



Assessment of Neck Circumference and Lipid Profile in Subjects with Polycystic Ovary Syndromes

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ABSTRACT:

Background: Polycystic ovary syndrome (PCOS) is a common hormonal disorder in women of reproductive age, often linked to obesity and abnormal lipid levels. Neck circumference (NC) has become a straightforward, non-invasive anthropometric indicator of upper-body fat and metabolic risk. This research sought to evaluate changes in NC and lipid profiles in women with PCOS and investigate their relationship.

Methods: A cross-sectional study was executed with 40 women diagnosed with PCOS and 40 age-matched controls without PCOS. Anthropometric measurements, such as body mass index (BMI), neck circumference (NC), waist circumference (WC), and hip circumference (HC), were documented. Lipid profiles after fasting-including total cholesterol (CHOL), triglycerides (TG), high-density lipoprotein (HDL), low-density lipoprotein (LDL), and very-low-density lipoprotein (VLDL) were assessed.

Results: Although age was not significantly differ across groups (p -value = 0.54), women with PCOS displayed notably higher BMI (p -value = 0.03), NC (p = 0.00), WC (p -value = 0.00), and HC (p -value = 0.00). Analysis of lipid profiles showed markedly increased levels of CHOL, TG, LDL, and VLDL (all p -value = 0.00) and decreased HDL (p -value = 0.00) in women with PCOS compared to controls. In the PCOS group, NC exhibited a notable positive correlation with TG (r = 0.38, p -value = 0.02) and VLDL (r = 0.38, p -value = 0.02), but did not show any correlation with CHOL, HDL, or LDL.

Conclusion: Women with PCOS show greater neck circumference and a poorer lipid profile than those without PCOS. The positive relationship between NC and TG and VLDL indicates that NC could act as a potential screening method for dyslipidemia in PCOS, necessitating additional research in larger groups.

Introduction: Polycystic Ovary Syndrome (PCOS) is a common hormonal disorder that impacts 6–15% of women of childbearing age worldwide [1, 2]. PCOS, marked by hyperandrogenism, ovulatory irregularities, and polycystic ovarian structure, is a major cause of infertility and closely linked to a range of metabolic issues such as insulin resistance, dyslipidemia, and central obesity. These metabolic traits increase the likelihood of individuals experiencing long-term issues like type 2 diabetes mellitus, cardiovascular diseases, and metabolic syndrome [3, 4]. Recognizing straightforward, affordable, and dependable anthropometric indicators that signify underlying metabolic issues in PCOS patients is essential for early risk assessment and management.

Neck circumference (NC) is a developing anthropometric measure that reflects the distribution of subcutaneous fat in the upper body [5]. Multiple studies indicate that NC is positively linked to insulin

resistance, dyslipidemia, and cardiovascular risk factors [6, 7]. In contrast to body mass index (BMI) or waist circumference (WC), which can be affected by elements like bloating or attire, NC provides a consistent, easily repeatable, and non-invasive assessment of metabolic risk associated with obesity [8]. Nevertheless, the usefulness of NC in evaluating metabolic risk in PCOS patients is still not thoroughly investigated, particularly regarding its relationship with lipid profile metrics.

This research seeks to examine the connection between neck circumference and lipid profile in women with PCOS, thus determining its possible function as an alternative indicator of metabolic risk. The reason for choosing NC as a measure is its straightforwardness, practicality in clinical settings, and its increasing acknowledgment as an indicator of cardiometabolic risk [9]. Moreover, irregularities in lipid profiles are one of the most prevalent and consistent observations in PCOS



patients, acting as a crucial element for evaluating cardiovascular risk [10].

Although the metabolic effects of PCOS are well-documented, a clear gap still exists in identifying straightforward clinical indicators that could facilitate early diagnosis and risk assessment. This research tackles the necessity for such a tool, seeking to deliver definitive proof regarding the function of NC in metabolic evaluation, potentially aiding in prompt intervention and enhanced patient outcomes.

Material and methods:

Study Design: A cross-sectional observational study based in a hospital was carried out to evaluate of neck circumference (NC) and lipid profile in individuals diagnosed with Polycystic Ovary Syndrome (PCOS) and their associations (table no.1). The Institutional Ethics Committee approved the study protocol.

