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ORIGINAL ARTICLE

Prevalence and Risk Factors of Metabolic Syndrome in Women with Polycystic Ovarian Syndrome

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ABSTRACT

OBJECTIVE: To find out the prevalence and risk factors of metabolic syndrome among females presenting with polycystic ovarian syndrome (PCOS) in a tertiary care setting.
METHODOLOGY: This cross-sectional study was performed at the Department of Obstetrics and Gynecology, The Combined Military Hospital (CMH), Rawalpindi, Pakistan, from January to December 2022. A total of 277 non-pregnant females aged 18-35 years and diagnosed with PCOS presenting in the outpatient department were analyzed. Metabolic syndrome was diagnosed according to the AHA/NHLBI (ATP III) definition, while PCOS was labeled as per Rotterdam consensus guidelines. Prevalence of metabolic syndrome and associated risk factors were noted.
RESULTS: In a total of 277 women with PCOS, the mean age was 27.4±5.6 years, while 149 (53.8%) women were aged between 18 and 25. The residential status of 189 (68.2%) women was rural. There were 81 (29.2%) women with PCOS who were found to have metabolic syndrome. Waist circumference ≥ 80 cm ($p=0.0031$), HDL cholesterol < 50 mg/dl ($p<0.0001$), triglyceride ≥ 150 mg/dl ($p<0.0001$), hypertension ($p<0.0001$) and fasting blood glucose (FBG) > 110 mg/dl ($p<0.0001$) were having significant association with the presence of metabolic syndrome.
CONCLUSION: A high prevalence of metabolic syndrome was found among women with polycystic ovarian syndrome. Central obesity, hypertension and abnormal levels of FBG, triglyceride and high-density lipoprotein were found to have a significant association with MBS among women with PCOS.

KEYWORDS: Hypertension, metabolic syndrome, obesity, polycystic ovarian syndrome, triglyceride.

INTRODUCTION

Polycystic ovarian syndrome (PCOS) is a heterogeneous and indistinct disorder which presents a complicated pathophysiology[1]. Among endocrine disorders, PCOS is the most common and affects around 4-20% of females of reproductive age[2]. Guidelines for the diagnosis of PCOS are well-established now[3]. Endocrine abnormalities comprise metabolic syndrome (MBS), which includes insulin resistance (IR), dyslipidemia, obesity, and hypertension. With MBS, the chances of cardiovascular disease (CVD) become double and five times those of type 2 diabetes (T2DM). National Cholesterol Education Program (NCEP) described in their report of Adult Treatment Panel III (ATPIII) that among central obesity with waist circumference ≥88 cm in women, elevated systolic and/or diastolic blood pressure of ≥130/85 mmHg, impaired fasting blood glucose (FBG) ≥ 110mg/dl, elevated fasting serum triglycerides≥150mg/dl, fasting high-density lipoprotein (HDL) cholesterol < 50 mg/dl, the presence of three or more risk factors is labeled as MBS[4]. Regional data shows the prevalence of MBS in females with PCOS to be 23.5% [5]. In PCOS, obesity is frequently observed, which further aggravates insulin resistance[6-8].

There is a need to prioritize the metabolic health of females who have PCOS, whereas time identification and preventive measures of MBS can be highly beneficial. The findings of this study might update the local data about the current burden and risk factors of metabolic syndrome among females. This research aimed to determine the prevalence and risk factors of MBS among females presenting with PCOS in a tertiary care setting.

METHODOLOGY

This observational cross-sectional study was done at The Department of Obstetrics and Gynecology, The Combined Military Hospital (CMH), Rawalpindi, Pakistan, from January to December 2022. Approval was taken from the "Institutional Ethical Committee" through letter number 326. At the time of enrollment, informed and written consent was sought. The estimated sample size was 277, taking the prevalence of MBS as 23.5%, [5] with a 95% confidence level and 5% margin of error. Inclusion criteria were non-pregnant females aged 18-35 years and diagnosed with PCOS presenting in the outpatient department. The MBS was diagnosed as per NCEP guidelines as "among central obesity with waist circumference ≥88 cm in women, elevated systolic and/or diastolic blood pressure of ≥130/85 mmHg, impaired fasting blood glucose (FBG) ≥ 110mg/dl, elevated fasting serum triglycerides≥150mg/dl, fasting high-density lipoprotein (HDL) cholesterol < 50 mg/dl, the presence of three or more risk factors is labeled as MBS" [4]. Known cases of "late-onset congenital adrenal hyperplasia", type-1 diabetes, adrenal tumors, Cushing's syndrome or Pituitary adenoma were excluded. Females who had used steroid or oral contraceptive drugs in the preceding three months or were previously diagnosed with any cardiovascular problems or cases of hyperprolactenemia were also not included. Women who did not wish to be part of this research for any reason were also excluded. A non-probability purposive sampling technique was adopted.

