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ASSOCIATION OF METABOLIC SYNDROME AND POLYCYSTIC OVARIAN SYNDROME -A CROSS-SECTIONAL STUDY

Obstetrics & Gynaecology

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ABSTRACT

Introduction: PCOS is widely acknowledged as the most frequent endocrinopathy among women of reproductive age, with a global prevalence of 6-10%. Women diagnosed with Polycystic Ovary Syndrome (PCOS) face enduring metabolic challenges, such as type 2 diabetes, unfavourable cardiovascular risk factors, as well as reproductive and psychological implications.

Aims and Objectives:

- To study the prevalence of polycystic ovarian syndrome (according to Rotterdam criteria) among cases attending Gynaecology OPD
- To study the prevalence of obesity among polycystic ovarian syndrome.
- To study the association of metabolic syndrome with polycystic ovarian syndrome.

Material and Methods: This is a cross-sectional study conducted at the Department of Obstetrics and Gynaecology, ACS Medical College, Chennai from July 2022 to December 2022. Sixty healthy non-pregnant females of 18-30 years having documented features of PCOS (according to Rotterdam criteria, 2003) were selected and assessed for the presence of metabolic syndrome (according to NCEP criteria). The data were collected in structured Proforma and analysed with relevant statistical methods. **Results:** Out of 60 cases, 36 (60%) were married and 24 (40%) were unmarried. Major presenting symptoms were irregular menses (90%) and hirsutism (85%). There was no difference between overweight/obese and normal cases concerning presenting symptoms ($p>0.05$). Metabolic syndrome was higher in obese and overweight cases while compared with non-obese cases, the P value was significant ($p<0.0001$). **Conclusion:** Every 1 out of 8 females attending Gynaecology OPD is suffering from PCOS, showing the gravity of the disease. Out of the total 45 obese and overweight PCOS cases, 30 (66.66%) had metabolic syndrome and out of 15 non-obese PCOS cases, only 3(20%) had metabolic syndrome Metabolic syndrome was higher in Obese and overweight cases, compared with non-obese cases. As a result, it is critical to determine the increasing trend of metabolic syndrome in PCOS-affected females and to act quickly to prevent the long-term consequences of this condition.

KEYWORDS

Metabolic syndrome, PCOS, endocrinopathy

Introduction:

1935 Irving F. Stein and Michael L. Leventhal described a symptom complex due to an ovulation[1]. Stein-Leventhal syndrome, often known as polycystic ovarian syndrome (PCOS), is a syndrome that affects women's reproductive health. Excess hair in the body, absence of menstrual cycle (amenorrhea) and infertility are all common symptoms of PCOS[2]

PCOS is the most common endocrinopathy among women in their reproductive years; its prevalence ranges from 6 to 10% globally.

The PCOS criteria were first established by the National Institutes of Health (NIH) in 1990[3], and then the Rotterdam criteria were introduced in 2003[4]. This criterion is fulfilled by any two of the following three conditions: (a) polycystic ovaries (There are approximately twelve 2–9 mm follicles in each ovary.), (b) clinical/biochemical hyperandrogenism, and (c) oligomenorrhea/anovulation. The Androgen Excess Society (AES) established the AES criteria in 2006; these included clinical and biochemical hyperandrogenism accompanied by either polycystic ovaries or oligo/anovulation.[5]

The National Cholesterol Education Programme - Adult Treatment Panel III (NCEP - ATP111) criteria originally defined metabolic syndrome in 2001 as the co-occurrence of three or more of the subsequent risk factors (i) In women, central obesity with a waist circumference of 88cm, (ii) ≥130/85mmHg in the systolic and diastolic blood pressure, (iii) lowered serum glucose during fasting ≥110mg/dL, (iv) increased triglycerides in the fasting serum ≥150mg/dL, and (v) HDL cholesterol (high-density lipoprotein) < 50 mg/dL during fasting[6].