Study Population: The research involved women between the ages of 18 and 40 who had been diagnosed with PCOS according to the Rotterdam criteria. Participants were gathered from the outpatient clinics of Obstetrics and Gynecology. Each participant gave written informed consent before being included in the study.

Inclusion Criteria: The research included women who were willing to give informed consent, were between the ages of 18 and 40, and had been diagnosed with polycystic ovarian syndrome (PCOS) based on the Rotterdam criteria.

Exclusion Criteria: The study excluded women with a history of smoking, alcohol use, or other chronic conditions affecting lipid metabolism, as well as those who were pregnant or nursing, had documented cases of diabetes mellitus, thyroid disorders, or Cushing's

syndrome, were taking lipid-lowering medications or hormone therapy within the previous three months, or had any of these conditions.

Sample Size: For the study, 80 participants were selected at random, 40 of whom had been diagnosed with PCOS based on the Rotterdam criteria and 40 of who served as controls.

Methods: After obtaining informed consent, every participant underwent a comprehensive clinical assessment and anthropometric measurements.

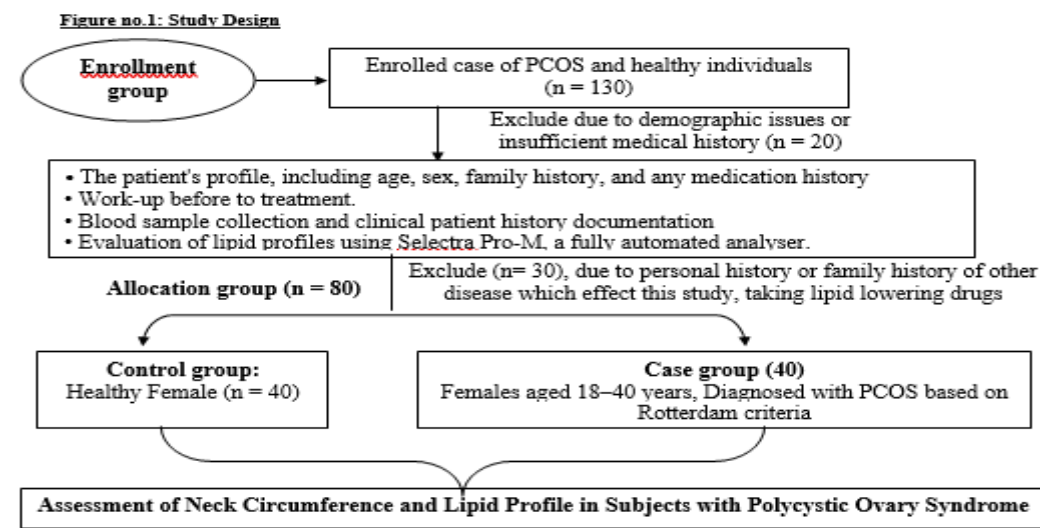
Neck Circumference (NC): Measured while the person is standing up straight and at the level of the thyroid cartilage using a non-elastic measuring tape.

Body Mass Index (BMI): Determined by the formula weight (kg)/height squared (m²).

Waist Circumference (WC): Measured at the midway point between the upper portion of the iliac crest and the bottom edge of the last discernible rib.

Laboratory investigation: After an overnight fast of 8–12 hours, blood samples were taken in order to evaluate the characteristics of the lipid profile. A completely automated analyser called Selectra Pro-M was used to measure the levels of high-density lipoprotein (HDL), triglycerides (TG), and total cholesterol (CHOL). The Friedewald formula was used to determine the levels of low-density lipoprotein (LDL) and very low-density lipoprotein (VLDL).

Data Analysis: Microsoft Excel was used to enter the data, and SPSS software version 28.0 was used to analyse it. The mean and standard deviation were used to analyse baseline characteristics. To assess the relationship between NC and lipid parameters, Pearson's correlation coefficient was utilised. P-values less than 0.05 were considered statistically significant.





