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Original Research Article

Study of lipid profile in polycystic ovarian syndrome: a case control study in tertiary care hospital

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ABSTRACT

Background: Polycystic ovarian syndrome (PCOS) is one of the most common causes of endocrine dysfunction in women of reproductive age. Dyslipidaemia plays an important role in the development of PCOS. Lipid abnormalities which include elevated low-density lipoprotein and triglyceride levels and reduced high-density lipoprotein levels are often found in women with PCOS and thus they are associated with long-term risk of coronary heart disease. The study aims to estimate lipid profile levels in patients with polycystic ovarian syndrome (PCOS) taken as cases and normal healthy subjects taken as controls.

Methods: This is a case control study conducted in the Department of Biochemistry in collaboration with Department of Obstetrics and Gynaecology, RIMS, Imphal. Fasting blood samples were collected from cases and controls and lipid parameters were estimated. Forty-five cases of PCOS patients in the age group of 18-44 years diagnosed according to Rotterdam criteria and forty-five age-matched healthy women with regular menstrual cycle taken as controls were recruited.

Results: The mean±SD of age in cases was 26.38±4.85 years and control was 28.23±3.99 years. However, the difference was found to be statistically insignificant. The majority of cases were from urban areas which comprised of 62% and only 55.6% were from rural areas. The mean±SD for cholesterol, TG, LDL were 203.40±54.20 mg/dl, 163.26±69.49 mg/dl, 132.82±50.39 mg/dl respectively and was higher in cases compared to controls and the difference was statistically significant. However, the mean±SD of HDL in cases 24.81±2.31mg/dl was lower as compared to controls and the difference was statistically significant with $p<0.05$.

Conclusions: PCOS is found to be associated with atherogenic lipid profile. Thus, it may be suggested that dietary control and improvement of living style to control dyslipidaemia should be taken up early in PCOS to prevent development of cardiovascular disease.

Keywords: Dyslipidemia, Polycystic Ovarian Syndrome, cholesterol, TG, LDL, HDL

INTRODUCTION

Polycystic ovarian syndrome (PCOS) is an endocrine disorder characterized by anovulation, menstrual disorder, amenorrhea and infertility.[1] It is the most common endocrine disorder causing subfertility in women of reproductive age.[2] The clinical presentation of the PCOS may include acne, hirsutism, acanthosis nigricans, weight gain and insulin resistance.[3] The prevalence of PCOS, although varied by diagnostic criteria, is estimated to be as high as 15% to 20%.[4] In the United States, PCOS is the

most common cause of an anovulatory infertility (90% to 95%) and infertility affects about 40% of PCOS women.[5] Most studies in India report prevalence of PCOS as 9.13% to 36%.[6] Dyslipidaemia is now known to play an important role in the development of PCOS.[7] It is a very common metabolic abnormality in women with PCOS, with a prevalence of up to 70%.[8] They may be associated with long-term risk of coronary heart disease. Women with PCOS have a greater prevalence of atherosclerosis and cardiovascular diseases and estimated seven-fold increased risk for myocardial infarction.[9,10] The reasons are not very clear but may be due to elevated androgen levels and frequent association of this syndrome with obesity.[11] Increased androgen levels decreases lipoprotein lipase (LPL) activity in abdominal fat cells that leads to central obesity.[12] Several studies on lipid profile in females with PCOS were conducted but conflicting results were reported due to factors such as race, genetics, diet, lifestyle and environmental factors. In this regard, this study aims to estimate the lipid profile in PCOS subjects in the North eastern region of India. The purpose of this study is to estimate serum lipid profile levels in patients with polycystic ovarian syndrome (PCOS) taken as cases and normal healthy subjects taken as controls and to compare the levels between them.

METHODS

The study was conducted in the department of biochemistry in collaboration with department of obstetrics and gynaecology, regional institute of medical sciences (RIMS), Imphal Manipur. The study was carried out during a period of 24 months with effect from October 2019 to September 2021. A total no of 90 subjects attending Gynaecology OPD in the age group (18-44) years participated in the study out of which 45 were subjects with polycystic ovarian syndrome (cases) and 45 were normal healthy subjects (controls).

