International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 14, No. 3, March 2025 Online ISSN: 2250-3137
Print ISSN: 2977-0122

DOI: 10.69605/ijlbpr_14.3.2025.196

Original Research

Study of lipid profile in polycystic ovarian syndrome in a tertiary care hospital

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Received date: 25 February, 2025 Acceptance date: 19 March, 2025 Published: 28 March, 2025

Abstract
Polycystic ovarian syndrome (PCOS) is a common health issue that affects women of reproductive age. One significant factor linked to PCOS is dyslipidaemia, which refers to abnormal lipid levels in the blood. Women with PCOS often have high levels of low-density lipoprotein (LDL) and triglycerides, as well as low levels of high-density lipoprotein (HDL). These lipid changes increase the long-term risk of heart disease. This study aims to compare lipid levels in women with PCOS to those in healthy women.
Methods: This study was conducted in collaboration with the esteemed Department of Obstetrics and Gynaecology of the Faculty of Medicine and Health Sciences located in Indore, Madhya Pradesh. A total of 98 participants were involved, comprising a diverse group of individuals aged between 18 to 45 years. This cohort was evenly split, consisting of 49 healthy control subjects and 49 individuals who had been clinically diagnosed with Polycystic Ovary Syndrome (PCOS). The aim was to explore the physiological aspects of this condition within a well-defined population.
Results: The mean ± SD of age in the cases was 27.83 ± 5.28 years, and in the control, it was 26.84 ± 5.18 years. Most cases were from Rural areas, which comprised 53%, and only 47% were from Urban areas. The mean ± SD for TG, LDL, and TC were 293.57 ± 16.25 mg/dL, 159.63 ± 14.87 mg/dL, and 234.21 ± 26.29 mg/dL, respectively. These values were higher in cases compared to controls, and the difference was statistically significant. However, the mean±SD of HDL in cases 44.21±6.79 mg/dl was lower as compared to controls, and the difference was statistically significant with $p<0.001$.
Conclusion: PCOS is closely linked to a lipid profile that increases the risk of cardiovascular disease. To mitigate this risk, it's essential to adopt healthy dietary habits and lifestyle changes early on. By prioritizing nutrition and wellness, individuals can significantly improve their health and reduce the likelihood of developing heart-related issues.
Keywords: Polycystic Ovarian Syndrome, cholesterol, TG, LDL, HDL

Introduction

Polycystic ovarian syndrome (PCOS) is a complex endocrine disorder that significantly impacts women's reproductive health. It is notably characterized by anovulation, which refers to the absence of ovulation, along with various menstrual irregularities, including amenorrhea (the absence of menstruation) and difficulties with fertility. This disorder stands out as the most prevalent endocrine condition, leading to subfertility among women of reproductive age, affecting a considerable number of women. [1]

Clinically, the manifestations of PCOS can be diverse and may include dermatological issues such as acne, excessive hair growth in areas typically associated with male-pattern hair distribution (hirsutism), and skin changes like acanthosis nigricans, which present as darkened patches on the skin. Additionally, many women with PCOS experience weight gain and exhibit insulin resistance, a condition where the body's cells become less responsive to insulin. [2]

The prevalence of PCOS varies depending on the diagnostic criteria used, but estimates suggest that it affects approximately 15% to 20% of women in their reproductive years. In the United States, PCOS is a leading cause of anovulatory infertility, accounting for an estimated 90% to 95% of such cases, with nearly 40% of women diagnosed with PCOS facing challenges related to infertility. In India, several studies have reported a varied prevalence of PCOS, ranging from 9.13% to an alarming 36%.[3]

Furthermore, dyslipidemia, a condition characterized by abnormal lipid levels in the blood, has been increasingly recognized as a critical factor contributing to the pathophysiology of PCOS. This metabolic anomaly is found in up to 70% of women with the syndrome and raises concerns regarding

DOI: 10.69605/ijlbpr_14.3.2025.196

long-term cardiovascular health, including a heightened risk of coronary heart disease. Evidence indicates that women with PCOS have an increased prevalence of atherosclerosis. This condition can lead to the hardening and narrowing of arteries and an estimated seven-fold elevated risk of experiencing a myocardial infarction or heart attack. [4]

While the exact mechanisms remain partially understood, it is believed that elevated levels of androgens—male hormones that are present in higher amounts in women with PCOS—alongside the often-concurrent issue of obesity play a crucial role. Increased androgen levels can inhibit the activity of lipoprotein lipase (LPL) in abdominal fat cells, leading to a tendency toward central obesity, which may further exacerbate metabolic issues. [5]

Various studies conducted to assess lipid profiles among women with PCOS have yielded conflicting results, influenced by numerous factors, including race, genetics, dietary habits, lifestyle choices, and environmental circumstances. Given this variability, the present study seeks a more precise understanding by evaluating and estimating the lipid profile, specifically in individuals diagnosed with PCOS from the northeastern region of India.

