RESEARCH PAPER

Association between Body Mass Index, Lipid Profile and Uric Acid in Polycystic Ovary Syndrome Patients

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ABSTRACT

Background: Polycystic ovary syndrome (PCOS) is a prevalent hormonal condition linked to metabolic issues, such as obesity, dyslipidemia, and changes in uric acid levels. The body mass index (BMI) is crucial in the progression of these metabolic disorders. This research aimed to investigate the relationship among BMI, lipid profile, and serum uric acid concentrations in women diagnosed with PCOS.

Methods: This cross-sectional research encompassed women diagnosed with PCOS. Measurements like age, weight, height, and BMI were taken. Biochemical studies involved serum uric acid, total cholesterol, triglycerides (TG), HDL, LDL, and VLDL cholesterol levels. A Pearson correlation analysis was conducted to assess the relationship between BMI and biochemical parameters.

Results: The average age of participants was 25.05 ± 5.57 years and the average BMI was 24.82 ± 3.98 kg/m². BMI demonstrated a noteworthy negative correlation with HDL cholesterol ($r = –0.238$, $p = 0.017$) and a noteworthy positive correlation with LDL cholesterol ($r = 0.303$, $p = 0.002$). Positive yet non-significant associations were noted between BMI and serum uric acid, total cholesterol, triglycerides, and VLDL.

Conclusion: An elevated BMI in PCOS individuals is notably linked to a negative lipid profile, especially lower HDL and higher LDL cholesterol, indicating heightened cardiovascular risk. Managing weight should be a key aspect of PCOS treatment to enhance metabolic results.

Keywords: Body mass index, lipid profile, uric acid, polycystic ovary syndrome

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Introduction: Polycystic Ovary Syndrome (PCOS) is among the most prevalent endocrine disorders in women of reproductive age, with worldwide occurrence varying from 6% to 20%, based on the diagnostic standards applied [1]. It is marked by a cluster of clinical characteristics, such as hyperandrogenism, ovulatory irregularities, and polycystic ovarian structure. Apart from reproductive issues, PCOS is acknowledged as a multifaceted metabolic condition linked to obesity, dyslipidemia, insulin resistance, and hyperuricemia, all of which together elevate the risk for cardiovascular diseases and type 2 diabetes mellitus [2].

Body Mass Index (BMI) acts as a straightforward but powerful anthropometric measure of obesity and metabolic well-being. Increased BMI in PCOS patients is associated with intensified hormonal imbalance and insulin resistance, aggravating the syndrome's clinical symptoms. Likewise, abnormalities in lipid profiles-like elevated triglycerides, low-density lipoprotein (LDL), and decreased high-density lipoprotein (HDL)-are commonly seen in PCOS and are regarded as early indicators of metabolic syndrome [3]. Uric acid, previously seen just as a byproduct of purine metabolism, has recently attracted interest as a new metabolic marker. Increased serum uric acid levels have been associated with oxidative stress, endothelial dysfunction, and insulin resistance, indicating a possible involvement in the pathophysiology of PCOS [4].

Although many studies have explored the metabolic irregularities in PCOS, findings still show variability among different populations, and the connection between BMI, lipid profiles, and uric acid levels is not yet completely understood. Certain research indicates that increased uric acid levels may separately link to dyslipidemia and elevated BMI, while other studies show inconsistent connections. These inconsistencies emphasize the necessity for additional research to elucidate these interrelations, especially within particular ethnic and regional contexts where genetic, dietary, and lifestyle elements might affect results [5-7].

This study intends to explore the relationship between body mass index, lipid profiles, and uric acid levels in women suffering from PCOS. A cross-sectional approach was selected to evaluate these parameters simultaneously and to investigate their connections. By analyzing these metabolic indicators collectively, the research aims to offer a deeper insight into metabolic risk trends among PCOS patients. This method could assist in recognizing individuals at risk sooner, allowing prompt lifestyle and treatment changes. The research aims to bridge the current knowledge gap concerning the metabolic interactions in PCOS and to enhance clinical management approaches focused on lowering long-term metabolic and cardiovascular hazards.

Material and methods: Study Design: A hospital-based cross-sectional observational study was conducted to examine the relationship between body mass index, lipid profile, and uric acid levels in patients with polycystic ovary syndrome. The study protocol was approved by the Institutional Ethics Committee.

Study Population: The study included women aged 19 to 49 who met the criteria for a PCOS diagnosis. Participants were recruited from the outpatient clinics of Obstetrics and Gynecology. Every participant provided written informed consent prior to their inclusion in the study.

