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Original Research

Correlating Clinical Manifestations with Biochemical Profiles in Polycystic Ovarian Syndrome

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ABSTRACT:

Background:Polycystic Ovarian Syndrome (PCOS) stands out as the prevailing endocrine disorder among women within the reproductive age bracket. It encompasses persistent anovulation, irregular menstrual patterns, hyperandrogenism, polycystic ovaries, and metabolic syndrome. The primary objectives of this study are to explore the clinical, biochemical, and hormonal profiles in individuals with PCOS and establish correlations with those of normal counterparts.**Methods**:A forward-looking case-control investigation involving 400 women aged 20-30 years is underway. The study comprises 200 participants diagnosed with Polycystic Ovarian Syndrome (PCOS) and an equal number of individuals forming the control group.**Results**:Ninety-two percent of individuals with Polycystic Ovarian Syndrome (PCOS) exhibited menstrual irregularities, with oligomenorrhea being the predominant presentation. Infertility was observed in 52% of cases, while 53% showed signs of hirsutism. In comparison to the control group, individuals with PCOS demonstrated statistically significant differences in mean BMI, waist-to-hip ratio, mean LH levels, LH:FSH ratio, total testosterone, fasting insulin, and total cholesterol (P value < 0.001).Specifically, the mean LH in PCOS was 15.44, higher than the control group's mean of 9.92. The mean LH:FSH ratio in PCOS was 2.86, compared to 1.71 in the control group, with an elevation noted in 67% of PCOS cases. These findings highlight distinctive hormonal and metabolic profiles in PCOS subjects compared to the control group.**Conclusion**:The majority of individuals with Polycystic Ovarian Syndrome (PCOS) exhibited features such as oligomenorrhea, hirsutism, elevated BMI, and an increased waist-hip ratio. Notably, PCOS cases demonstrated statistically significant elevations in mean LH, LH:FSH ratio, testosterone levels, and fasting insulin levels compared to the control group. These findings underscore the association of PCOS with hormonal imbalances, metabolic factors, and specific clinical presentations.

Keywords:anovulation,oligomenorrhea,hirsutism,hyperandrogenism.

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INTRODUCTION

Polycystic Ovary Syndrome (PCOS) emerges as a widespread endocrine disorder significantly impacting women during their reproductive years, serving as a prominent contributor to both hyperandrogenism and oligoanovulation.[1] The repercussions of these physiological alterations extend beyond the realm of mere medical concerns, casting substantial psychological, social, and economic consequences upon affected individuals. As adult women bear the brunt of this condition, various studies have reported a prevalence ranging from 4% to 12%, underscoring its considerable impact on a significant portion of the female population.[2,3]The historical context of PCOS dates back to 1935 when the classic form was meticulously described by Stein and Leventhal, marking a pivotal moment in the understanding of this complex syndrome. PCOS unfolds as a multifaceted condition characterized by chronic anovulation, disruptions in menstrual patterns, the presence of hyperandrogenism, the formation of polycystic ovaries, and noteworthy associations with metabolic syndrome. The intricate interplay of these elements contributes to the diverse clinical manifestations observed in individuals with PCOS, thereby emphasizing the need for a comprehensive understanding of the syndrome and its far-reaching implications.

The collaborative efforts of the Rotterdam consensus workshop in 2003, facilitated by the European Society for Human Reproduction and Embryology (ESHRE) and the American Society for Reproductive Medicine (ASRM), marked a crucial milestone in the establishment of a comprehensive diagnostic framework for Polycystic Ovary Syndrome (PCOS).[4] Within this framework, the diagnosis of PCOS is confirmed when an individual manifests at least two of the following three criteria.Firstly, irregular or absent menstrual cycles, clinically termed as oligo/anovulation, form a key aspect of PCOS diagnosis. This aspect reflects a disruption in the normal ovulatory process, highlighting the reproductive implications associated with the syndrome.Secondly, the presence of clinical and/or biochemical signs of hyperandrogenism, such as acne or hirsutism, plays a significant role. Importantly, these signs must persist after thorough investigation rules out other potential causes of hyperandrogenism, emphasizing the specificity of the diagnostic criteria.[5]Lastly, the ultrasound appearance of polycystic ovaries constitutes a crucial diagnostic component. This involves the identification of 12 or more follicles with diameters ranging from 2 to 9 mm in one or both ovaries, or an ovarian volume exceeding 10 cm3. The ultrasound criteria contribute to a more nuanced understanding of the morphological aspects of PCOS.The standardized definition resulting from the Rotterdam criteria has greatly enhanced the consistency and accuracy of PCOS diagnosis. This, in turn, empowers clinicians to adopt a more uniform and targeted approach in identifying and managing the complex and multifaceted aspects of this prevalent endocrine disorder. The guidelines have not only contributed to clinical clarity but have also paved the way for more effective research, understanding, and management of PCOS on a global scale.[6]