The objective of this study is to thoroughly assess and quantify the serum lipid profiles in individuals diagnosed with polycystic ovarian syndrome (PCOS). These subjects, representing the case group, will be compared to a cohort of healthy individuals serving as controls. By analyzing these lipid levels, we aim to uncover significant differences and patterns that may exist between the two groups, shedding light on the metabolic implications of PCOS.

METHODS

This study was conducted in collaboration with the esteemed Department of Obstetrics and Gynaecology of the Faculty of Medicine and Health Sciences located in Indore, Madhya Pradesh. A total of 98 participants were involved, comprising a diverse group of individuals aged between 18 to 45 years. This cohort was evenly split, consisting of 49 healthy control subjects and 49 individuals who had been clinically diagnosed with Polycystic Ovary Syndrome (PCOS). The aim was to explore the physiological aspects of this condition within a well-defined population.

Selection Criteria

Inclusion Criteria (for cases only):

- Women aged 18-45 years
- Diagnosed with PCOS based on the Rotterdam criteria
- Not taking hormonal treatments or medications that affect cardiovascular parameters for at least 6 months before the study

Exclusion Criteria (for both Cases and Controls):

- History of cardiovascular diseases
- Diabetes mellitus
- Hypertension
- Any other endocrine disorders (e.g., thyroid dysfunction)
- Pregnant or lactating women
- Smoking or alcohol consumption

Methods of data and sample collection

Informed written consent was obtained from all selected patients prior to commencing the study. 5 ml of overnight fasting blood samples was be obtained from the participants to assess the lipid profile. Measurements included total cholesterol, LDL-C, HDL-C, and triglycerides. Blood samples were collected according to standardized protocols and analyzed using enzymatic methods. Serum lipid parameters were estimated using a **Vitros 250 Chemistry Analyzer.**

RESULTS

Table 1: Demographic characteristics of participants

Characteristics	Study groups Subjects with the PCOS N%	Control groups Subjects without the PCOS N%
No. of subject	49	49
Body weight (kg)	59.67±7.72	61.53±7.84
BMI (kg/m^2)	26.79±5.18	21.53±5.05
Age groups (Mean±SD)	27.83±5.28	26.84±5.18
18-25	19	17
26-30	16	15
31-35	7	9
36-40	5	7
41-45	2	1
Socio-economic status		
Upper	9(18.36%)	10(20.4%)
Middle	11(22.45	13(26.53%)
Lower middle	17(34.69%	15(30.61%)
BPL	12(24.49%)	11(22.45%)
Education level		

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High school	15	13
College	22	20
Graduate	12	16
Place of residence		
Rural	26	25
Urban	23	24
Chief complaints		
Irregular Menses	39	41
Hirsutism	10	6

Table 1 indicates that the majority of polycystic ovary syndrome (PCOS) cases occurred in the age group of 18-25 years, accounting for 38.7% (19 cases) of the total. This is followed by 32.6% (16 cases) in the age group of 26-30 years, 14.2% (7 cases) in the 31-35 age group, 10.2% (5 cases) in the 36-40 age group, and 4% (2 cases) in the 41-45 age group.
Additionally, the table shows that a significant portion of the cases, 53%, was from rural areas, while 47% (23 cases) were from urban areas. Among the control group, 51% (25 individuals) were from rural areas, and 49% (24 individuals) were from urban areas.