Results: 40 women diagnosed with polycystic ovary syndrome (PCOS) and 40 controls of the same age without PCOS took part in this research. As indicated in Table 2, there was no statistical difference in age between women with PCOS (24.05 ± 5.96 years) and those without PCOS (23.45 ± 1.88 years) (p -value = 0.54). However, significant differences were observed in essential anthropometric measurements. Women with PCOS demonstrated a significantly greater average BMI (24.14 ± 4.05 kg/m²) compared to women without PCOS (22.17 ± 3.71 kg/m²; p -value = 0.03). Neck circumference (NC), an essential measure in this study, was significantly greater in the PCOS group (32.3 ± 1.99 cm) than in the non-PCOS group (31.11 ± 1.28 cm) (p -value = 0.00). Likewise, waist circumference (WC) and hip circumference (HC) were significantly elevated in women with PCOS (WC: 79.53 ± 10.43 cm; HC: 99.03 ± 9.76 cm) compared to the control group (WC: 70.53 ± 7.73 cm; HC: 93.35 ± 7.70 cm), with both assessments showing highly significant differences (p -value = 0.00)

Table 3 shows that women with PCOS displayed significantly different lipid profiles compared to those without PCOS. The group with PCOS showed considerably higher total cholesterol (CHOL) levels

(142.95 ± 26.04 mg/dl) when compared to the non-PCOS group (123.18 ± 23.83 mg/dl; p -value = 0.00). Triglyceride (TG) levels were notably elevated in women with PCOS (127.13 ± 35.39 mg/dl) in contrast to controls (96.98 ± 15.01 mg/dl; p -value = 0.00). The PCOS group exhibited significantly lower high-density lipoprotein (HDL) levels (47.06 ± 6.99 mg/dl) than non-PCOS women (51.53 ± 5.09 mg/dl; p -value = 0.00). Furthermore, the levels of low-density lipoprotein (LDL) and very-low-density lipoprotein (VLDL) were significantly higher in women with PCOS (LDL: 97.08 ± 25.45 mg/dl; VLDL: 25.43 ± 7.08 mg/dl) compared to those without PCOS (LDL: 88.88 ± 9.75 mg/dl; VLDL: 19.4 ± 3.0 mg/dl), with p -values = 0.00 for each

Pearson correlation analysis was conducted to examine the connection between neck circumference and lipid profile parameters in the PCOS group (Table 4 and figure no. 1-5). Triglyceride and VLDL levels exhibited a significant positive correlation with neck circumference ($r = 0.38$, p -value = 0.02) and triglyceride levels ($r = 0.38$, p -value = 0.02). No statistically significant association was found between neck circumference and HDL ($r = -0.17$, p -value = 0.29), LDL ($r = 0.22$, p -value = 0.17), or total cholesterol ($r = 0.06$, p -value = 0.67)

Table 2: Showing the comparison of anthropometric measures of PCOS women and non-PCOS women

Parameter	PCOS Women (Mean \pm SD)	Non-PCOS Women (Mean \pm SD)	p-value
Age (years)	24.05 ± 5.96	23.45 ± 1.88	0.54
BMI (Kg/m ²)	24.14 ± 4.05	22.17 ± 3.71	0.03*
NC (cm)	32.3 ± 1.99	31.11 ± 1.28	0.00**
WC (cm)	79.53 ± 10.43	70.53 ± 7.73	0.00**
HC (cm)	99.03 ± 9.76	93.35 ± 7.7	0.00**

Table 3: Showing the comparison of Lipid Profile Parameters of PCOS women and non-PCOS women

Parameter	PCOS Women (Mean \pm SD)	Non-PCOS Women (Mean \pm SD)	p-value
CHOL (mg/dl)	142.95 ± 26.04	123.18 ± 23.83	0.00**
TG (mg/dl)	127.13 ± 35.39	96.98 ± 15.01	0.00**
HDL (mg/dl)	47.06 ± 6.99	51.53 ± 5.09	0.00**
LDL (mg/dl)	97.08 ± 25.45	88.88 ± 9.75	0.00**
VLDL (mg/dl)	25.43 ± 7.08	19.4 ± 3.0	0.00**

Table 4: Showing the correlation of neck circumference with lipid profile in PCOS women

		CHOL	TG	HDL	LDL	VLDL
NC	r-value	0.06	0.38*	-0.17	0.22	0.38*
	p-value	0.67	0.02	0.29	0.17	0.02

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



Figure no. 1: Showing the correlation of neck circumference (NC) with serum total cholesterol (CHOS) in PCOS women