Hyperandrogenism, a prevalent characteristic in Polycystic Ovary Syndrome (PCOS), is primarily ovarian in origin and is clinically manifested by common features such as hirsutism and acne. Women diagnosed with PCOS often exhibit insulin resistance and hyperinsulinemia. The interplay of excessive insulin levels, coupled with elevated luteinizing hormone (LH), can lead to an overproduction of testosterone in the ovaries.[7] This, in turn, disrupts the normal follicle maturation process, hampering ovulation.The ramifications of PCOS extend beyond its immediate symptoms, with insulin resistance playing a pivotal role in the late complications associated with the syndrome. Over 40% of women with PCOS demonstrate impaired glucose tolerance, and 10% eventually develop type 2 diabetes mellitus. In cases of mild insulin resistance, there may be slightly elevated fasting serum insulin levels, while severe forms can manifest with conditions such as acanthosis nigricans.Insulin resistance is particularly pronounced in women with PCOS who experience chronic anovulation. The syndrome is closely linked to obesity, with excess adiposity in the central body region exacerbating hyperandrogenism and menstrual disturbances. Central or visceral obesity is also associated with heightened insulin resistance.Addressing PCOS in adolescents holds significant importance beyond symptom relief, as untreated cases pose an increased risk of infertility, endometrial hyperplasia, and carcinoma. Additionally, there is a heightened risk of developing type 2 diabetes mellitus, metabolic syndrome, and potentially cardiovascular diseases such as myocardial dysfunction, stroke, and hypertension.[8,9]The overarching aim of the study is to discern and correlate various clinical features, hormonal changes, and biochemical parameters among individuals with PCOS and those in a normal control group. This research endeavors to deepen our understanding of the intricate aspects of PCOS, facilitating more targeted and effective interventions to mitigate its immediate and long-term consequences.

MATERIALS AND METHODS

In this prospective study, women aged 20-30 years presenting with irregular menstrual cycles, oligomenorrhea/amenorrhea, infertility, hirsutism, and excessive acne were comprehensively evaluated. The diagnosis of Polycystic Ovary Syndrome (PCOS) was established based on the Rotterdam criteria. The study cohort included 200 patients with PCOS, divided into 100 married and 100 unmarried individuals, while the control group comprised 200 women, equally distributed between married and unmarried categories. Ethical approval from the Institutional Ethics Committee was obtained to conduct the study.Exclusion criteria encompassed women with a history of current or previous use of oral contraceptives, glucocorticoids, antiandrogens, ovulation induction agents, antidiabetic and antiobesity drugs, or other hormonal medications. Additionally, those with a history of pregnancy, breastfeeding, Diabetes Mellitus, chronic illness, and hyperandrogenism due to other endocrinopathies were excluded. Written informed consent was secured from all study participants.

Anthropometric measurements, including height, weight, waist, and hip circumference, were recorded, and Body Mass Index (BMI) and waist:hip ratios were calculated. Hirsutism was graded using the Ferriman & Gallway score, with a score exceeding 8 considered significant. Ultrasound examinations of the lower abdomen were conducted for each participant.Hormonal assessments involved morning blood samples for the analysis of serum LH, FSH, total testosterone, fasting insulin, FT3, FT4, TSH, and Prolactin levels. Samples were obtained on day 2 or 3 of the menstrual cycle in menstruating women and randomly in those with oligomenorrhea. Established normal values for FSH, LH, and total testosterone were 3-4.3 mIU/ml, 4.2-6.3 mIU/ml, and 8-60 ng/dl,

respectively. An LH: FSH ratio of 2:1 was deemed significant. Fasting insulin levels with a normal value <25 mIU/L were considered significant. Thyroid profile normal values included FT3 (3.1-6.8 pmol/L), FT4 (12-22 pmol/L), and TSH (0.27-4.2 µIU/ml). A normal serum Prolactin level was considered to be 2-29 ng/ml. Hormonal assays were performed using enzyme-linked immunosorbent assay (ELISA) kits on an ELISA reader (Stat fax-2100 technology instruments) at the institution.Furthermore, fasting blood sugar (FBS), 2-hour postprandial blood sugar (PPBS), total cholesterol, triglycerides, HDL, and LDL were analyzed using an autoanalyzer. The detailed and comprehensive methodology ensures a thorough exploration of clinical, hormonal, and biochemical aspects in individuals with PCOS and the control group, contributing valuable insights to the understanding of this complex syndrome.

