Lipid Profile in Sudanese Women with Polycystic Ovary Syndrome: A Prospective Case-Control Study Conducted at Gezira State, Central Sudan

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Abstract:

Objective: The study aimed to assess dyslipidemia in Sudanese women with polycystic ovary syndrome (PCOS).

Method: This is a prospective case-control study done in Gezira state central Sudan during the period between June 2011 to December 2013. Seventy cases were diagnosed with PCOS based on 2003 Rotterdam criteria, and 60 women with regular menstrual cycle and without history of hyperandrogenism (HA) were recruited as

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*control. Clinical features and lipid profile were investigated among
study groups.*

***Results:** The results showed that, among the 70 PCOS women,
52.9% presented with the 3 Rotterdam criteria (HA, PCO, and OD),
98.6% had oligmenorrhoea, 75.7% had hyperandrogenism, and 78.6%
had polycystic ovary (PCO) on ultrasonographic examination. 38.6% of
the women with PCOS fall in the age between 20-25 years and 92.3%
of them have impaired fasting blood glucose. Women with PCOS
showed significantly high triglyceride, LDL, and LDL/HDL ratio (p=
0.03, 0.000, and 0.00 respectively), and low total cholesterol and HDL
when compared with the control group (p= 0.003 and 0.000). 61.4% of
the women with PCOS had hypeinsulinemia, and 50.0% had insulin
resistant, compared with 28.9% and 24.0% in the control group. 48.6%
of the women with PCOS were obese, 74.0% of them had insulin
resistant, and 76.0% had hyperinsulinemia. Lipid profile showed no
significant difference between obese and non obese patients.*

***Conclusion:** Sudanese women of PCOS showed high rates of
oligmenorrhoea, hyperandrogenism, polycystic ovary (PCO), obesity,
hyperinsulinemia, and insulin resistance. As such, women with
polycystic ovary syndrome are at high risk of developing
cardiovascular diseases due to the presence of dyslipidemia.*

Key words: polycystic ovary syndrome, lipid profile, Dyslipidemia,
Obesity Sudanese women, Sudan.

INTRODUCTION:

The polycystic ovary syndrome (PCOS) is one of the most
common endocrine diseases in women, affecting up to 8% of
women in reproductive age (1).

PCOS is characterized by chronic anovulatory cycles,
oligo- or amenorrhea, hirsutism, and insulin resistance, while
obesity is also common. PCOS not only has a negative effect on
fertility, but it is also considered a clear-cut plurimetabolic

syndrome being associated with type 2 diabetes mellitus (T2DM), hypertension, and dyslipidemia (2).

Women of PCOS have increased coronary heart disease risk factors including abnormal lipid profile (3).

Hyperinsulinemia is often associated with dyslipidemia, which has been shown increased greater among PCOS women that could be an increased risk for coronary artery disease (CAD) (4) calculated by risk factor analysis due to the prevalence of glucose intolerance, hypertension, insulin resistance (IR), central obesity and dyslipidemia. At least, one abnormal lipid level is seen in 70% of women with PCOS (5).

Dyslipidemia is characterized by low levels of high-density lipoprotein cholesterol (HDL-C) and raised triglyceride (TG) (6).

PATIENTS AND METHODS:

Patients:

This is a prospective case-control study carried out at National Cancer Institute (NCI) - hormonal assay unit and Wad Medani Teaching Hospital for Obstetrics and Gynecology (WTHOG), at Gezira state, Central Sudan during the period from June 2011 to December 2013. Seventy patients (53.8 %) with PCOS, aged from 14 to 40 years with mean (26.33 ± 7.04) years, and sixty healthy (46.2 %) age, weight, and BMI-matched fertile women with regular menses, no hirsutism, and no hyperandrogenism features were included as control. Patients presented with thyroid dysfunction, hyperprolactinemia, non-classical congenital adrenal hyperplasia (NCCAH), Cushing's syndrome, ovarian neoplasm, acromegaly, type 1 diabetes mellitus, use of medication known to affect sex steroid metabolism, such as oral contraceptives or insulin sensitizing drugs and other hormonal agents known to affect menstrual cycle for at least 3 month before collection of the samples had been excluded from this

study. The diagnosis of PCOS was determined according to the Rotterdam's criteria 2003 (7). These criteria comprised two of the following three criteria: Oligo and/or anovulation; clinical and/or biochemical signs of hyperandrogenism; polycystic ovaries with the exclusion of congenital adrenal hyperplasia androgen secreting tumour. History, anthropometric measurements (body weight, body height, calculating BMI), medical examination (ultrasonographic examination of ovaries), fasting lipids profile triglyceride (TG), total cholesterol (TC), low density lipoprotein (LDL), high density lipoprotein (HDL) levels, calculating LDL/HDL ratio, and measurement of fasting blood glucose and insulin were done.