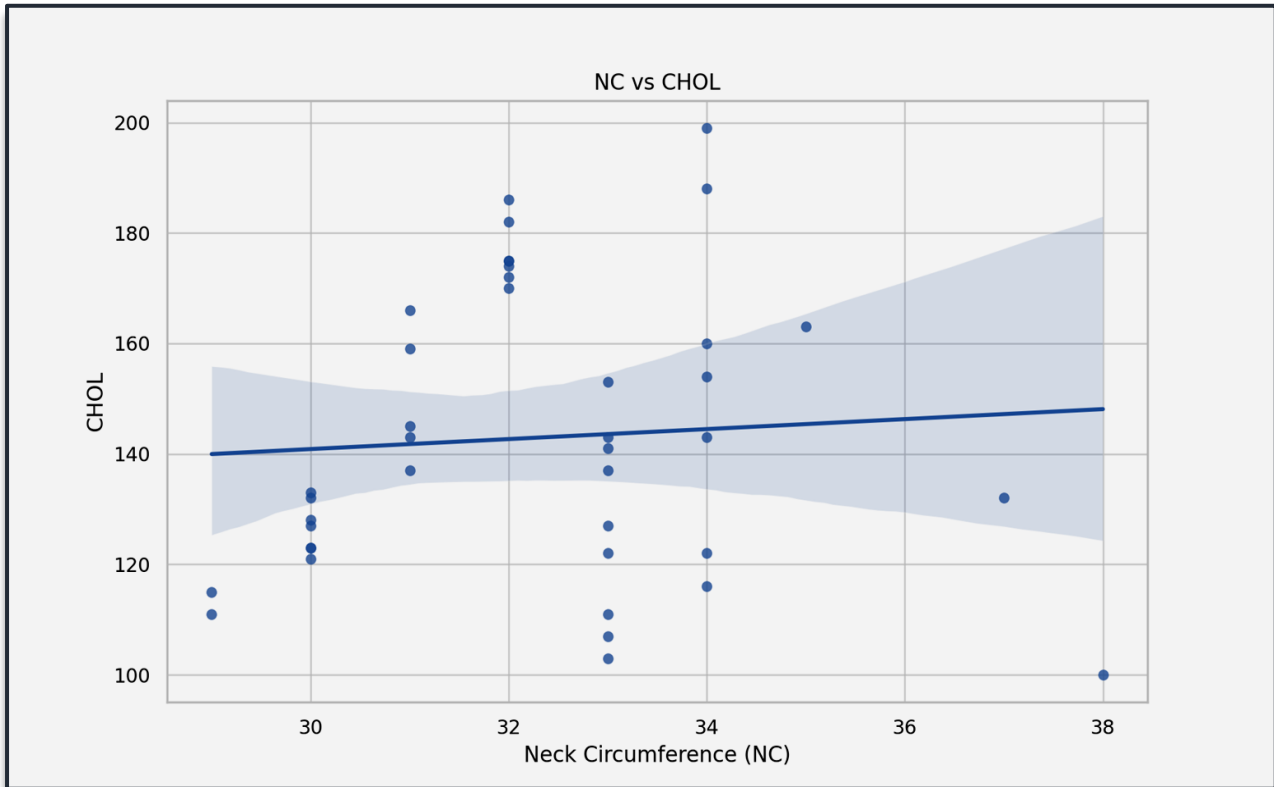


Figure no. 2: Showing the correlation of neck circumference (NC) with serum triglycerides (TG) in PCOS women