Lifelong metabolic problems, such as insulin resistance (IR), type 2 diabetes (T2D), and unfavourable cardiovascular risk profiles, are experienced by women with PCOS.[7,8] and reproductive (such as difficulties during pregnancy, infertility)[9] and psychological implications (e.g., anxiety, sadness, low quality of life (QoL), eating disorders)[10,11,12]

PCOS and obesity are commonly linked to insulin resistance[13]. The most prevalent cause of compensatory hyperinsulinemia and insulin resistance is fat[14]. Obesity is common in PCOS and further aggravates insulin resistance[15]

One of the endocrine and metabolic syndromes that women of reproductive age report having the most is PCOS. It is a heterogeneous illness with symptoms of ovarian malfunction and androgen excess if no other diagnosis occurs. The most commonly reported signs of PCOS that lead to infertility in women are irregular menstruation and problems with reproduction.[16, 17] Compared to the general population, PCOS patients had two to six times greater rates of endometrial cancer, hypertension, lipid metabolic problems, and cardiovascular disease[18]. This highlights the significance of early identification of metabolic syndrome and insulin resistance in PCOS-affected women, followed by the implementation of preventive treatments. The clinical expression and metabolic manifestation of PCOS are significantly impacted by obesity.

Aims & Objectives:

- To study the prevalence of polycystic ovarian syndrome (according to Rotterdam criteria) among cases attending Gynaecology OPD
- To study the prevalence of obesity among polycystic ovarian syndrome.
- To study the association of metabolic syndrome with polycystic ovarian syndrome

Methods:

Study was conducted at the Department of Obstetrics and Gynaecology, ACS Medical College, Chennai from July 2022 to December 2022. Sixty non-pregnant females of 18-30 years having documented features of PCOS (according to Rotterdam criteria, 2003[4]) were selected from those attending the outpatient department (OPD) and assessed for the presence of metabolic syndrome (according to NCEP criteria[6]).

Each patient had undergone a detailed clinical examination and a relevant laboratory evaluation.

Inclusion criteria-

1. Women with PCOS aged 18 to 30 who are not pregnant (based on the Rotterdam criteria, 2003[4])

Exclusion criteria-

1. Women less than 18 years and more than 30 years
2. Diagnosed case of any other Endocrine disorder
3. Abnormal prolactin level
4. Abnormal thyroid level
5. Pregnant women

Investigations:

Age, weight, waist circumference and blood pressure were recorded. Collection of blood samples: 5ml of venous blood was collected in the heparinised bottle after an overnight fast of 12 hrs. The serum was separated and the following parameters were estimated -

1. Estimation of fasting blood sugar
2. Estimation of total cholesterol by CHOD-PHOD/phosphor tungstate method of Alliance
3. Estimation of High-Density Lipoprotein (HDL) cholesterol by CHOD – POD phosphotungstate method by Burstein
4. Estimation of triglycerides by glycerol phosphate oxidase method of Jacob
5. Rotterdam PCOS diagnostic criteria[4]:
6. NCEP diagnostic criteria for metabolic syndrome[6]
7. BMI (Body Mass Index) was calculated for each patient according to formula:

$BMI = \text{Weight in kg} / (\text{Height in meters})^2$

Patients were classified according to BMI into 4 groups:

a) Underweight: Body mass index <19.9 kg/m^2
b) Normal weight: body mass index 20 kg/m2 to 24.9 kg/m^2
c) Overweight: body mass index 25 kg/m2 to 29.9 kg/m^2
d) Obese: body mass index >30 kg/m^2

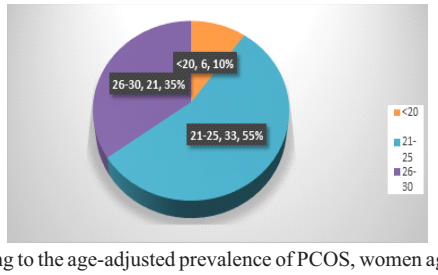
The institutional ethics committee approves this study. The data were collected in structured proforma and analysed with relevant statistical methods.

