels of BMI as compared to other ethnic groups.[8]

Obese PCOS usually presents in older age group than lean PCOS as in the present study, mean age was higher in obese group (26.28±4.18 years) than in lean group (23.32±3.14 years). Morales AJ et al observed that the mean age of lean PCOS was 26.7±1.9 years and obese PCOS was 27.9±2.1 years which is comparable to this study.[9] PCOS was more common in obese women from affluent society than in lean women.

Independent of obesity and consistent with the increased insulin resistance, women with PCOS displayed an increased prevalence of impaired glucose tolerance and type 2 diabetes in this study as evident by a high incidence of deranged GTT, high HOMA-IR score (>2.5) and high HbA1c (>6.5). Several studies have pinpointed insulin resistance (IR) as the fundamental link associating PCOS and metabolic syndrome, although IR may be present in PCOS independently of obesity.[10] Boudreaux et al reported 5 fold risk of developing DM2 over a period of 8 years in women with PCOS, compared with the risk calculated using age and weight matched controls.[11]

The prevalence of mild hypertension was more in obese group than in lean group which is comparable with the other studies.[12] Obese PCOS had significantly higher deranged lipid profile than the lean PCOS women. Holte J et al studied serum lipoprotein lipid profile in women with PCOS and their weight matched controls and observed obese women with PCOS had higher concentrations of total cholesterol, LDL, low HDL than in lean counterparts. But he also inferred that the atherogenic lipoprotein pattern is entirely accounted by obesity and there is no significant effect of PCOS or hyperinsulinism on lipoprotein profile.[13]

CONCLUSION

The present study reveals that obesity seen in 56% of observed patients plays an important role in metabolic alterations in women with polycystic ovarian syndrome. The consequences of PCOS extend beyond reproductive axis. Hyperinsulinemia and glucose intolerance were present in both lean and obese PCOS, but obesity aggravates the underlying insulin resistance as judged by a higher HOMA-IR score in obese PCOS. Metabolic abnormalities like hypertension and deranged lipid profile

and the concurrent cardiovascular health risks were more frequently observed in obese PCOS. Thus they are at substantial risk of developing metabolic syndrome and obesity was a significant contributor to its development.

Hence it is suggested that life style modification such as exercise and weight reduction and periodic monitoring should be done in all PCOS women and more so in obese. The most important aspect of long term care of PCOS is managing cardiovascular risks such as obesity, insulin resistance, diabetes, hypertension and elevated blood lipids.

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