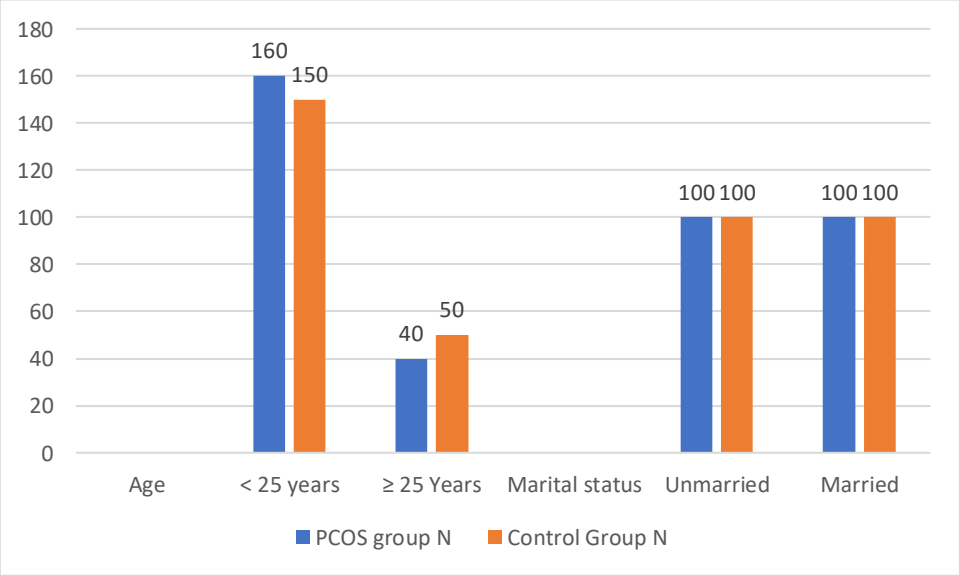
RESULTS

In our study, we observed that the mean age of participants in the PCOS group was 22.60 years, slightly lower than the mean age of 23.37 years in the control group. However, this difference did not reach statistical significance (P value = 0.055). Interestingly, a substantial proportion of both groups, 80% in the PCOS group and 75% in the control group, were below the age of 25 years. Despite this numerical difference, the statistical analysis revealed that the age distribution between the two groups was not significantly different (P value = 0.397).Furthermore, in terms of marital status, our study maintained an equitable distribution, with both married and unmarried participants evenly represented in both the PCOS and control groups. This balanced distribution ensures that any observed effects or variations in the study parameters are less likely to be influenced by differences in marital status. Overall, these demographic details provide a foundation for comparing and interpreting the subsequent findings related to PCOS and the control group in our study.

Table 1: Comparison of age and marital status a between the PCOS and control group

Variables	PCOS group N (%)	Control Group N (%)	P value
Age			0.397
< 25 years	160 (80%)	150 (75%)	
≥ 25 Years	40 (20%)	50 (25%)	
Marital status			1.00
Unmarried	100 (50%)	100 (50%)	
Married	100 (50%)	100 (50%)	

Figure 1: Comparison of age and marital status a between the PCOS and control group



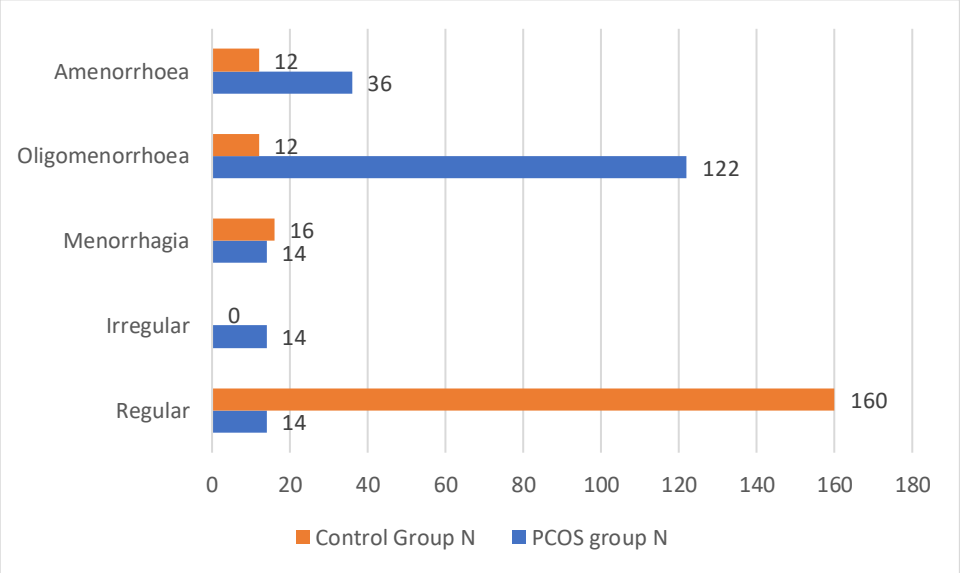
In our study, menstrual irregularity was notably prevalent among individuals with Polycystic Ovary Syndrome (PCOS), with 92% (184 out of 200) experiencing disruptions in their menstrual cycles. In stark contrast, only 15% (30 out of 200) of participants in the control group exhibited menstrual irregularities. The observed difference in proportions between the PCOS and control groups was statistically significant, with a P value less than 0.001.Upon closer examination of the types of menstrual irregularities within the PCOS group, oligomenorrhea emerged as the most common, affecting 61% of cases, followed by amenorrhea, which was observed in 18% of individuals. In