Observations and Results:

Table 1: Demographic status

Characteristics	No. of patients (n=60)	%
Age group (years)		
<20	6	10
21-25	33	55
26-30	21	35
Marital Status		
Unmarried	24	40
Married	36	60

CHART1



According to the age-adjusted prevalence of PCOS, women aged 21 to 25 had a greater prevalence of the condition 33 (55%) compared to just 6 (10%) in the age group under 20. Out of the total 60 cases, 36 (60%) were married while the remaining 24 (40%) were unmarried. (TABLE 1, CHART 1)

Table 2: Association of Age with BMI Category

Obesity / Overweight	N	Mean Age	SD	p-value
No	15	22.61	2.99	0.13
Yes	45	24.98	3.89	

The mean age of the cases with lean PCOS was lower than obese PCOS (22.61 vs 24.98 years; p-0.13). The difference was however statistically non-significant. (Table2)

Table 3: Association of Presenting Symptoms with BMI Category

Symptoms	Obesity/ Overweight		Total	p-value
	Yes (n-45)	No (n-15)		
Irregular Menstruation	41(91.1%)	13(86.7%)	54 (90%)	0.63
Hirsutism	39(86.7%)	12(80%)	51 (85%)	0.67
Infertility	11(45.8%)	5(41.7%)	16 (44.4%)	1.00
Acne	11(24.4%)	2(13.3%)	13 (21.7%)	0.48
Alopecia	7(15.6%)	2(13.3%)	9 (15.0%)	1.00

Major presenting symptoms were irregular menses (90%), Hirsutism (85%), acne (21.7%), and alopecia (15%). Infertility was seen in 16 out of 36 married females (44.4%). No difference was observed between overweight/ obese and normal cases concerning presenting symptoms (p>0.05). (Table 3 & Chart 2)

CHART 2

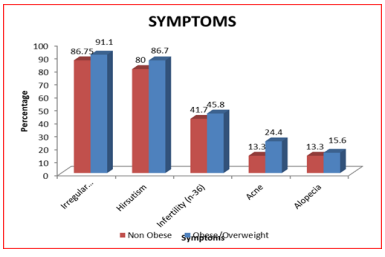


Table 4. Association of Family History with BMI Category

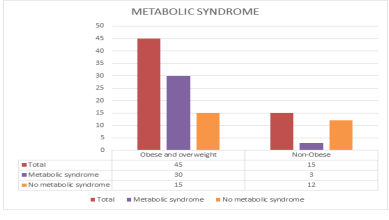
Family History	Obesity/ Overweight		Total	p-value
	Yes (n-45)	No (n-15)		
PCOS	17 (37.8%)	1 (6.75%)	18 (30%)	<0.05
Diabetes	16 (35.6%)	1 (6.75%)	17 (28.3%)	<0.05

Overweight/ obese cases had a significant association with a positive family history of PCOS (37.8% vs 6.7%) and a history of diabetes (35.6% vs 6.7%) in comparison to lean PCOS. (Table 4)

Table 5: Prevalence of Metabolic syndrome among obese and Non-Obese PCOS groups

Metabolic Syndrome	Obese & Overweight (N=45)		Non-Obese (N=15)		P value
	Number	%	Number	%	
Yes	30	66.66	3	20.00	P<0.0001
No	15	33.33	12	80.00	P<0.0001

CHART 3



Out of the total 45 obese and overweight PCOS cases, 30 (66.66%) met the diagnostic criteria of metabolic syndrome and out of 15 non-obese PCOS cases, only 3(20%) had metabolic syndrome.