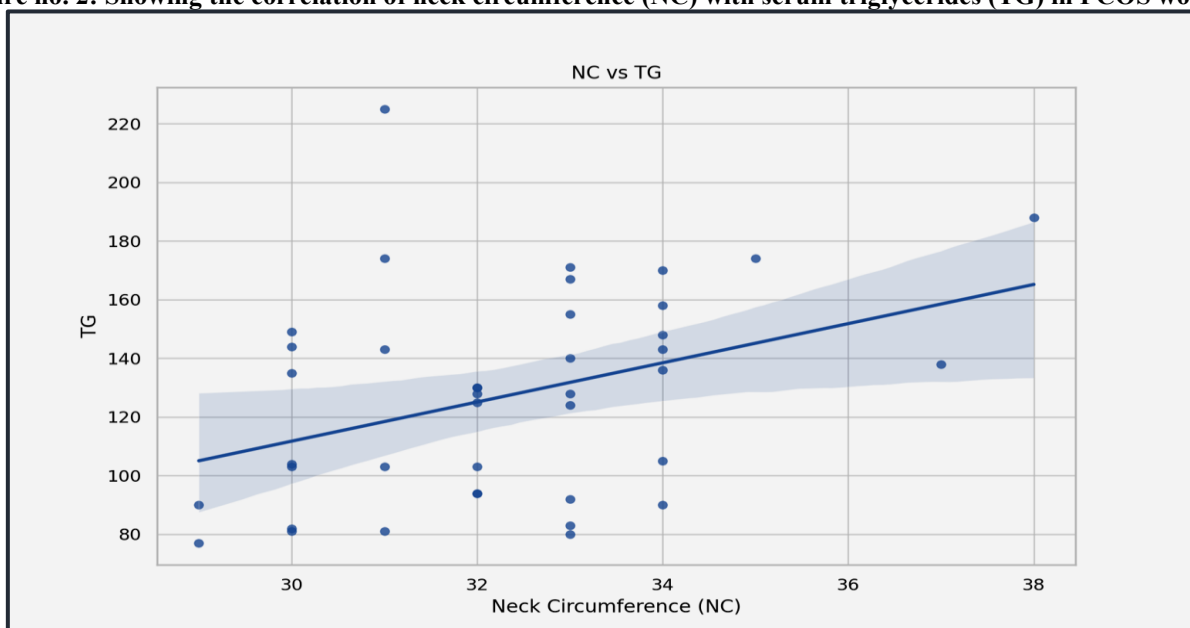




Figure no. 3: Showing the correlation of neck circumference (NC) with serum HDL-cholesterol (HDL) in PCOS women

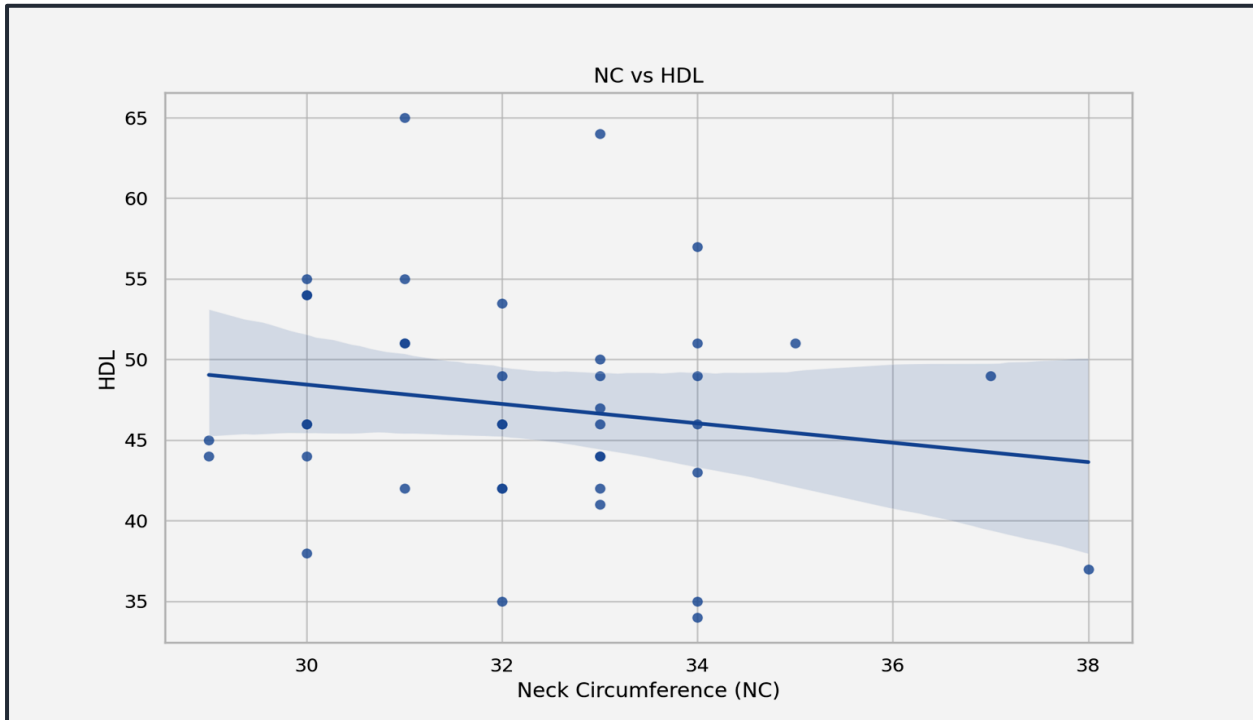


Figure no. 4: Showing the correlation of neck circumference (NC) with serum LDL-cholesterol (LDL) in PCOS women