Inclusion Criteria: The study involved women who agreed to provide informed consent, were aged between 19 and 49, and had received a diagnosis of polycystic ovarian syndrome (PCOS) according to the Rotterdam criteria.

Exclusion Criteria: The research excluded females with a smoking history, alcohol consumption, or other chronic issues impacting lipid metabolism, alongside those who were pregnant or breastfeeding, had confirmed diabetes mellitus, thyroid issues, or Cushing's syndrome, used lipid-lowering drugs or hormone therapies within the last three months, or had any of these conditions.

Sample Size: The research involved 100 participants diagnosed with PCOS according to the (PCOS) diagnostic criteria were chosen.

Methods: Following the acquisition of informed consent, each participant received an extensive clinical evaluation along with anthropometric measurements.

Body Mass Index (BMI): Calculated using the formula weight (kg) divided by height squared (m^2).

Laboratory study: Following a night of fasting for 8–12 hours, blood samples were collected to assess the features of the lipid profile. An entirely automated analyzer known as Selectra Pro-M was utilized to assess the concentrations of high-density lipoprotein (HDL), triglycerides (TG), and total cholesterol (CHOL). The Direct method was employed to assess the concentrations of low-density lipoprotein (LDL). Uric acid levels in serum were measured using Uricase-Peroxidase through an Auto-analyzer.

Data Analysis: The data was entered using Microsoft Excel, while SPSS software version 28.0 was utilized for analysis. The baseline characteristics were analyzed using the mean and standard deviation. Pearson's correlation coefficient was employed to evaluate the association between body mass index, lipid profile, and uric acid in patients with polycystic ovary syndrome. P-values lower than 0.05 were deemed statistically significant.

RESULTS: 100 women diagnosed with polycystic ovary syndrome (PCOS) were assessed for anthropometric measures, lipid profile, and serum uric acid concentrations. Participants' ages varied between 19 and 49 years, with an average age of 25.05 ± 5.57 years. The majority of patients were young adults, indicated by a median age of 24.5 years. The average body weight was 57.94 ± 9.77 kg, and the average height was 1.53 ± 0.04 m. The average BMI was 24.82 ± 3.98 kg/m^2, with a range of 14.61 to 34.17 kg/m^2, suggesting that a significant number of participants fell into the overweight category. Concerning biochemical parameters, the average serum uric acid concentration was 4.95 ± 2.01 mg/dl. The average total cholesterol was 146.57 ± 10.65 mg/dl, whereas the average triglyceride levels were 106.67 ± 9.53 mg/dl. The average HDL cholesterol was 46.58 ± 6.14 mg/dl, average LDL cholesterol was 96.81 ± 4.28 mg/dl, and average VLDL cholesterol was 21.33 ± 0.89 mg/dl as presented in table

no.1. These results show that while average lipid levels were close to normal ranges, there was variability, indicating dyslipidemia in some PCOS patients.

Table 2 and Figure 1 display the outcomes of the Pearson correlation analysis conducted to evaluate the connection between BMI and biochemical parameters. BMI showed a weak positive association with serum uric acid (r = 0.112), but this was not statistically significant (p = 0.269). Likewise, BMI exhibited weak, non-significant positive associations with total cholesterol (r = 0.152, p = 0.131), triglycerides (r = 0.122, p = 0.228), and VLDL cholesterol (r = 0.122, p = 0.228). Nonetheless, notable correlations were found with particular lipid fractions. BMI showed a notable negative correlation with HDL cholesterol (r = –0.238, p = 0.017), suggesting that increased BMI was linked to reduced HDL levels. Conversely, BMI demonstrated a moderate positive correlation with LDL cholesterol (r = 0.303, p = 0.002), which was significant at the 0.01 level. These results indicate that a higher BMI in PCOS patients is markedly linked to an unfavorable lipid profile, especially lower HDL and higher LDL cholesterol levels.

Table 1: Showing the parameters of polycystic ovary syndrome patients

Parameters	Minimum	Maximum	Median (IQR)	Mean	SD
Age (Years)	19	49	24.5 (20-)28	25.05	5.57
Weight (kg)	32	80	57(52-65)	57.94	9.77
Height (M)	1.42	1.61	1.53 (1.5-1.56)	1.5271	0.04
Body mass index (BMI)	14.61	34.17	24.77(22.31-27.5)	24.8278	3.98
Uric Acid (mg/dl)	3.6	8.58	4.7 (4.3-5.4)	4.954	2.01
Total cholesterol (mg/dl)	100	215	141(124.5-167)	146.57	10.65
Triglyceride(mg/dl)	45	225	98.5 (86.5-122)	106.67	9.53
HDL-cholesterol (mg/dl)	34	67	45 (42-50.25)	46.585	6.14
LDL-cholesterol (mg/dl)	54	153	95.5(77.75-110.5)	96.81	4.28
VLDL-cholesterol (mg/dl)	9	45	19.7 (17.3-24.4)	21.334	0.89

