

# Peripheral Hematological Parameters in Sudanese Women with Polycystic Ovary Syndrome

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## Abstract

The aim of this study is to assess the association between polycystic ovarian syndrome (PCOS) and hematological parameters [hemoglobin, red cell parameters, white blood cells (WBCs), platelets volume (MPV)]. This is a matched case-control study (60 women in each arm of the study) which was conducted in Saad Abualila infertility center Hospital in Khartoum, Sudan. Infertile women with PCOS were the cases and healthy non pregnant women were the controls. The gynecological characteristics were gathered through questionnaire and blood samples were analyzed for different blood parameters by automated hematology analyzer. While the two groups were matched in their age; body mass index was significantly higher in women with PCOs compared to the normal control. The investigated different hematological parameters (hemoglobin, RBCs, RDW, WBCs, platelets and MPV) showed no statistical difference between the women with PCOS and the controls.

## Keywords

Hemoglobin, Platelets Volume, Polycystic Ovarian Syndrome, Red Blood Cells, White Blood Cells

## 1. Introduction

Polycystic ovary syndrome (PCOS) is essentially a group of endocrine disorders, with a complex of metabolic, endocrinological and genetic factors that commonly affect women during reproductive age [1]. This syndrome is characte-

rized by irregular, anovulatory menstrual cycles, features of hyperandrogenism, and polycystic ovaries. PCOS can lead to poor obstetric outcomes such as infertility, pregnancy loss, gestational diabetes and macrosomia which are affecting 5% - 20% of women with reproductive age [2] [3] [4]. Moreover, PCOS is associated with various changes such as metabolic syndrome, insulin resistance, hypertension, dyslipidemia and increased cardiovascular disease [5] [6].

In spite of the advance in the many disciplines (genetic, environmental and inflammatory biomarker), the exact etiology and pathophysiology of PCOS are not yet fully elucidated [7]. Several recent researches have reported inconsistent association between PCOS and the different components of the hematological parameters [8]-[19]. Thus, association between hematological parameters and PCOs is still an area of active research. Hence there is a need to conduct further research on blood parameters and PCOs. Moreover, the analyses of the peripheral blood parameters were previously performed using manual procedure which was a time consuming and needs personnel with high technical skills and its results might be doubtful. Nowadays the analyses and interpretation of peripheral blood parameters are conducted using automated analyzers. PCOS is the main cause of female infertility in Sudan [20]. Previous studies have shown that different metabolic and hormonal factors were associated with PCOS in Sudan [21] [22]. In Sudan, there are no published data concerning the relation between PCOS and complete blood count (CBC). Thus, the current study was conducted among Sudanese women to describe the relation between PCOS and different hematological parameters Saad Abualila infertility center (Khartoum, Sudan).

## 2. Methods

This was a case-control study carried out at Saad Abualila infertility center (Khartoum, Sudan) during the period of May to December 2019. Saad Abualila Hospital is a tertiary semi-private hospital governed by the Faculty of Medicine, University of Khartoum. Cases were women with confirmed PCOS based on Rotterdam criteria [3]. Women with systemic disease (cardiovascular disease and diabetes mellitus), on medication for 6 months prior to the study (oral contraceptives, glucocorticoids, ovulation induction agents, and estrogenic or anti-androgenic) were excluded from the cases and controls.

After signing an informed consent the socio-demographic, medical and gynecological history was taken from each patient using questionnaire. The detailed medical and gynecological history was taken (menstrual, fertility, hirsutism, acne, acanthosis nigricance, scalp, hair loss or thinning) were taken from all patients included in the study. Then full general and pelvic examinations were performed.

Body weight (kg), height (cm), was measured in all women and BMI was calculated by dividing the weight (in kg) by the height ( $m^2$ ). Thereafter, two 2 mL of blood was withdrawn (under aseptic condition) from every participant in an ethylene diamine tetra acetic acid by a trained technician. The sample was ana-

lyzed for a complete blood count using an automated hematology analyzer guided by the manufacturers' instructions (Sysmex KX-21, Japan) previously described [23] [24].

A total sample size of 60 women in each arm of the study (cases and controls) was calculated according to the expected difference in the mean of the investigated variables (WBC, hemoglobin, platelets RBCs and RDW) that would provide 80% power to detect a 5% difference at  $\alpha = 0.05$  and assumed that 10% of women would not respond or have incomplete data.

### 3. Statistics

Data were entered in computer using SPSS for data analyses and expressed as proportions, mean (SD) and median (interquartile). The continuous variables were assessed for normality using Shapiro test. *T*-test and Mann-Whitney *U*-test were used to compare the continuous data between the cases and the controls when the data were normally and abnormally distributed, respectively.  $\chi^2$  test was used to compare the categorical variables. Two-tailed tests were used and  $P < 0.05$  was considered statistically significant.