All females were clinically examined, and related laboratory investigations were conducted. At the time of enrollment, age, menstrual pattern, blood pressure (both systolic and diastolic), waist circumference (WC), modified "Ferriman Gallwey (FG) score", PCO pattern on ultrasonography, fasting blood glucose (FBG) and fasting lipid profile were noted. Prevalence of MBS was the primary outcome of this research. PCOS was labeled as ESHRE/Rotterdam consensus guidelines[9].

Data analysis adopted "Statistical Package for Social Sciences (SPSS)", version 28.0. Descriptive statistics were used to highlight the data. The chi-square test and independent sample t-test were used to determine the level of significance considering $p<0.05$ statistically significant. Relative risk (RR) and 95% confidence intervals were also calculated.

RESULTS

In a total of 277 women with PCOS, the mean age was 27.4±5.6 years, while 149 (53.8%) women were between 18-25 years. The residential status of 189 (68.2%) women was rural. The mean waist circumference was 86.5±4.2 cm. The mean HDL, triglyceride and FBG levels were 52.6±6.4 mg/dl, 156.2±8.6 mg/dl and 98.4±8.1 mg/dl, respectively. **Table I** shows the characteristics of women's PCOS. Evaluation of MBS revealed that 81(29.2%) women with PCOS had MBS, as demonstrated in **Figure I**.

Comparison of study variables concerning presence of MBS among women with PCOS showed that waist circumference ≥ 80 cm (RR=2.09; 95%CI: 1.22-3.56, p=0.0031), HDL cholesterol < 50 mg/dl (RR=2.12; 95%CI: 1.45-3.12, p<0.0001), triglyceride ≥ 150 mg/dl (RR=2.50; 95%CI: 1.65-3.78, p<0.0001), hypertension (RR= 2.24; 95%CI: 1.58-3.16, p<0.0001) and FBG>110 mg/dl (RR=2.62; 95%CI: 1.85-3.70, p<0.0001) were having significant association with the presence of MBS while age, residential status and hirsutism FG score > 8 were not having any considerable relationship with MBS (p>0.05) as shown in **Table II**.

Table I: Characteristics of Women with PCOS (n=277)

Characteristics		Number (%)
Age (years)	18-25	149(53.8%)
	26-35	128(46.2%)
Residence	Urban	88(31.8%)
	Rural	189(68.2%)
Waist Circumference ≥80 cm		198(71.2%)
HDL-Cholesterol < 50 mg/dl		127(45.8%)
Triglyceride ≥ 150 mg/dl		135(48.7%)
Blood pressure ≥ 130/85		73(26.4%)
Fasting blood glucose > 110 mg/dl		78(28.2%)
Hirsutim FG score > 8		186(67.1%)

Figure I: Prevalence of MBS among Women with PCOS (n=277)

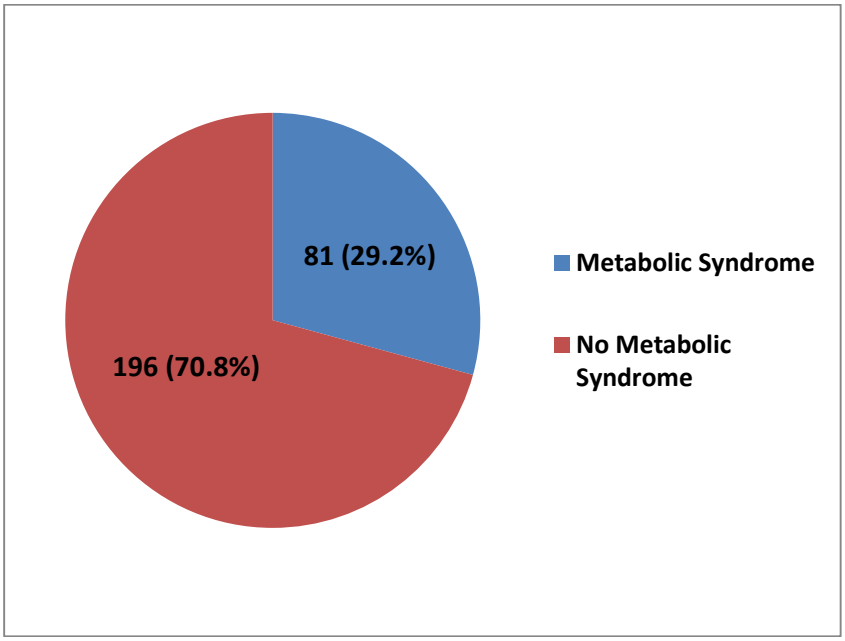

Table II: Distribution of Study Variables concerning the presence of MBS (n=277)