Blood sampling and lipid profile measuring:
After overnight fasting, the venous blood samples (5 ml) were aspirated at 08:00-10:00 am during day 3-6 of the menstrual cycle (early follicular phase) for patients with normal cycles, subjects with amenorrhea for more than 3 months were examined at presentation. TG, TC, LDL and HDL levels were measured by using lipoprotein lipase method, fasting plasma glucose was measured using the glucose oxidase method on a chemistry analyzer (ACCENT-200, Lominaki, Poland). Insulin by the immunoassay technique using (Cobase 411, Hitachi high technologies corporation, Tokyo-Japan). The insulin sensitivity index was evaluated by the homeostasis model assessment insulin resistance (HOMA-IR) index using the following formula: HOMA-IR = (Glucose ×Insulin)/405. The protocol for this study was approved by the Research and Ethical Committee, University of Gezira University.

Statistical Analysis:
The statistical analysis was performed using SPSS version 18. Means and standard deviations for numerical variables and frequency and proportion for categorical variables were

reported along with histogram or bar chart if necessary. Independent t-test, Mann-Whitney U Test and Chi Square were used to compare clinical and laboratory data between cases and control. P value less than 0.5 was considered significant.

Results:

A total of 130 women (70 PCOS and 60 controls) were examined at the NCI endocrinology measurement unit, these two groups were compared in terms of demographic characteristics and biochemical parameters.

As in **Table 1**, women with PCOS showed significantly high triglyceride, LDL, and LDL/HDL ratio (p= 0.03, 0.000, and 0.00 respectively), and low total cholesterol and HDL when compared with the control group (p= 0.003 and 0.000). Insulin and insulin resistance were significantly high among PCOS group compared with the control and the fasting blood glucose was low among the PCOS group, however, it falls within the normal range.

Table 1. Comparison of anthropometric and lipid profile between PCOS cases and the control.

Parameters	Cases (N= 70) Mean ± SD	Control (N= 60) mean ± SD	*P*.value
Age, years	26.33 ± 7.04	25.67 ± 4.57	NS
BMI (Kg/m²)	28.34 ± 5.09	27.02 ± 5.08	NS
Total Cholesterol (mg/dl)	172.31 ± 28.63	193.7 ± 47.64	0.003*
Triglyceride (mg/dl)	111.04 ± 55.58	93.30 ± 36.53	0.031*
HDL (mg/dl)	37.37 ± 9.03	74.59 ± 44.17	0.000*
LDL (mg/dl)	112.17 ± 24.35	88.98 ± 29.25	0.000*
HDL/LDL ratio	3.39 ± 0.88	2.21 ± 2.53	0.000♣
Insulin	40.02 ± 66.16	12.90 ± 13.02	0.0001△
FBG (mg/dl)	88.77 ± 10.66	94.07 ± 22.93	0.064*
Insulin resistance	8.52 ± 13.89	3.14 ± 3.44	0.006♣

Lipids profile in cases and control**:** values were presented as mean ± SD, (* Independent t-test, △ Mann-Whitney U Test and ♣ Chi Square) was used to compare between cases and control, *P*<0.05 were considered significant. Body mass index (MBI), high density lipoprotein (HDL), low density lipoprotein (LDL), N= number of samples, NS= not significant.

61.4% of the women with PCOS had hyperinsulinemia, and 50.0% had insulin resistant, while in the control group 28.9% had hyperinsulinemia, and 24.0% had insulin resistant **(Table 2)**.

Among all patients, 52.9% presented with the 3 Rotterdam criteria (HA, PCO, and OD), 98.6% had oligmenorrhoea, 75.7% had hyperandrogenism, and 97.1% had polycystic ovary (PCO) on ultrasonographic examination **(Table 2)**. 38.6% of the women with PCOS fall in the age between 20-25 years and 92.3% of them have impaired fasting blood glucose.

Table 2. The clinical characteristics of the PCOS patients and the control.