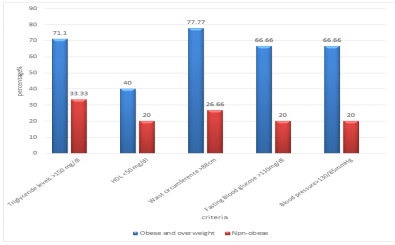
Metabolic syndrome was higher in obese and overweight cases. While comparing with non-obese cases P value was significant (p<0.0001) Among 15 non-obese PCOS cases, 12(80%) were not affected by metabolic syndrome, and out of 45 obese and overweight PCOS cases, 15(33.33%) were not affected by metabolic syndrome. (Table5, Chart 3)

Table 6: CRITERIA FOR METABOLIC SYNDROME AMONG OBESE AND NON-OBESE PCOS GROUPS

Criteria for Metabolic Syndrome	Obese & Overweight (N=45)		Non-Obese (N=15)		P value
	Number	%	Number	%	

Triglyceride levels >150 mg/dl	32	71.11	5	33.33	P<0.0001
HDL <50 mg/dl	18	40.00	3	20.00	P<0.0001
Waist circumference >88cm	35	77.77	4	26.66	P<0.0001
Fasting Blood glucose >110mg/dl	30	66.66	3	20.00	P<0.0001
Blood pressure>130/85mmHg	30	66.66	3	20.00	P<0.0001

CHART 4



In the present study out of 45, triglyceride levels were increased in 32 (71.11%) Obese cases, HDL 18 (40%), and fasting blood glucose levels were increased in 30 (66.66%), waist circumference was increased in 35(77.77%) in Obese and overweight cases. While comparing metabolic syndrome with Obese and Non-Obese values are statistically significant (P<0.0001) (TABLE 6,CHART 4)

DISCUSSION:

This study aimed to study the prevalence of polycystic ovarian syndrome (PCOS) among cases attending Gynaecology OPD and to find the prevalence of metabolic syndrome among cases of PCOS. Polycystic ovarian syndrome cases were diagnosed according to Rotterdam criteria.

The age-adjusted prevalence of metabolic syndrome has shown that women between 21-25 years have a higher prevalence 33 (55%) of metabolic syndrome, in comparison to only 6 (10%) in the <20 years age group. Similarly in the study of Prema N et al. (2018)[19] the occurrence of metabolic syndrome was more in the age group 26 to 35 years (62.33%).

Hanif et al.[20] evaluated the relationship between Body Mass Index, PCOS and its clinical presentation. A total of 80% of patients suffering from PCOS were obese or overweight. This is similar to the present study where the prevalence was 75%.

Overweight/obese cases had a significant association with a positive family history of PCOS (37.8% vs 6.7%) and a history of diabetes (35.6% vs 6.7%) in comparison to lean PCOS. A similar study by Akshaya S et al.[21], also observed a family history of PCOS and obesity to be more in the obese group than in the lean group.

Major presenting symptoms were irregular menses (90%), Hirsutism (85%), acne (21.7%) and alopecia (15%). Infertility was seen in 16 out of 36 married females (44.4%). No difference was observed between overweight/ obese and normal cases concerning presenting symptoms (p>0.05). Similarly, Sowmya D et al.[22] in their study observed common clinical symptoms were: hirsutism (96%), acne (42%), heavy voice (4%) and breast atrophy (4%).

In the present study out of 45, triglyceride levels were increased in 32 (71.11%) Obese cases, HDL 18 (40%) and fasting blood glucose levels were increased in 30 (66.66%), waist circumference was increased in 35(77.77%) in Obese and overweight cases. Comparing metabolic syndrome with Obese and Non-Obese values is significant. The prevalence of metabolic syndrome was significantly associated with increasing BMI. Among the individual metabolic parameter's waist circumference ≥88cms and serum Triglyceride ≥150mg/dl were the most commonly deranged parameters. A study conducted by Dey Ramprasad et al[23] found waist circumference > 88 cm in 34%, HDL cholesterol< 50 mg/dl in 50%, triglycerides ≥ 150 mg/dl in 40%, BP ≥130/85 mm Hg in 50% and FBS≥ 110 mg/dl in 16%.