Study Variables		Metabolic Syndrome (n=81)	No Metabolic Syndrome (n=196)	Relative Risk	95% CI		P-Value
Age (years)	18-25	45 (55.6%)	104 (53.1%)	1.07	0.74	1.55	0.7048
	26-35	36 (44.4%)	92 (46.9%)	0.93	0.64	1.35	
Residence	Urban	32 (39.5%)	56 (28.6%)	1.40	0.97	2.02	0.0754
	Rural	49 (60.5%)	140 (71.4%)	0.75	0.55	1.03	
Waist Circumference ≥80 cm		68 (84.0%)	130 (66.3%)	2.09	1.22	3.56	0.0031
HDL-Cholesterol < 50 mg/dl		52 (64.2%)	75 (38.3%)	2.12	1.45	3.12	<0.0001
Triglyceride ≥ 150 mg/dl		57 (70.4%)	78 (40.0%)	2.50	1.65	3.78	<0.0001
Blood pressure ≥ 130/85		36 (44.4%)	37 (18.9%)	2.24	1.58	3.16	<0.0001
Fasting blood glucose > 110 mg/dl		41 (50.6%)	37 (18.9%)	2.62	1.85	3.70	<0.0001
Hirsutim FG score > 8		51 (63.0%)	135 (68.9%)	0.83	0.57	1.21	0.3401

DISCUSSION

This study found that the occurrence of MBS among PCOS patients was 29.2%, which was lower than the 42% mentioned in research done by Dey and colleagues[10]. PCOS affects women of all age groups, while its presentation varies a lot as the spectrum of symptomology is broad[11]. Goverde and coworkers[12] found the prevalence of MBS among females having PCOS to be 15.9%, which is somewhat lower than what we noted. The variation in the prevalence rates of MBS among females having PCOS could be attributed to differences in age groups considered in different research. We had analyzed females aged between 18-35, but Dey R 2011[10] enrolled females aged between 15 to 35 years. Another reason could be that we utilized the ethnic-specific WHO recommendation, which mentioned the waist circumference cut-off value for Asian women as ≥80 cm.

The incidence of MBS was significantly associated with higher waist circumference. Among the South Asian population, MBS is affected by regional factors like urbanization, standard of living, and traditions[13]. In terms of metabolic parameters, waist circumference (≥80cm), HDL (<50 mg/dl), serum Triglyceride (≥150mg/dl), FBG (>110 mg/dl), and hypertension were the commonly deranged parameters and had a significant association with MBS. According to Dey R 2011[10,] the commonest parameters were low HDL cholesterol and hypertension, consistent with the present findings. To confirm the risk of MBS or to exclude it, every described criterion was studied for its evaluation in this study.

The regional data also reports a much higher prevalence of MBS among women with PCOS (46.2%) when both younger and adult females presenting with PCOS and following the IDF criteria were studied. According to the previous data, among PCOS females, there have been specific phenotypes for whom the chances of developing MBS are higher and, latterly, prolonged risk of cardiovascular disease and/or T2DM[14,15]. Higher occurrence of MBS was observed in weight-matched PCOS females against non-PCOS females in another study[16]. Hahn S et al. [17] described 33.8% as the incidence rate of MBS in German females presenting PCOS (IDF criteria). They concluded that with the increasing age and obesity, the occurrence rate also increased. In the Netherlands, PCOS women with anovulatory cycles were studied, which represented waist circumference >83.5 cm, with hyperandrogenism being evident biochemically, predicting the existence of MBS and IR[12]. The association of central obesity with the occurrence of MBS in females produced by our study was in accordence with Janssen I 2004[18] who discovered that waist circumference was more significant in terms of obesity-related risk factors. Past local data has shown the prevalence of MBS to be 35.6% among women with PCOS. At the same time, relatively higher age, waist circumference, FBG levels, and deranged-related hormonal levels have been reported[19]. Ideally, all infertile females presenting PCOS should be screened, but practically, it is not so easy, remarkably, when the resources are limited. We suggest, based on our study results, that females presenting with central obesity waist-hip ratio >85 cm should undergo MBS evaluation[20,21].

The study place was a tertiary hospital, while non-PCOS females were not enrolled to form a control group. From the perspective of accurate estimation of MBS occurrence among women with PCOS, further studies involving large sample sizes can be planned.

CONCLUSION

A high prevalence of MBS was found among women with PCOS. Central obesity, hypertension and abnormal levels of FBG, triglyceride and high-density lipoprotein were found to have a significant association with MBS among women with PCOS.

Ethical permission: Combined Military Hospital, Rawalpindi Pakistan IRB letter No. 324.
Conflict of Interest: No conflicts of interest.
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Data Sharing Statement: The corresponding author can provide the data proving the findings of this study on request. Privacy or ethical restrictions bound us from sharing the data publicly.

AUTHOR CONTRIBUTION

Wasim Z: Study concept, Methodology, data collection
Riaz T: Substantial contributions to the conception of the work
Shafique S: Drafting and revising the work for important intellectual content
Shahid G: Data Collection, Literature Review
Bano I: Data Collection, Assembly of data
Shehzadi H: Proof Reading, Critical Revisions

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