		Cases (70) N (%)	Controls (60) N (%)
Polycystic ovaries		68 (97.1)	-
PCOS phenotypes	HA + PCO + OD	37 (52.9)	-
	HA + PCO	1 (1.4)	-
	HA + OD	15 (21.4)	-
	PCO + OD	17 (24.3)	-
Oligo-ovulation		69 (98.6)	-
Hyperandrogenism		53 (75.7)	-
Hirsutism		2 (2.9)	-
Weight	Underweight (BMI < 18.5)	0 (0)	2 (3.3)
	Normal (BMI = 18.5-25)	14 (20.0)	24 (40.0)
	Overweight (BMI = 25-30)	22 (31.4)	19 (31.7)
	Obese (BMI > 30)	34 (48.6)	15 (25.0)
Hyperinsulinemia		43 (61.4)	13 (21.5)
Insulin resistance		35 (50.0)	11 (18.3)

Number (N), body mass index *(BMI)*, hyperandrogenism *(HA)*, polycystic ovaries *(PCO)*, oligo-ovulation *(OD)*. Body weight

based on BMI values for men and women over 18 recommended by World Health Organization's (WHO).

Table 3 shows two PCOS subgroup divided based on obesity, 48.6% of the PCOS patients were obese, 74.0% of them had insulin resistant, and 76.0% had hyperinsulinemia. The insulin levels and fasting blood glucose were significantly high among obese compared with non obese PCOS sub groups (P=0.008; 0.035), additionally there was no statistical differences between the two subgroups for lipid profiles **(Table 3)**.

Table 3. Comparison of lipid profile between PCOS subgroup of patients divided based on obesity.

	Obese (N=34) mean ± SD	Non Obese (N=36) mean ± SD	P. value
BMI (Kg/m^2)			
Total Cholesterol (mg/dl)	182.79 ± 31.34	162.42 ± 21.96	0.312*
Triglyceride (mg/dl)	113.35 ± 38.90	108.86 ± 68.21	0.397*
HDL (mg/dl)	38.12 ± 8.73	36.67 ± 9.38	0.981*
LDL (mg/dl)	117.85 ± 24.39	106.81 ± 23.39	0.649*
Insulin	53.87 ± 82.98	26.93 ± 42.11	0.008△
FBG (mg/dl)	90.74 ± 11.47	84.97 ± 9.15	0.035*

Values were presented as mean ± SD, (* Independent t-test and △ Mann-Whitney U Test was used to compare between cases and control. Body mass index *(MBI)*, higher density lipoprotein *(HDL)*, lower density lipoprotein *(LDL)*, fasting blood glucose *(FBG)*, number of samples (N).

DISCUSSION:

Polycystic ovary syndrome (PCOS) is one of the most common endocrine disorders in women; since it has an impact on infertility, many studies have been reported regarding the clinical manifestations and hormonal profile associated with PCOS, nevertheless, few studies tackling the lipid profile among Sudanese PCOS women. Based on the results of this study, 52.9% of study cases met the 2003 value of Rotterdam criteria, which is less than the frequency (63%) reported among Hong Kong women with PCOS (8), this difference may be attributed to differences in ethnic groups between the two population and the small sample size in our study. Our study showed high levels of TG, LDL, and HDL/LDL ratio in cases compared to the control with significant differences. However, plasma TG falls within the normal reference range. Our finding agree with study done in UAE (9) and with the reports in the literature which indicate that 40% of PCOS women had high total cholesterol, TG and LDL and low HDL, and conversely with other study done in Saudi Arabia indicated normal levels for the aforementioned parameters (10). Contrary with other studies (9), total cholesterol in this study fall within the normal range and it was lower in cases compared with the control, in addition to low levels of HDL. It has been stated that women with PCOS has a greater frequency and degree of both hyperinsulinemia (11-13), and insulin resistance (11, 14, 15) and there is strongly association between obesity, hyperinsulinemia and insulin resistance among PCOS women (9, 14). Insulin resistance can be present in obese and non obese PCOS women (16). Our data showed that, 48.6% of the study cases were obese, and insulin and insulin resistance were remarkably high and represents more than half the study cases compared with the control group. This data is similar to other reports (17-19). Dyslipidemia has been reported higher in obese

PCOS women compared with the lean women (20), here we reported high levels of TG, TC, LDL, and HDL without significant difference between obese and non obese PCOS women, furthermore, insulin level was remarkably high among obese compared with non obese women.

CONCLUSION AND RECOMMENDATION:

In conclusion, the rates of oligmenorrhoea, hyperandrogenism, polycystic ovary (PCO), obesity, hyperinsulinemia, and insulin resistance were tremendously high. Previous studies in Sudan viewed the increasing number of patients with PCOS among Sudanese women, this should accompanied with increasing awareness of weight reduction and changing life style of obese women with PCOS to avoid complications such as cardiovascular diseases. Further studies with large scale sample size are needed to unravel the burden of PCOS among Sudanese women.

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