contrast, the majority of participants in the control group, accounting for 80%, reported regular menstrual cycles.These findings underscore the substantial impact of PCOS on menstrual regularity, highlighting the higher prevalence of irregularities, particularly oligomenorrhea, in comparison to the control group. Such insights contribute to a more comprehensive understanding of the clinical manifestations associated with PCOS and provide valuable information for both diagnosis and management strategies.

Table 2: Comparison of menstrual cycle pattern between the PCOS and control group

Menstrual cycle	PCOS group N (%)	Control Group N (%)	P value
Regular	14	160	< 0.001
Irregular	14	0	
Menorrhagia	14	16	
Oligomenorrhoea	122	12	
Amenorrhoea	36	12	

Figure 2: Comparison of menstrual cycle pattern between the PCOS and control group



DISCUSSION

In our study, the deliberate inclusion of participants within the age range of 20-30 years provided a nuanced perspective on the demographic characteristics of Polycystic Ovary Syndrome (PCOS) in this specific age group.[10] The mean age of individuals with PCOS was observed to be 22.60 years, slightly younger than the mean age of 23.37 years in the control group. Interestingly, these findings align with the work of Kumar AN, who extended the age range to 19-35 years and reported a mean age of 25.6 for PCOS and 26.7 for the control group. Spandana and Shetty, in their research, noted a mean age of 27 years, with a significant portion falling within the 26-30 years age group.The meticulous exploration of menstrual irregularities revealed oligomenorrhea as the predominant pattern in PCOS, affecting 61% of cases in our study. This contrasted sharply with the control group, where only 6% experienced such irregularities.[11] The prevalence of oligomenorrhea in PCOS was consistent with Spandana and Shetty's findings, reporting a comparable rate of 59%. Notably, our study revealed that 8% of PCOS cases had regular menstrual periods, diverging from Panda et al's observations, which indicated a higher rate of 14% with normal menstruation.Focusing on infertility, a significant aspect of PCOS, our study unveiled a stark contrast between PCOS cases (52%) and the control group (10%), with the difference being statistically highly significant (P value < 0.001). These findings diverged from Panda et al's report of a lower percentage of infertility in PCOS (16%) compared to the control group (4%). In contrast, Himabindu and Neelima identified a higher prevalence of infertility, affecting 40% of PCOS cases. Arain et al contributed further insights by characterizing PCOS as the second most common cause of female factor-related infertility, comprising 38.5% of cases.The comparative analysis across these studies underscores the intricate variability in demographic patterns, menstrual irregularities, and infertility rates within the realm of PCOS. This variability may arise from diverse populations, regional differences, and the multifaceted nature of the syndrome itself. Such insights contribute to a deeper understanding of the heterogeneity associated with PCOS, offering valuable considerations for tailored diagnostic and therapeutic approaches.

