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ASSESSMENT OF HORMONAL DYSREGULATION IN PATIENTS WITH POLY CYSTIC OVARIAN SYNDROME

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Abstract

Background: *Women of reproductive age are susceptible to PCOS, a common endocrine disorder marked by hyperparathyroidism, menstruation irregularoty, abnormal hormonal function, and disturbed metabolism. The clinical and biochemical manifestation of the syndrome is known to be influenced by lifestyle factors and obesity.*

Objective: *To assess the relationship between body mass index (BMI), clinical characteristics, and lifestyle patterns and to measuure hormonal dysregulation in PCOS patients.*

Methodology: *A crosswise study involving 30 PCOS patients was carried out. Analyses of anthropometric measurements, structured clinical histories, and laboratory analyses of hormone parameters such as prolactin, testosterone, FSH, LH, T3, T4, and TSH were used to gather data. Participants were divided into groups with low BMIs (n = 10) and high BMIs (n = 20). Descriptive statistics, correlation analysis, and mean comparisons between groups were all included in the statistical analysis; $p < 0.05$ was deemed statistically valid.*

Results: *According to the study, 30% of participants were overweight, and 43% were obese, suggesting that PCOS patients have a high prevalence of elevated BMI. Acne, hirsutism, and hair loss were all common hyperandrogenic manifestations, affecting 40% of participants.In excess of 50% of the participants had irregular menstruation. Despite minor variations in hormonal parameters between groups with high and low BMI, none of them were statistically significant ($p > 0.05$). The connection was somewhat positive ($r = 0.661$) between the LH/FSH ratio and BMI, indicating a possible link between gonadotropin imbalance and obesity.*

Conclusion: *The results show that substantial clinical and metabolic variability are linked to PCOS. Although obesity was common, this sample's basal hormone levels were not significantly impacted by BMI alone. Effective diagnosis and treatment require a thorough hormonal evaluation in addition to a lifestyle assessment. It is recommended that additional study be conducted using bigger sample sizes and metabolic markers in order to fully comprehend the connection between PCOS and obesity and hormonal dysregulation.*

INTRODUCTION

For reproductive age women, among the most prevalent secretory organ-metabolic disorders is Polycystic Ovarian Syndrome (PCOS). Ovulatory dysfunction (oligo- or anovulation), clinical or biochemical hyperandrogism and polycystic ovarian morphology on ultrasound are among the diverse constellation of clinical, biochemical, and morphological characteristics that define it. World Health Organization (WHO) suggest that, PCOS usually begins during adolescence, although symptoms may fluctuate over time, and it remains a chronic condition without a definitive cure(1).

The reason of PCOS remains uncertain, but evidence suggests a complex origin involving inherited predisposition, epigenetic influences, biological science factors (such as diet, lifestyle and endocrine-disrupting chemicals), and complex interactions among the HPO axis, insulin and adipose tissue signalling(2).Clinically,PCOS women may have irregular periods, infertility, hirsutism, acne, alopecia, obesity and metabolic derangements. The syndrome is not only a disorder of a reproductive system, but increasingly recognised as a systemic condition with chronic health conditions(3).

Because of this breadth, PCOS has been described as a condition at the intersection of reproductive endocrinology, metabolism and cardiovascular risk. For your study on hormonal dysregulation in PCOS, it is critical to appreciate this broader context: while the hallmark features are reproductive (ovulatory dysfunction, hyperandrogenism), the metabolic and hormonal dysregulations are deeply intertwined Estimating the ratio of PCOS is difficult because of variability in diagnostic criteria (such as the Rotterdam criteria, National Institutes of Health (NIH) criteria, and the Androgen Excess and PCOS Society (AES) criteria), differences in research methodology, study populations, age ranges, ethnic groups and healthcare access. A past analysis covering 35 studies with more than 12 million women found a worldwide ratio of PCOS of about 9.2% (95% CI: 6.8-12.5%) when all diagnostic criteria were pooled.(4) When broken down by diagnostic criteria: 5.5% (95% CI: 3.9-7.7%) using NIH criteria; 11.5% (95% CI: 6.6-19.4%) using Rotterdam criteria; and 7.1% (95% CI: 2.3-20.2%) using AES criteria(4).

As an example of regional burden, the WHO fact-sheet estimates that PCOS affects 6-13% of women of procreative age globally, and that up to 70% of cases may unknown. Moreover, studies show marked regional variation: for instance, a recent review noted that African females had a ratio of almost 16.4%, whereas in some studies had around 40(5).

Fluctuating sex hormone levels are a key feature of PCOS. Clinical manifestations like Hirsutism Acne and oily skinAndrogenic alopecia (scalp hair thinning) These signs result from increased ovarian androgen production and hypersensitivity of hair follicles(8) Most women with PCOS showing rsestance of insulin, even without obesity. Metabolic features include Central obesity,Increased risk of type 2 diabetes and high level of triglycerides, low level of HDL,Higher chance of metabolic syndrome(9). Hyperinsulinemia worsens androgen excess,resulting in a unbalanced hormonal cycle(10).