### 4. Results

During the study 60 women in each arm of the study were enrolled in the study. There was no significant difference between the cases and the controls in their age, residence and education. The BMI was significantly higher in women with PCOs compared to the normal controls, **Table 1**.

There was no significant difference in all of the hematological parameters (hemoglobin, RBCs, WBCs, platelets), **Table 2**.

### 5. Discussion

The current study showed no significant difference in the various hematological values between the women with PCOs and the controls. In our neighbor Kingdom of Saudi Arabia, recently ALhabardi *et al.*, have shown that the hematological

**Table 1.** Comparing the socio-demographic characteristics in women with polycystic ovarian syndrome with the controls.

<i>The mean (SD)</i>	<b>Polycystic ovarian syndrome (n = 60)</b>	<b>Controls (n = 60)</b>	<b>P</b>
Age, years	24.2 (3.9)	24.7 (5.2)	0.541
Body mass index, kg/m <sup>2</sup>	30.5 (7.8)	27.8 (5.8)	0.031
Number (%) of			
Rural residence	16 (26.6)	12 (20.0)	0.388
Education level $\leq$ secondary level	11 (18.3)	14 (23.3)	0.500
Housewives	34 (56.6)	36 (60.0)	0.711

**Table 2.** Median (interquartile range) of hematological values in women with polycystic ovarian syndrome and the controls.

Variables	Polycystic ovarian syndrome (n = 60)	Controls (n = 60)	P
White blood cell, cells $\times 10^9/l$	6.550 (5.210 - 7.675)	6.550 (5.525 - 7.700)	0.854
Neutrophils, cells $\times 10^9/l$	3.050 (2.100 - 4.475)	3.250 (2.100 - 4.650)	0.974
Lymphocytes, cells $\times 10^9/l$	2.400 (1.915 - 2.975)	2.400 (1.800 - 2.700)	0.445
Hemoglobin, gm/dl	12.6 (11.3 - 13.7)	11.95 (10.525 - 13.25)	0.076
Haematocrit, %	38.7 (35.32 - 41.6)	37.300 (34.15 - 39.675)	0.351
Red blood cell cells	4.600 (4.37 - 4.90)	4.800 (4.500 - 5.000)	0.103
MCV	83.9 (76.25 - 88.000)	81.400 (71.472 - 88.200)	0.326
MCH	28.200 (25.525 - 29.475)	27.000 (23.425 - 28.600)	0.099
MCHC	32.300 (30.2 - 33.350)	32.300 (31.100 - 33.000)	0.735
Red cell distribution width, %	13.2 (12.6 - 14.5)	13.45 (12.4 - 17.32)	0.264
Platelets count, $10^3/\mu l$	305.5 (247.5 - 355.2)	330.0 (260.0 - 353.0)	0.511
Mean platelet volume, f	8.2 (7.8 - 9.0)	8.8 (8.0 - 9.8)	0.257
Platelet distribution width, %	15.4 (15.1 - 15.7)	15.5 (14.9 - 15.7)	0.861

parameters were not different between women with PCOS and health controls [8]. Moreover, Kałużna *et al.*, have shown that WBC were not different between women with PCOS and controls [9]. Our findings were consistent with Ucakurk *et al.*, findings who observed no significant difference in the homological parameters namely hemoglobin, RBCs, platelets count and WBCs between the women with PCOS and women without PCOS [25]. Likewise, It has been reported previously reported that serum iron levels were not different between women who had PCOs and the controls of women who had no PCOS [26].

A significantly higher of hemoglobin has been reported in women with PCOS compared with the healthy women (control) [27]. This finding (high hemoglobin) has been explained by the hormone levels in PCOS women which might in-

fluence on hemoglobin levels through a dose-dependent stimulatory effect on erythropoiesis [28] [29]. Furthermore, androgen receptor in the bone marrow might lead to increase in hemoglobin level [30]. The reduced frequency of menstruation in women with PCOS group is thought to cause the differences of hemoglobin level between PCOS and control groups.

Our results showed no significant difference in the WBCs counts between the women with PCOS compared with women without PCOS. Several previous studies have shown that WBC count was significantly higher in the women with PCOS group [12] [17] [18]. Moreover, a positive predictive effect of WBCs as well as a negative predictive effect of lymphocytes on insulin resistance has been reported in women with PCOS [31]. It is worth to be mentioned that an aerobic exercise might reverse the higher WBCs in women with PCOS [32].

Although, we did not show a significant difference in the MPV, RDW in women with PCOS and controls, previous studies have shown that MPV, NLR, neutrophil count, neutrophil to total leucocyte ratio were significantly higher in women with PCOS compared with the controls [13] [14] [33].

## 6. Conclusion

The current study showed no significant difference in the hematological parameters in Sudanese women with PCOS and the healthy controls. A study with larger sample size is required in the future to confirm this finding and we did not assess many other hematological variables e.g. serum ferritin as well as other inflammatory markers e.g. C-reactive protein and insulin resistance.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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