In young women, the clinical landscape of androgen excess is predominantly marked by hirsutism, a condition characterized by excessive and unwanted hair growth in androgen-sensitive areas.[12] The nuanced presentation of hirsutism varies considerably among different ethnic populations, necessitating a population-specific approach to define thresholds for abnormality. In our study, a striking 53% of individuals diagnosed with Polycystic Ovary Syndrome (PCOS) exhibited hirsutism, in stark contrast to the control group, where only 13% displayed this distinctive clinical feature. This aligns with the observations of Abdulrazzak et al and Pache TD et al, both reporting hirsutism prevalence of 64.49% and 63% among PCOS cases, respectively.Turning our attention to clinical parameters associated with obesity, both Body Mass Index (BMI) and waist-hip ratio emerged as key indicators. Notably, our study revealed a statistically highly significant difference in mean BMI between the PCOS group (26.08) and the control group (23.44), with the former exhibiting a higher BMI. This corroborates with the findings of Hahn S et al, who reported a substantial elevation in mean BMI within the PCOS group (31.30) compared to the control group (22.80). Likewise, Dipankar et al found a mean BMI of 28.98 in PCOS cases, in contrast to 21.63 in normal female individuals.These consistent observations underscore the intimate connection between PCOS and elevated BMI, shedding light on the intricate interplay between hormonal dysregulation and metabolic factors.[13] Beyond aiding in the diagnostic process, understanding the dynamics of these clinical parameters offers crucial insights into the broader health implications associated with PCOS. Moreover, recognizing the ethnic variability in hirsutism prevalence and appreciating the impact of obesity-related parameters contribute to a more holistic and personalized approach to the assessment and management of PCOS in diverse populations. The multifaceted nature of PCOS necessitates a comprehensive understanding, allowing for tailored interventions that address not only reproductive health but also broader metabolic and endocrine considerations.[14]

Dyslipidemia, the abnormal levels of lipids in the bloodstream, is a prevalent and clinically significant feature observed in individuals diagnosed with Polycystic Ovary Syndrome (PCOS). This condition often manifests as increased levels of low-density lipoprotein (LDL) and triglycerides (TG), accompanied by decreased levels of high-density lipoprotein (HDL).[15] The intricate relationship between dyslipidemia and PCOS is multifaceted, with contributing factors including unhealthy dietary habits, obesity, metabolic syndrome, hyperandrogenism, sedentary lifestyles, and genetic predispositions.In our study, although no significant differences were observed between the PCOS and non-PCOS groups in terms of LDL and HDL levels, there was a noteworthy finding regarding total cholesterol and TG levels. Specifically, these lipid parameters were found to be higher in the group without polycystic ovarian (PCO) morphology. This suggests that the presence or absence of PCO morphology might play a role in influencing the lipid profiles of individuals with PCOS. The connection between hyperandrogenism, a hallmark characteristic of PCOS, and dyslipidemia is well-established. While our study did not reveal significant differences in androgen levels between the two groups, it is interesting to note that all PCOS patients without PCO morphology were diagnosed with clinical and/or biochemical hyperandrogenism. This suggests that the heightened level of hyperandrogenic presentation in PCOS patients without PCO morphology could potentially contribute to elevated total cholesterol and TG levels in this specific subgroup.These findings highlight the intricate interplay between hormonal, metabolic, and morphological factors within the context of PCOS.[16,17] Recognizing that hyperandrogenism, even in the absence of typical PCO morphology, may contribute to dyslipidemia emphasizes the need for a comprehensive understanding of the syndrome. Such insights are critical for tailoring interventions that address not only the reproductive health concerns associated with PCOS but also the broader metabolic implications. This holistic approach ensures a more effective and personalized management strategy for individuals navigating the complexities of PCOS.

CONCLUSION

Oligomenorrhea emerged as the predominant and most commonly reported presenting symptom among individuals diagnosed with Polycystic Ovary Syndrome (PCOS). This irregular menstrual pattern was found to be significantly correlated with elevated luteinizing hormone (LH) levels and an increased LH: follicle-stimulating hormone (FSH) ratio in PCOS cases. The connection between menstrual irregularities and hormonal imbalances underscores the reproductive implications of PCOS.Furthermore, a substantial portion of individuals with PCOS experienced infertility and hirsutism, emphasizing the multifaceted nature of this endocrine disorder. The coexistence of these symptoms signifies the broader impact of PCOS on both reproductive and cosmetic aspects, affecting the overall well-being of affected individuals.In terms of metabolic parameters, individuals with PCOS exhibited higher mean Body Mass Index (BMI) and waist-to-hip ratio, both of which are key indicators of obesity, when compared to the control group. These findings corroborate the well-established association between PCOS and metabolic disturbances. Notably, the total testosterone level, elevated in 67% of PCOS cases, emerged as a noteworthy hormonal marker. Elevated androgen levels contribute to the clinical manifestations of hirsutism and further underline the hormonal

dysregulation inherent in PCOS.Moreover, markers of metabolic health, including mean fasting insulin and total cholesterol levels, were significantly higher in the PCOS group compared to the control group. This elevation in insulin and cholesterol levels poses a potential risk factor for the future development of type 2 Diabetes Mellitus and cardiovascular diseases. These findings highlight the importance of addressing not only the reproductive aspects of PCOS but also its broader metabolic implications. Early intervention and management strategies are crucial in mitigating the long-term health risks associated with PCOS.

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