Psychological distress is increasingly recognized in PCOS. Common concerns include Anxiety and depression ,Low self-esteem related to cosmetic symptoms like Fatigue and sleep disturbances (including sleep apnea)(7). These factors significantly affect quality of life.

One of the most prevalent endocrine and metabolic conditions affecting women of reproductive age is polycystic ovarian syndrome (PCOS). It is recognized as a leading public health concern because of its high prevalence, reproductive complications, and chronic metabolic disfunctions(6). The epidemiological estimates vary widely because of differences in diagnostic criteria, populations studied, and ethnic variations. However, PCOS is considered a

worldwide condition issue bother millions of women, with increasing recognition in both developed and developing countries(11).PCOS often remains underdiagnosed due to variations in clinical presentation and limited awareness among healthcare providers and affected women(12).

The disorder typically manifests during adolescence, but may go unrecognized until adulthood, especially when women seek medical help for menstrual irregularities or infertility. According to different diagnostic criteria, the estimated prevalence of PCOS varies from 6 percent to 20 percent worldwide.(13).According to widely accepted criteria, most epidemiological studies report a prevalence of approximately 10–15% among reproductive-age women(14). Higher prevalence is noted in populations with rising obesity rates, sedentary lifestyles, and metabolic risk factors(15).

Ethnic differences exist, with more ratio and more strong biological process manifestations reported in South Asian, Geographical region, and Hispanic women, while Caucasian populations show higher rates of hirsutism but comparatively milder metabolic effects.Research suggests that improved awareness and screening practices have contributed to increased detection of PCOS in recent years(16).

South Asia records one of the highest prevalence rates of PCOS and prevalence rates are higher than most western countries because of the genetic predisposition, dietary habits, sedentary living and the rising obesity rates(17).Studies from South Asian countries estimate the ratio of PCOS from 9% and 22% calculate on identification criteria(17).In Pakistan, prevalence rates have been reported to be between 10% and 21% in women of reproductive age with high prevalence in urban populations(18).The incidence is on the rise among young women including university students and this is probably because of the changes in lifestyle and the early hormonal imbalance(19). In South Asian PCOS women are have higher rates resistance of insulin, central obesity, and metabolic syndrome compared to women from other ethnic groups(20), emphasizing the need for advance determination and interference.The increasing rate in Pakistan proves the significance of public health measures, screening and awareness campaigns to encourage early diagnosis and enhance the reproductive and metabolic health results of women.

Genetics plays an important role in the pathogenesis of PCOS and has clearly been shown to run in the family (6). Women are much more likely to get PCOS if they have a first-degree relative who has the condition(21). Patterns of polygenic inheritance have also been noted that can contribute to susceptibility via multiple genes(22). The involvement of genes of Androgen biosynthesis /Insulin pathways and Gonadotrophic hormone secretion, Inflammatory pathways have been implicated(23). Genomewide association studies(24) have indicated variants associated with FSHR, LHCGR, DENND1A and INSR genes. The results indicate that the association between PCOS and genetic susceptibility is a genetic interaction with environment. Although genetic disposition plays a crucial role, environmental and lifestyle determinants play a role in the manifestation and intensity of PCOS symptoms such as Obesity and sedentary/ lifestyleHigh-calorie, high-glycemic diet, Stress and disrupted sleep patterns and Disclosure to endocrine-disrupting chemicals (EDCs) like BPA(25). Hyperinsulinemia and imbalance in other hormones is worsened by obesity, particularly in women with a genetic predisposition to developing PCOS. Moreover, reproductive hormones may be influenced by chronic stress and sleep disturbances that may induce hypothalamic-pituitary-ovarian (HPO) axis(26). Exposure (including intrauterine environment) during early-life may also augment future PCOS risk(27).

PCOS has various reproductive complications. Subfertility, increased risk of early pregnancy loss and pregnancy complications such as preterm birth, gestational diabetes, and preeclampsia are all caused by chronic anovulation (28). Endometrial hyperplasia can be a result of long-term exposure to estrogens without progesterone. PCOS women have increased chances of having complex biological processes, high blood pressure,

dyslipidemia and poor glucose tolerance(29). Such metabolic abnormalities greatly increase the risk of cardiovascular problems in the long term. Cardiometabolic health is further deteriorated by increased visceral fat and chronic low-grade inflammation.PCOS is closely linked with mental health issues, such as depression, anxiety, low self-esteem, and lowered quality of life(30). Body image discontent, stress of infertility, and persistent signage like hairiness and acne amend to psychological distress. Early recognition and support are important for comprehensive management.