Out of the total 45 obese and overweight PCOS cases, 30 (66.66%) have metabolic syndrome and out of 15 non-obese PCOS cases, only 3(20%) have metabolic syndrome. Thus, Metabolic syndrome was higher in Obese and overweight cases when compared with non-obese cases.

Sachdeva G et al[24] evaluated that Insulin Resistance, metabolic syndrome, deranged lipid profile, statistically more common in the obese PCOS group (P < 0.05).

CONCLUSION:

The ill-defined symptom complex known as polycystic ovarian syndrome requires adequate care. The severity of PCOS is demonstrated by the fact that 1 in 8 female patients at the gynaecology outpatient department has the condition.Compared to the general population, PCOS patients had two to six times greater rates of endometrial cancer, hypertension, lipid metabolic problems, and cardiovascular disease.

This highlights the significance of early identification of Metabolic syndrome and insulin resistance in PCOS-affected women, followed by the implementation of preventive treatments. The clinical expression and metabolic manifestation of PCOS are significantly impacted by obesity. Also, when comparing different metabolic parameters, serum triglycerides and waist circumference were the most common abnormal parameters defining metabolic syndrome.

In obese PCOS compared to lean PCOS, PCOS, and metabolic syndrome are inherently connected to one another, and early detection of one can aid in the diagnosis and treatment of the other.

To completely comprehend the relationship between polycystic ovarian syndrome and metabolic syndrome, more research is necessary into the complex pathophysiological mechanisms, especially given the rising prevalence of lifestyle disorders in our culture.

Out of the total 45 obese and overweight PCOS cases, 30 (66.66%) had Metabolic syndrome and out of 15 non-obese PCOS cases, only 3(20%) had metabolic syndrome. Metabolic syndrome was higher in Obese and overweight cases compared with non-obese cases The increasing occurrence of Metabolic syndrome in women with PCOS makes it imperative to evaluate the situation and take early action to prevent the long-term consequences of this medical condition.

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AUTHOR CONTRIBUTIONS:

Dr Shahana pv designed the concepts of the article, collected data, conducted the literature search and wrote the initial draft of the article. Dr P.S Jikki Kalaiselvi and Dr Vijayalakshmi Gnanasekaran conducted revisions to the manuscripts.

DECLARATIONS

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Conflict of interest: The authors declare that they have no conflict of interest.

Ethical approval: This study is approved by the institutional ethics committee

REFERENCES:

1. Stein IF, Leventhal ML. Amenorrhea is associated with bilateral polycystic ovaries. Am J Obstet Gynecol 1935; 29: 181.
2. "The Stein-Leventhal Syndrome: A Curable Form of Sterility" (1958), by Irving Freiler Stein Sr. (2017)
3. Dunaif A: Polycystic ovary syndrome in 2011: Genes, ageing and sleep apnea in polycystic ovary syndrome. Nat Rev Endocrinol. 2011, 8:72-4.
4. Rotterdam ESHRE/ASRM-Sponsored PCOS Consensus Workshop Group: Revised 2003 consensus on diagnostic criteria and long-term health risks related to polycystic ovary syndrome (PCOS). Hum Reprod. 2004, 19:41-7.
5. Azziz R, Carmina E, Dewailly D et al. Positions statement: criteria for defining polycystic ovary syndrome as a predominantly hyperandrogenic syndrome: an Androgen Excess Society guideline. J Clin Endocrinol Metab. 2006, 91:4237-45.
6. Lepor NE, Vogel RE. National Cholesterol Education Program Adult Treatment Panel III. Summary of the third report of the National Cholesterol Education Program Adult Treatment Panel III. Rev Cardiovas Med 2001;2:160-5.
7. Kakoly N, Khomami M, Joham A et al. Ethnicity, obesity and the prevalence of impaired glucose tolerance and type 2 diabetes in PCOS: A systematic review and meta-