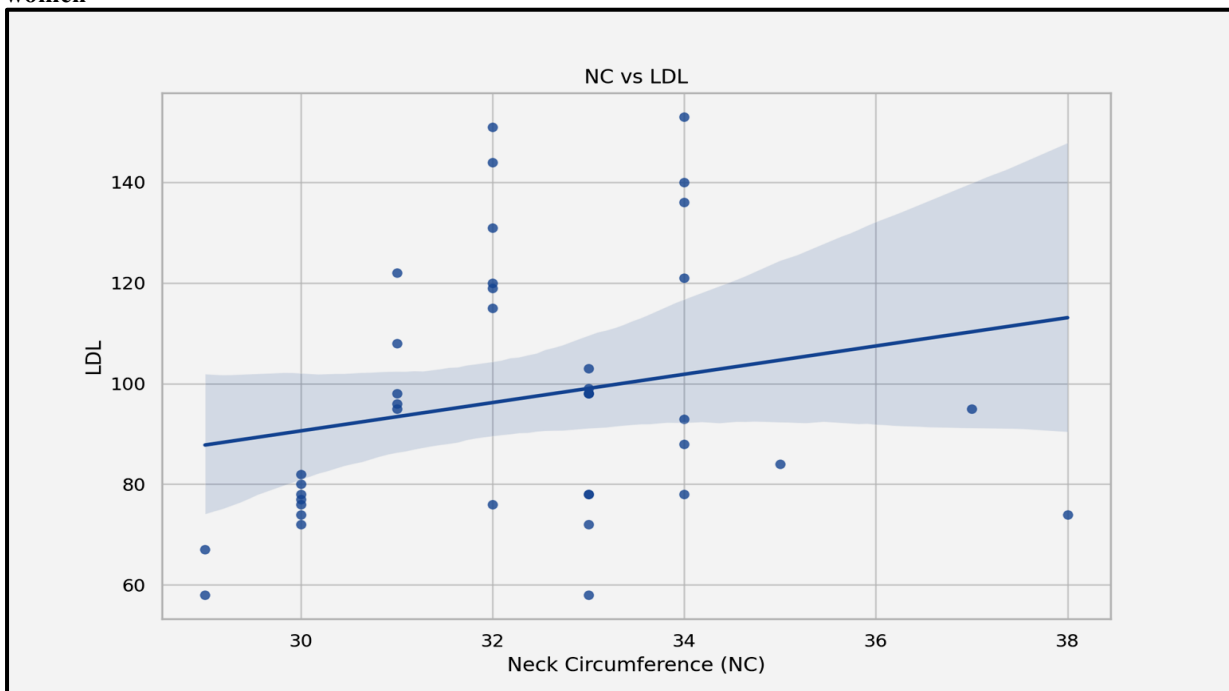
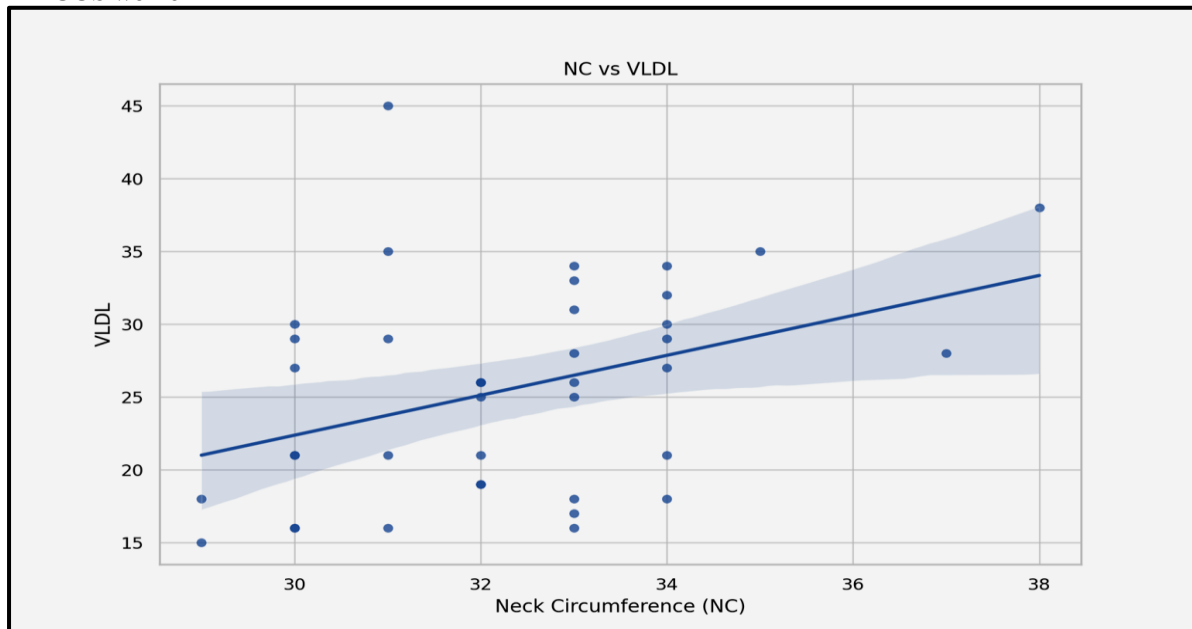