Inclusion and exclusion criteria

Diagnosed cases of PCOS based on Rotterdam criteria irrespective of socio-economic status and ethnicity and had not taken any medications were included. Normal healthy females of reproductive age group of 18-44 years were included as controls. Subjects with the conditions like systemic diseases, smoking, chronic alcohol consumption and pregnancy were excluded.

Methods of data and sample collection

Informed written consent was taken from all the selected patients before starting the study. 5ml of venous blood sample was collected in plain vial after 8-12 hours of overnight fasting and allowed to clot for 20 mins. The vial was then centrifuged for 10 mins at 2000-3000 rpm in a centrifuge machine and serum lipid parameters were estimated using enzymatic endpoint colorimetric method, RANDOX Rx IMOLA autoanalyzer.

Statistical analysis

Statistical analysis: The collected data were analysed using IBM: SPSS version 21 for windows. Results were reported as number of cases along with percentages for the categorical variables and proportion were used. Independent samples t-test, Chis-quare test were used to compare mean and p value <0.05 was taken as significant. Approval was sought from the Research Ethics Board, Regional Institute of Medical Sciences, Imphal.

RESULTS

The (Figure 1) shows that the majority of cases of PCOS occurred in the age groups of 18 to 25 years with 48% (22) of total cases, followed by 23% (10) in the age group 26-30 years, 18% (8) in the age group of 31-35 years, and 11% (5) in the age group of 36-40 years. The (Table 2) shows that majority of the cases were from urban areas which comprised of 62.2% (28) and 55.6% (25) were from rural areas. Among the control group 44.4% (20) were from urban areas whereas 37.8% (17) were from rural areas.

Table 1: Distribution of the respondents by age stratified by cases and controls.

	Groups	N	Mean±SD	P value
Age (years)	Cases	45	26.38±4.85	0.70
	Controls	45	28.23±3.99	

Independent student t test

Table 2: Distribution of the respondents by place of dwelling stratified by cases and controls.

Place of dwelling	Cases N (%)	Controls N (%)	P value
Urban	28 (62.2)	25 (55.6)	0.673
Rural	17 (37.8)	20 (44.4)	

Chi square test

Table 3: Distribution of respondents by religion stratified by cases and controls.

Religion	Cases N (%)	Controls N (%)	P value
Hindu	27 (60)	30 (66.7)	1.0
Muslim	10 (22.2)	09 (20)	
Christian	08 (17.8)	06 (13.3)	

Chi square test

However, the difference between the cases and controls was not statistically significant (p=0.673), so they were comparable in terms of address. The (Table 3) shows that majority of cases, 60% (27) were Hindus followed by Muslim 22.2% (10) and Christians 17.8% (8). Controls had similar pattern with Majority being Hindus 66.7% (30), followed by Muslim 20% (9) and Christian 13.3% (6) and the difference was statistically insignificant with p=1.0. The (Table 4) shows that in cases the mean±SD of BMI (25.65±3.25 kg/m2), WHR (0.87±0.04), SBP

(130.14±8.84 mm/Hg), DBP (94.22±4.99 mmHg) were found to be significantly higher than the controls whose mean±SD of BMI, WHR, SBP, DBP were (22.21±1.90 kg/m2), (0.78±0.03), (109.7±9.16 mm/Hg) (72.88±5.48 mm/Hg) respectively and the difference was statistically significant with p<0.05 in all the above parameters.

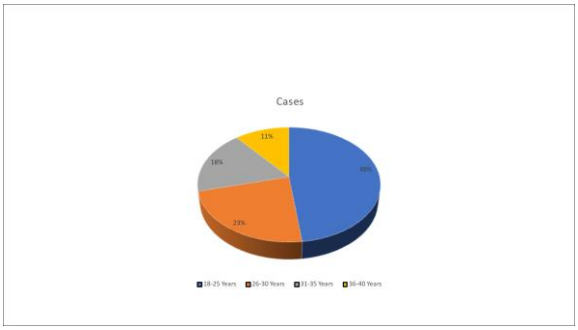

Figure 1: Age distribution of the respondents among PCOS group (cases).