Materials and Methodology

The present cross-sectional study was conducted to assess the association of serum prolactin, luteinizing hormone (LH), testosterone, thyroid-stimulating hormone (TSH) and follicle-stimulating hormone (FSH) levels among women diagnosed with Polycystic Ovary Syndrome (PCOS). Forty patients with PCOS (aged 23–40 years) were recruited from Lahore by convenience sampling. The study was carried out for duration of six months at Department of Medical Laboratory Sciences, Riphah International University and Doppler Ultrasound Centre & Central Laboratory.

Women with ovulation disorders or oligomenorrhea with clinical or biochemical evidence of hyperandrogenism were included in the study. Patients with endocrine disorders, ovarian tumours, Cushing's disease, hyperthyroidism or a history of hormonal therapy were excluded.

Data were collected using a structured questionnaire that asked about demographic characteristics, medical history and lifestyle factors. Venous blood (3–5 ml) was collected aseptically and the serum was separated by centrifugation at 3000 rpm for 10 min. Hormonal analysis including TSH, T3, T4, FSH, LH, prolactin and testosterone levels were performed by chemiluminescent immunoassay (CLIA) techniques on the Alinity ci-Series analyzer. To ensure analytical accuracy, samples that were hemolyzed, lipemic, or icteric were excluded.

The CLIA technique was based on antigenantibo dy reactions with luminescent detection, where e mitted light intensity was directly proportional to the concentration of the analyte. Hormone conc entrations were calculated based on standard cali bration curves, following the manufacturer's prot ocol.

Results

Figure 1 shows that 53.33% of participants were married, while 46.67% were unmarried. This indicates a nearly balanced distribution of marital status in the study sample.

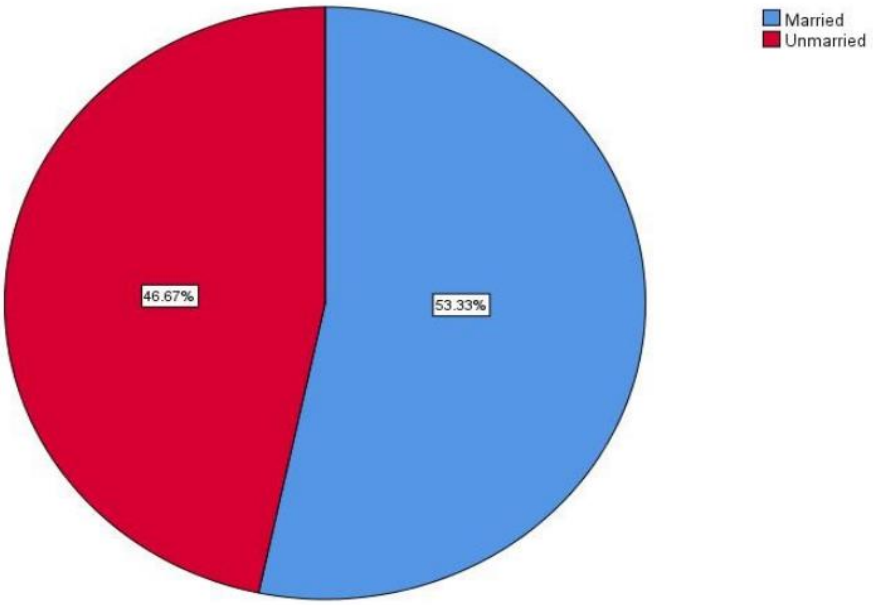

Figure 1 Distribution of Marital status

Figure 2 illustrates the thyroid history of the patients included in the study. The findings show that 40% of participants reported a positive history of thyroid disease, while an equal proportion (40%) reported no such history. Additionally, 20% of patients were unaware of their thyroid status. This distribution indicates that thyroid-related conditions were present in a substantial portion of the study population, while a notable percentage lacked knowledge of their thyroid history, which may have implications for clinical assessment and disease management.