Figure no. 4: Showing the correlation of neck circumference (NC) with serum VLDL-cholesterol (VLDL) in PCOS women



Discussion: The present study evaluated and compared anthropometric and lipid profile metrics in women with polycystic ovary syndrome (PCOS) to non-PCOS controls, highlighting neck circumference (NC) and its association with lipid indicators. The findings showed that women with PCOS had significantly higher BMI, waist circumference (WC), hip circumference (HC), and neck circumference compared to women without PCOS. These findings align with earlier research indicating that PCOS is often associated with central obesity and increased upper-body fat, both of which are risk factors for insulin resistance and cardiovascular problems [10-12]. The significant increase in neck circumference in women with PCOS suggests that NC may serve as a simple, non-invasive measure of upper-body fat in clinical settings [13].

The analysis of lipid profiles revealed that women with PCOS had significantly elevated levels of total cholesterol, triglycerides, LDL, and VLDL, as well as reduced HDL levels. These results correspond with the dyslipidemia trends frequently observed in PCOS and bolster the theory that women with PCOS are at an increased risk for atherosclerosis and metabolic syndrome [14-15]. Correlation analysis revealed a significant positive association between NC and triglyceride alongside VLDL levels in the PCOS group. This suggests that increased NC acts not only as a sign of body fat but also as a potential predictor of dyslipidemia in these women [16, 17]. Although NC did

not demonstrate a strong correlation with total cholesterol, HDL, or LDL, the moderate correlations identified indicate that NC could still affect the assessment of overall metabolic health in PCOS [18].

These findings support previous studies suggesting that NC is a reliable anthropometric indicator of metabolic problems [19]. It offers tangible advantages over other fatness metrics such as BMI and WC due to its easy measurement, lower variability, and minimal influence from elements like abdominal distension after meals or bloating linked to menstruation [20].

Limitations: This study has some limitations. The sample size was limited, and the cross-sectional design does not allow for causal inferences. Additionally, factors that might distort results, such as diet, exercise, and insulin resistance, were not accounted for.

Conclusion: This research revealed that neck circumference is notably greater in women with PCOS and has a positive correlation with triglycerides and VLDL levels. NC seems to be a useful and practical anthropometric indicator for recognizing PCOS women susceptible to dyslipidemia. Integrating it into standard clinical evaluations might facilitate the early detection and treatment of metabolic issues in PCOS. Additional extensive, longitudinal research is needed to confirm neck circumference as a predictive indicator for



metabolic syndrome and cardiovascular risk in PCOS groups.

Conflict of Interest: With relation to the publishing of this research, the authors affirm that they have no competing interests.

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