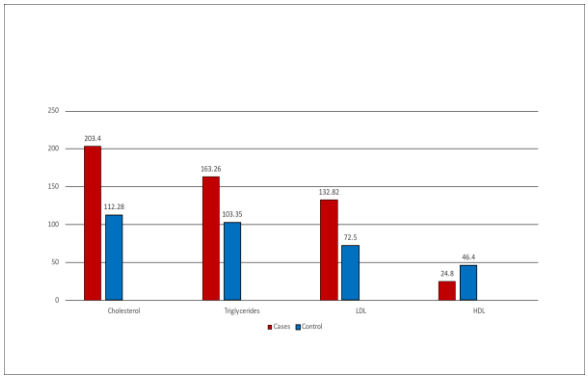

Figure 2: Distribution of the respondents by lipid profile level in cases and controls.

Table 4: Distribution of the respondents by other variables stratified by cases and controls.

Other variables	Cases (N=45) Mean±SD	Controls (N=45) Mean±SD	P value
BMI (kg/m^2)	25.65±3.25	22.21±1.90	0.000
WHR	0.87±0.04	0.78±0.03	0.000
SBP (mm/Hg)	130.14±8.84	109.7±9.16	0.000
DBP (mm/Hg)	94.22±4.99	72.88±5.48	0.000

Independent sample t-test

The (Figure 2) shows that in cases the mean±SD of total cholesterol was (203.40±54.20 mg/dl) and in controls (112.28±22.30 mg/dl), triglycerides in cases was (163.26±69.49 mg/dl) and in controls (103.35±37.96 mg/dl) and LDL (132.82±50.39 mg/dl) in cases and controls (72.75±21.89 mg/dl) respectively showing that the values were higher in cases as compared to control group and the difference was found to be statistically significant with p<0.05. However, the mean±SD of HDL in cases (24.81±2.31 mg/dl) was lower as compared to controls (46.35±3.53 mg/dl) and the difference was statistically significant with p<0.05.

DISCUSSION

Our study compared the lipid profiles between women with PCOS and normal healthy women. This study was conducted on 90 subjects, 45 belonging to PCOS group and 45 normal healthy subjects. PCOS is a common endocrinological disorder in women of reproductive age characterized by excessive androgen secretion, persistent anovulation and polycystic ovarian morphology.[13,14] This study shows that the mean age for cases was 26.38 ± 4.85 years and control was 28.23±3.99 years and the difference was statistically insignificant (p=0.70). Similar findings were observed in a study conducted by Bashir et al who found out in their study that the maximum prevalence of PCOS (50%) was found in the age group of 15-24 years.[15] It may be due to the fact that PCOS is commonly diagnosed in early child bearing age group, especially when females having oligomenorrhea and those who have difficulty in conceiving attend health care facility for their early medical interventions.

It is seen that majority of the cases were from urban areas which comprise about 62.2% and only 55.6% were from rural areas. In the control group 44.4% were from urban areas whereas 37.8% were from rural areas. However, the difference between the cases and controls was not statistically significant (p=0.673). 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.[16] It was observed that 90.24% of girls from urban areas had knowledge about PCOS and only 8.34% of the rural population were aware of it. It might be due to availability of better health awareness in urban areas as compared to rural areas. It is also seen that the majority of cases (60%) were Hindus followed by Muslim (22.2%), and Christian (17.8%). Controls had similar pattern with majority being Hindus 66.7% followed by Muslim (20%) and Christian (13.3%). This variation might be due to the fact that the study was conducted in a Hindu dominated area.