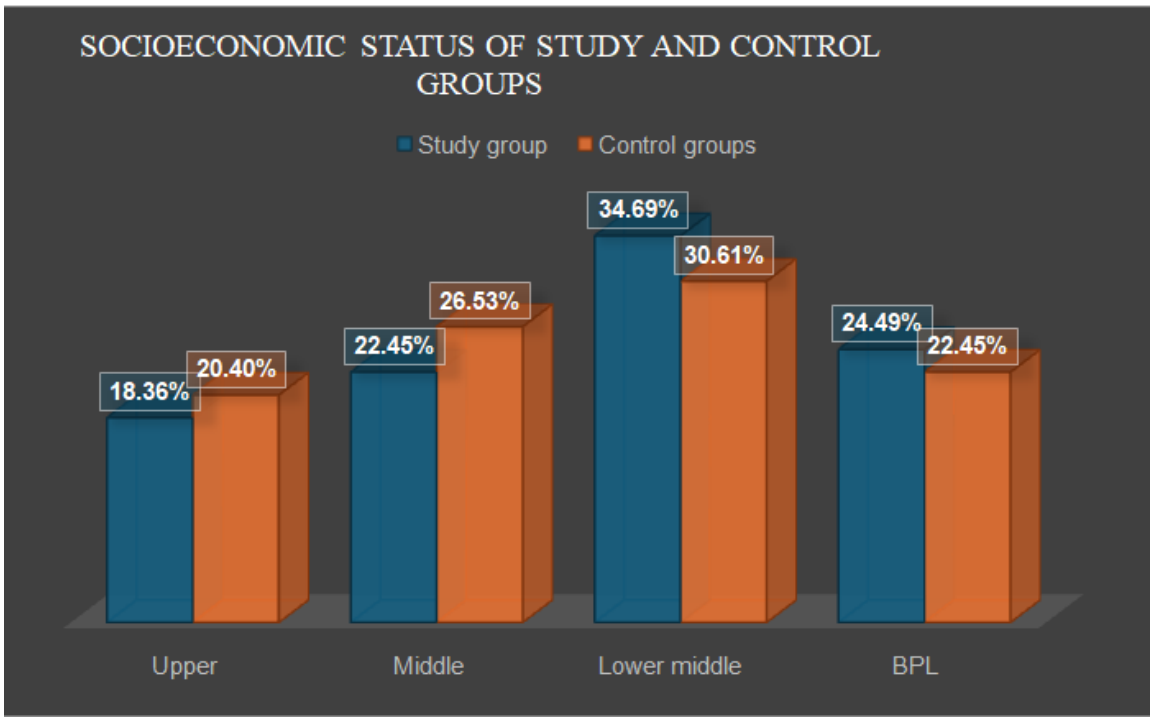

Figure 1: Socioeconomic status

Table 1 and Figure 1 illustrate the distribution of patients based on their socioeconomic status. The socioeconomic status of individuals was assessed and categorized into two groups, as shown in Table 1 and Figure 2. It was observed that 18.36% of the study group and 20.40% of the control group belonged to the upper class, followed by 22.45% and 26.53% from the Middle class, 34.69% and 30.61% from the lower middle class, and 24.49% and 22.45% from BPL, respectively.

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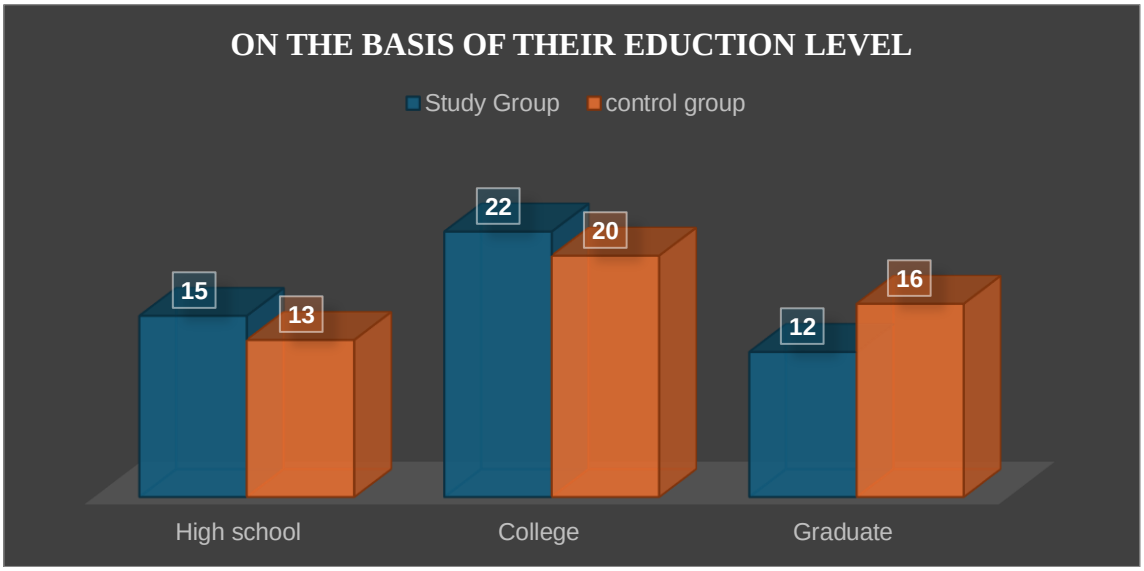