regression. Hum. Reprod. Update 2018, 24, 455–467.
8. Wekker V, Van Dammen L, Koning A. A. Long-term cardiometabolic disease risk in women with PCOS: A systematic review and meta-analysis. Hum. Reprod. Update 2020, 26, 942–960.
9. Bahri Khomami M, Moran LJ, Kenny L. Lifestyle and pregnancy complications in polycystic ovary syndrome: The SCOPE cohort study. Clin. Endocrinol. 2019; 90 : 814–821.
10. Teede H, Deeks A, Moran L. Polycystic ovary syndrome: A complex condition with psychological, reproductive and metabolic manifestations that impacts health across the lifespan. BMC Med. 2010
11. Barry JA. Exploration of Biological Causes of Psychological Problems in Polycystic Ovary Syndrome (PCOS); City University London: London, UK, 2011 8, 41
12. Pirotta S, Barillaro M, Brennan L. Disordered eating behaviours and eating disorders in women in Australia with and without polycystic ovary syndrome: A cross-sectional study. J. Clin. Med. 2019; 8: 1682.
13. Legro RS, Kunselman AR, Dodson WC et al. Prevalence and predictors of risk for type 2 diabetes mellitus and impaired glucose tolerance in polycystic ovary syndrome: A prospective, controlled study in 254 affected women. J Clin Endocrinol Metab.1999; 84:165– 69
14. Faloia E, Canibus P, Gatti C et al. Body composition, fat distribution and metabolic characteristics in lean and obese women with polycystic ovary syndrome. J Endocrinol Invest. 2004; 27: 424–9.
15. Yildiz BO, Bozdag G, Yapici Z et al. Prevalence, phenotype and cardiometabolic risk of polycystic ovary syndrome under different diagnostic criteria. Hum Reprod. 2009; 27(10):3067–73.
16. Azziz R, Woods KS, Reyna R et al. The prevalence and features of polycystic ovary syndrome in an unselected population. J Clin Endocrinol Metab. 2004; 89: 2745-9.
17. Giviziez CR, Sanchez EG, Approbato MS et al. Obesity and anovulatory infertility: a review. JBRA Assist Reprod. 2016; 20 : 240-5.
18. Kauffman RP, Baker TE, Baker VM et al. Endocrine and metabolic differences among phenotypic expressions of polycystic ovary syndrome according to the 2003 Rotterdam consensus criteria. Am J Obstet Gynecol. 2008; 198: 670.e1-7.
19. Prema N, Vaidehi V. An Observational Study on the Prevalence of Metabolic Syndrome in Reproductive Aged Women with PCOS. Indian Journal of Obstetrics and Gynaecology, 2018; 6 (6): 581-587.
20. Hanif F et al. Association of Body Mass Index, Polycystic Ovarian Syndrome and its Clinical Presentation. Ann. Pak. Inst. Med. Sci. 2015; 11(3):129-132.
21. Akshaya S et al. Comparative study of clinical profile of lean and obese polycystic ovary syndrome women. Int J Reprod Contracept Obstet Gynecol. 2016; 5(8) : 2530-2533.
22. Sowmya D et al. Clinical study of polycystic ovarian syndrome (PCOS) in tertiary care centre. Int J Reprod Contracept Obstet Gynecol. 2017; 6(8) : 3247-3251.
23. Ramprasad D, Shiuli M, Ranu R, Arunima M, Biswas SC. Associationof Metabolic Syndrome in Polycystic Ovarian Syndrome : anObservational Study. J Obstet Gynaecol India. 2011;61(2):176–81
24. Sachdeva G, Gainder S, Suri V, Sachdeva N, Chopra S. Obese and Non-obese Polycystic Ovarian Syndrome: Comparison of Clinical, Metabolic, Hormonal Parameters, and their Differential Response to Clomiphene. Indian J Endocrinol Metab. 2019 Mar-Apr;23(2):257-262. doi: 10.4103/ijem.IJEM_637_18. PMID: 31161114; PMCID: PMC6540884