It was also seen that the BMI (25.65±3.25 kg/m2) and waist hip ratio (0.87±0.04) was found to be significantly higher in cases than in the controls where BMI and WHR (22.21±1.90 kg/m2) and (0.78±0.03) respectively and the difference was significant with p<0.05. The study conducted by Yadav et al also showed that the anthropometric measurements like height, weight, BMI and waist hip ratio were higher in subjects with PCOS compared to subjects without PCOS.[17] It is also seen that in our study the SBP (130.14±8.84 mm/Hg) and DBP (94.22±4.99 mm/Hg) in cases were found to be significantly higher in cases compared to controls SBP (109.7±9.16 mm/Hg), DBP (72.88±5.48 mm/Hg) and the

difference was statistically significant with p<0.00. 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.[18] The PCOS subjects were at higher risk of hypertension than in the normal controls. The mechanism underlying the increased prevalence of hypertension in PCOS has been linked to several factors such as hyperandrogenism, insulin resistance (IR), obesity and heart autonomic dysfunction. The hyperandrogenic state of PCOS exacerbates the risk of cardiovascular diseases with consequent endothelial dysfunction and elevated blood pressure.

In our study, the dyslipidaemic profiles characterized by elevated total cholesterol, triglycerides, LDL-C was seen in PCOS women. The level of total cholesterol (203.40±112.28 mg/dl), triglycerides (163.26±103.35 mg/dl) and LDL-C (132.82±72.75 mg/dl) respectively was higher in cases as compared to control group whose levels where total cholesterol (112.28±22.30 mg/dl). Triglycerides (103.35±37.96 mg/dl), LDL (72.75±21.89 mg/dl) respectively and the difference was found to be statistically significant with p<0.05. However, level of HDL was (24.81±46.4 mg/dl) in cases was lower as compared to controls (46.35±3.53 mg/dl) and the difference was also statistically significant with p<0.05. The findings in this study were in accordance to study done by Manjunatha et al who opined that there was significant increase in serum triglycerides, serum cholesterol, serum LDL, serum VLDL and decrease in the levels of serum HDL levels in PCOS subjects.[19] There was alteration in serum lipid profile and they concluded that dyslipidaemia is one of the important risk factors associated with PCOS. Dyslipidaemia is increasingly common in young adult women with PCOS.[20]

The causes of dyslipidaemia in PCOS are multifactorial. Dyslipidaemia may occur due to insulin resistance, which is seen in PCOS patients. Insulin resistance appears to have a pivotal role mediated in part by stimulation of lipolysis and altered expression of lipoprotein lipase and hepatic lipase. Insulin resistance also contributes to increased catabolism of HDL particles and formation of LDL particles. In addition to the insulin resistance, hyperandrogenism may also contribute to altered lipid profile.[21] Hyperandrogenism has been associated with increased hepatic lipase activity which has role in catabolism of HDL particles. Hyperinsulinemia and hyperandrogenaemia allowed adipocytes to undergo increased lipolysis caused by catecholamine and release free fatty acids into the circulation. Increased free liver fatty acids cause VLDL secretion, leading to hypertriglyceridemia. Hypertriglyceridemia leads through the reverse cholesterol transfer pathway to reduced HDL cholesterol and elevated LDL cholesterol levels.[22] The increase in triglycerides may also be due to the increased lipogenesis, decreased clearance or reduced fatty acid oxidation. Increased level of triglycerides can be a contributory factor for adiposity in PCOS women. Altered lipid profile, adiposity and insulin resistance contribute to the increase risk of cardiovascular diseases. Thus, PCOS patients need to be screened and monitored regularly, to prevent complications associated with cardiovascular diseases. Due to small sample size which is one of the limitations of this study, further studies with larger sample size are necessary to assess the role of lipid profile in the prevention and management of women with polycystic ovarian syndrome.

CONCLUSION

The present study was carried out to estimate the level of lipid profile in polycystic ovarian syndrome (PCOS) subjects and normal healthy controls. This study showed that women with PCOS had atherogenic lipoprotein profile characterized by increased cholesterol, LDL and triglycerides which may be risk factors for development of cardiovascular complication later. Thus, it is recommended that all women with PCOS should be screened regularly for dyslipidaemia so that necessary dietary control and lifestyle modification measures can be taken up early for effective cardiovascular risk prevention.

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