Fig 2: Educational profile

Table 1 and Figure 2 illustrate the distribution of patients categorized by their educational status. The data reveal that the most significant percentage of patients, 42, have completed a college education. Additionally, 28 patients hold graduate degrees, while another 28 patients have attained a high school education. This breakdown offers insight into the educational backgrounds of the patient population, highlighting the notable presence of individuals with higher levels of education.

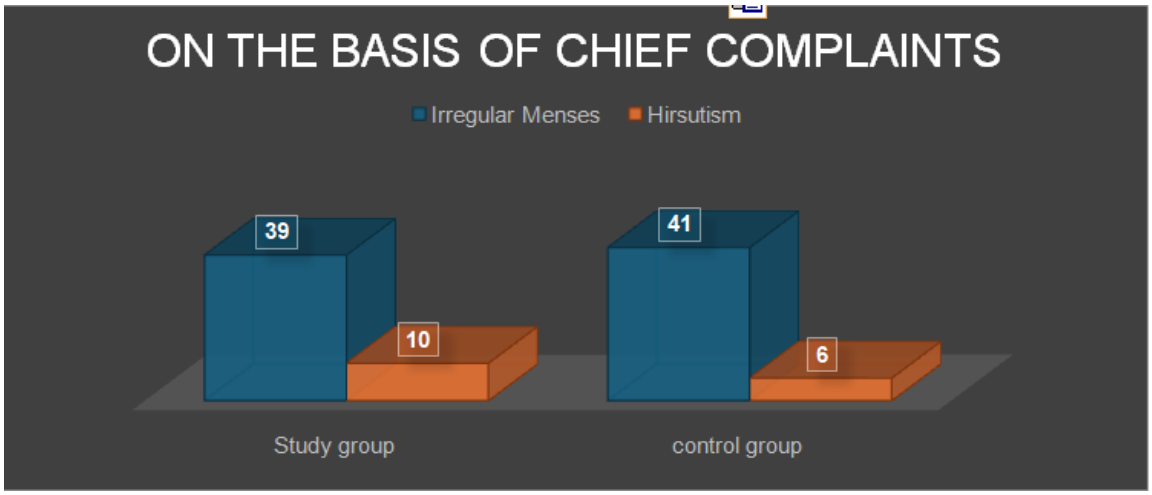

Figure 3: chief complaints

Table 1 and Figure 3 present a comprehensive overview of the distribution of patients categorized by their chief complaint status. Among the participants in the study group and the control group, the predominant chief complaint was irregular menses, with 39 patients in the PCOS study group and 41 patients in the control group reporting this issue. This indicates a significant prevalence of menstrual irregularities within both cohorts.
In contrast, the occurrence of hirsutism, another common symptom associated with PCOS, was notably lower. Only 6 participants in the PCOS study group identified hirsutism as their chief complaint, compared to 10 participants in the control group. This highlights that while irregular menses are a common concern, hirsutism affects a smaller subset of patients across both groups.

Table 2: Comparison of lipid profile among study group and control group

variable	Study group (N=49) Mean±SD	Control group (N=49) Mean±SD	P value
TG (mg/dl)	293.57±16.25	141.17±8.53	<0.0001
LDL-C (mg/dl)	159.63±14.87	117.32±9.21	
HDL-C (mg/dl)	44.21±6.79	69.43±8.68	
TC (mg/dl)	234.21±26.29	157.31±15.59	