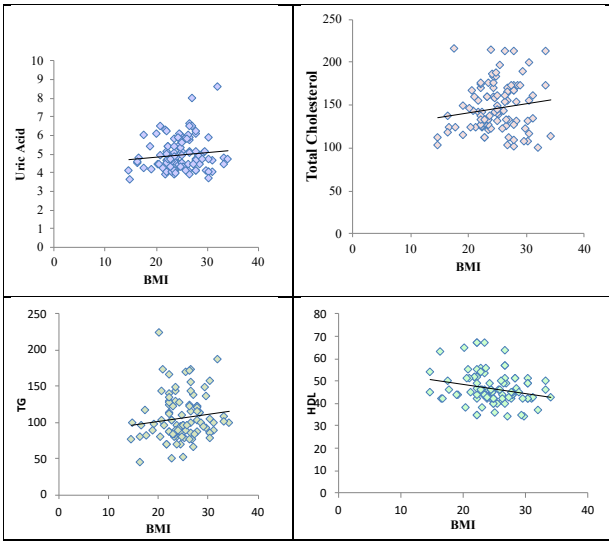
Table 2: Showing the association of body mass index with lipid profile and uric acid in polycystic ovary syndrome patients

		Uric acid	CHOL	TG	HDL	LDL	VLDL
BMI	r-value	0.112	0.152	0.122	-0.238*	0.303**	0.122
	p-value	0.269	0.131	0.228	0.017	0.002	0.228

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 1: Showing the association of body mass index with lipid profile and uric acid in polycystic ovary syndrome patients



DISCUSSION: PCOS is a reproductive and metabolic condition, with obesity significantly contributing to the worsening of its metabolic issues. This study assessed the relationship between BMI, lipid profile, and uric acid levels in women diagnosed with PCOS. The average BMI (24.82 kg/m²) in this research suggests that a significant number of patients were overweight. Excess body fat is recognized to aggravate insulin resistance, a

central pathophysiological characteristic of PCOS, which subsequently affects lipid metabolism [8].

A major discovery of this research is the notable negative correlation between BMI and HDL cholesterol. HDL offers heart protection, and its decline with rising BMI indicates a heightened cardiovascular risk for overweight and obese patients with PCOS. This discovery is consistent with the established impact of obesity and insulin resistance in lowering HDL levels via modified lipoprotein metabolism [9]. Moreover, BMI displayed a notable positive association with LDL cholesterol. LDL promotes atherogenesis, and its rise alongside BMI emphasizes the cardiometabolic risks in PCOS. The presence of low HDL and high LDL indicates a notably adverse lipid profile [10].

Even though BMI showed positive correlations with total cholesterol, triglycerides, and VLDL, these correlations were not statistically significant. This could be attributed to generally standard mean lipid levels or constraints in sample size, yet the association's direction continues to indicate a trend toward dyslipidemia as adiposity increases. Serum uric acid displayed a positive yet not significant correlation with BMI [11]. Uric acid is more commonly identified as an indicator of metabolic syndrome and insulin resistance. The absence of statistical significance might suggest that the increase in uric acid in PCOS is affected by factors beyond BMI, including dietary patterns, renal processing of uric acid, and levels of insulin resistance [12]. The results highlight that an increased BMI in PCOS is strongly associated with an atherogenic lipid profile, despite average lipid levels seeming nearly normal. This highlights the significance of: Early assessment of lipid levels in PCOS patients; Weight control as the main approach; Lifestyle changes to lower long-term heart disease risk

CONCLUSION: This study assessed the relationship among body mass index (BMI), lipid profile, and serum uric acid concentrations in women suffering from polycystic ovary syndrome (PCOS). The results indicate that BMI has a notable correlation with particular elements of the lipid profile. A notable negative correlation exists between BMI and HDL cholesterol, while a significant positive correlation is found between BMI and LDL cholesterol, suggesting that greater adiposity in PCOS patients is associated with an atherogenic lipid profile. Nevertheless, BMI did not reveal a statistically significant correlation with total cholesterol, triglycerides, VLDL, or serum uric acid levels, although a positive trend was observed. BMI can act as a significant clinical marker for recognizing PCOS patients who are at greater risk for cardiovascular issues. Initial lifestyle changes focused on weight loss can potentially enhance lipid profiles and lower long-term cardiometabolic risk in this group

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