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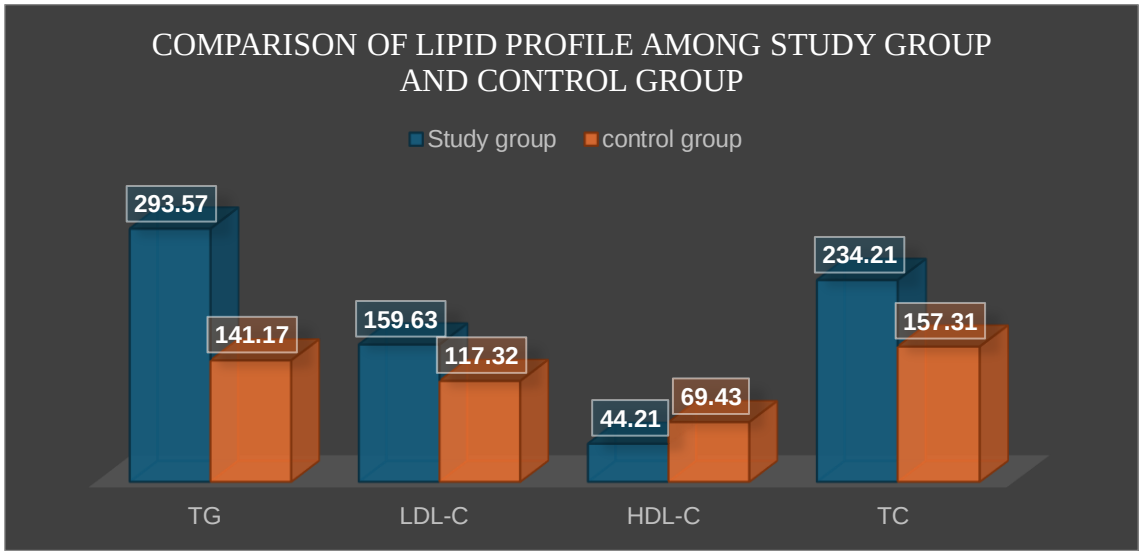

Figure 4: Comparison of lipid profile among study group and control group

Table 2and Figure 4 compare the two groups in terms of the mean values of TG, LDL-C, HDL-C, and TC. The mean TG ± standard deviation was293.57 ± 16.25 and 141.17 ± 8.53, respectively. The results indicate a significant difference between the study group and the control group, with a p-value of less than 0.001.Additionally, the mean LDL-C values ± standard deviation were159.63 ± 14.87 and 117.32 ± 9.21 for the study group and control group, respectively. The results were significant, with a p-value of less than 0.001. Similarly, the mean HDL-C ± standard deviation was 44.21 ± 6.79 and 69.43 ± 8.68 for the study group and control group, respectively, and the results were statistically significant ($p < 0.001$). At last, the mean TC ± standard deviation was 234.21 ± 26.29 and 157.31 ± 15.59 for the study group and control group, respectively, and the results were significant, as indicated by a p-value of less than 0.001.

DISCUSSION

In our research, we delved into the contrasting lipid profiles of women diagnosed with Polycystic Ovary Syndrome (PCOS) and those who are considered healthy and normal. The study comprised a comprehensive analysis of 98 participants, evenly divided into two groups: 49 individuals representing the PCOS group and an equal number of healthy women. Through this exploration, we aimed to uncover the nuanced differences that may exist between these two groups, shedding light on the metabolic intricacies associated with PCOS.

Polycystic Ovary Syndrome (PCOS) is a common endocrine disorder in women of reproductive age, characterized by elevated androgen levels, persistent anovulation (irregular or absent ovulation), and the presence of small cysts on the ovaries. This condition often results in symptoms such as irregular menstrual cycles, weight gain, acne, excessive hair growth, and fertility issues, significantly affecting women's health and quality of life.[1]

In this study, participants from different age groups were observed, with a total of 98 subjects aged between 18 and 45 years. The study consisted of 49 healthy controls and 49 patients with clinically diagnosed cases of polycystic ovary syndrome (PCOS). The study examined different age groups and found a higher prevalence of PCOS among both patients and the control group in the 18 to 25-year-old age range. Table 1 indicates that the highest number of control subjects (17) was from the 18 to 25 age group, followed by 15 subjects from the 26 to 30 age group, 9 from the 31 to 35 age group, 7 from the 36 to 40 age group, and 1 from the 41 to 45 age group. In the study group of PCOS patients, 19 were from the 18 to 25 age group, followed by 16 from the 26 to 30 age group, 7 from the 31 to 35 age group, 5 from the 36 to 40 age group, and 2 from the 41 to 45 age group.

Our study compared the lipid profiles of women with PCOS to those of normal, healthy women. This study was conducted on 98 subjects, comprising 49 individuals with PCOS and 49 healthy control subjects. PCOS is a common endocrinological disorder in women of reproductive age characterized by excessive androgen secretion, persistent anovulation and polycystic ovarian morphology. [6,7].Similar findings were observed in a study conducted by Bashir et al., who found that the maximum prevalence of PCOS (50%) occurred in the 15-24 year age group. [8,9]. PCOS is often diagnosed in the early childbearing age group, particularly among females with oligomenorrhea and those facing difficulties in conceiving who seek early medical intervention.

This study reveals that the average age of participants with the condition was 27.83 years, with a standard deviation of 5.28 years, while the control group had an average age of 26.84 years, with a standard deviation of 5.18 years. Comparable results were documented in a research study conducted by Bashir et al., which highlighted that the highest

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prevalence of Polycystic Ovary Syndrome (PCOS)a notable 50% %was observed within the youthful age bracket of 15 to 24 years [8]. This trend may be attributed to the fact that PCOS is frequently diagnosed during the early years of childbearing. Many young women experiencing symptoms such as oligomenorrhea or facing challenges conceiving seek medical help, prompting them to visit healthcare facilities for timely interventions and support.

Notably, most of the study group and the control group were in rural areas, with 26(53.06%) participants from the PCOS group and 25(51.02%) from the control group residing in these regions. Conversely, the research also included participants from urban areas, with 23(46.93%) individuals in the PCOS study group and 24(48.97%) in the control group hailing from these urban settings. This distribution highlights the demographic variations between the two groups regarding their residential environments. This finding was in accordance with study done by Bharathi et al who found that the incidence rate was higher in urban area (8.9%) when compared to the rural (1%) area.[10]

The findings revealed that the Body Mass Index (BMI) in the study group averaged at 26.79±5.18 kg/m², significantly higher than that of the control group, which had a BMI of 21.53±5.05 kg/m². This notable difference underscores the impact of Polycystic Ovary Syndrome (PCOS) on body composition. Furthermore, the research conducted by Yadav et al. corroborated these results, indicating that various anthropometric measurements—including height, weight, BMI, and waist-hip ratio—were consistently elevated in individuals diagnosed with PCOS when compared to those without the condition. This suggests a clear association between PCOS and increased body measurements, highlighting the importance of these metrics in understanding the syndrome.[10]

It is also seen that in our study the SBP (128.31±7.84mm/Hg) and DBP (86.34±5.73 mm/Hg) in the study group were significantly higher in cases compared to controls SBP (111.21±7.21 mm/Hg), DBP (78.51±6.13 mm/Hg) and the difference was statistically significant with p <0.0001. These findings were supported by the study done by Wu et al where they reported that the incidence rate of hypertension was higher in PCOS subjects as compared to control groups.[11].

In our study, the study group (PCOS patients) had lipid profiles characterized by elevated total cholesterol, triglycerides, LDL-C, and HDL-C. The level of total cholesterol (234.21±26.29 mg/dl), triglycerides (293.57±16.25mg/dl), LDL-C (159.63±14.87mg/dl) and HDL-C (44.21±6.79 mg/dl) respectively was higher in cases as compared to control group whose levels where total cholesterol (157.31±15.59mg/dl). Triglycerides (141.17±8.53 mg/dL), LDL (117.32±9.21 mg/dL), and HDL-C (69.43±8.68 mg/dL), respectively, with a statistically significant difference (P <<0.001). The results of this study align closely with those ofGiallauria et al. and Mritunjay Kumar Azad et al. [12,13], which focused on a cohort of 243 young women diagnosed with polycystic ovary syndrome (PCOS) who did not exhibit any known cardiovascular risk factors. This reinforces the relevance of investigating cardiovascular health within this specific population, highlighting the potential importance of early detection and intervention strategies.

CONCLUSION

This study aimed to comprehensively assess the lipid profiles of individuals diagnosed with polycystic ovarian syndrome (PCOS) in comparison to a group of healthy controls. The findings reveal that women suffering from PCOS exhibit a distinctly unfavorable atherogenic lipoprotein profile, marked by elevated levels of cholesterol, low-density lipoprotein (LDL), and triglycerides. This profile may serve as a significant risk factor for the future development of cardiovascular complications. Consequently, it is highly advisable for all women affected by PCOS to undergo regular screenings for dyslipidemia. Early detection can pave the way for implementing dietary adjustments and lifestyle modifications, thereby enhancing preventive measures against cardiovascular risks and promoting overall health.

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