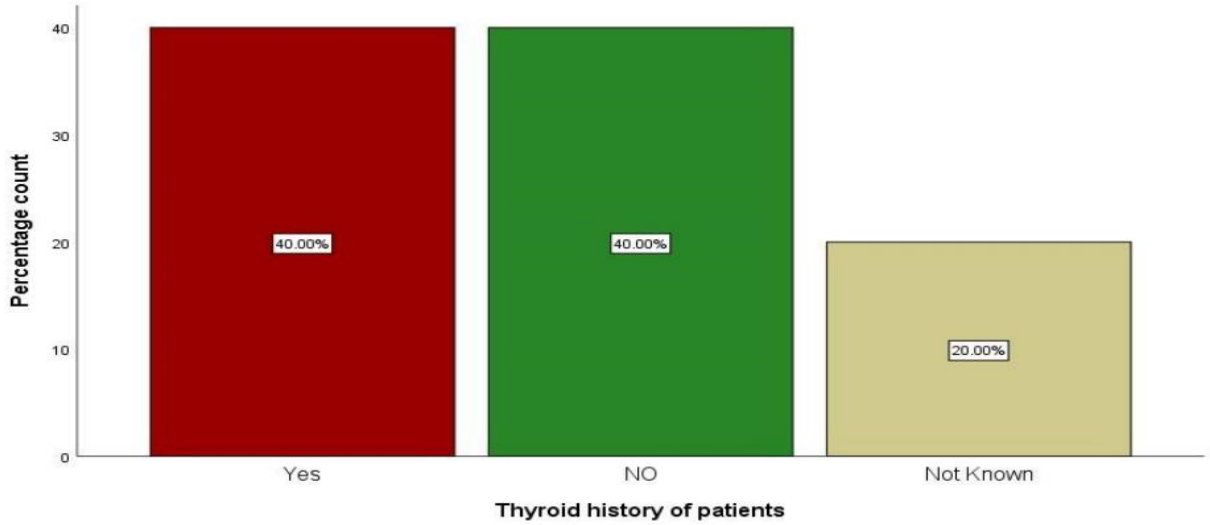

Figure 2 Thyroid history of under study Patients

The distribution of menstruation period duration of the participants is presented in Figure 3. Most of the respondents (40%) mentioned that the period was 3-4 days and 26.67% were 2 days. 16.67% of participants had periods of 5-6 days and 7 days or more, respectively. The overall findings

suggest that in the study population, the most common duration of the menstrual period was 3-4 days, with longer durations being less common.

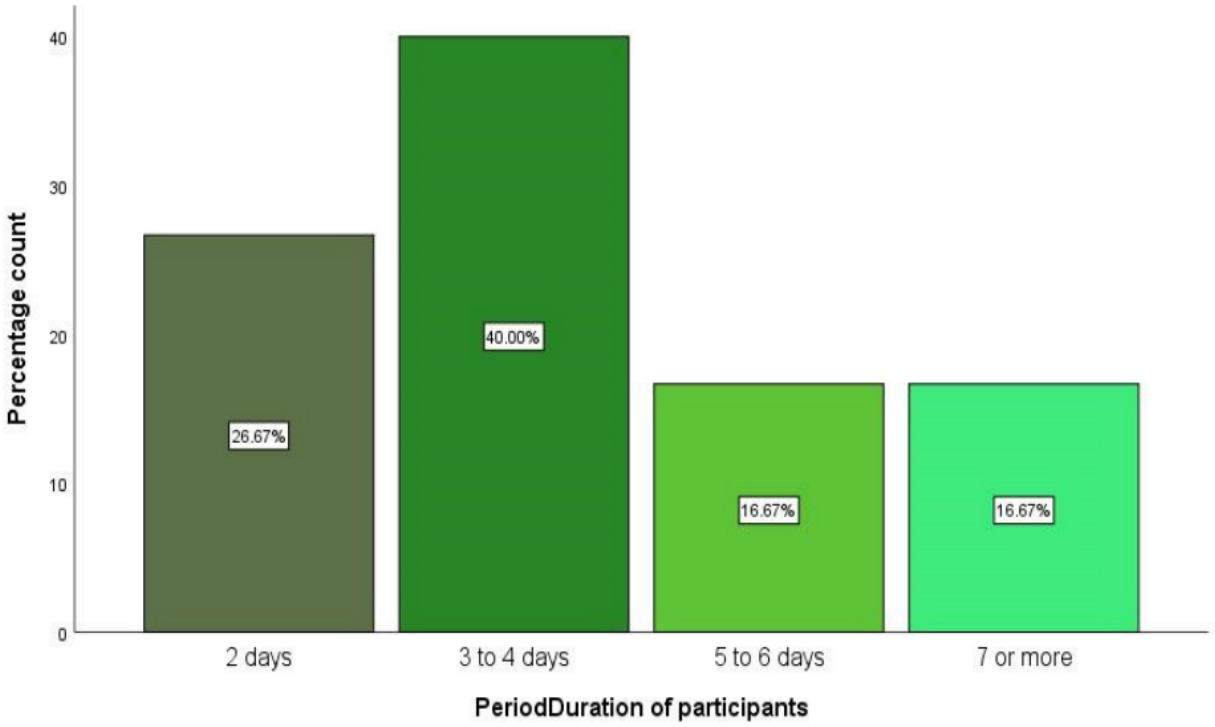

Figure 3 period's duration of under study participants

The bar chart shows the number of hyperandrogenism symptoms that were present in study participants. The results indicate that 20.00% of respondents had acne, hirsutism, and hair loss alone; and 40.00% of the respondents had all three symptoms together. This was an interesting parallel and may be a clue to the importance of the disease, as well as the need for a complete diagnostic process.

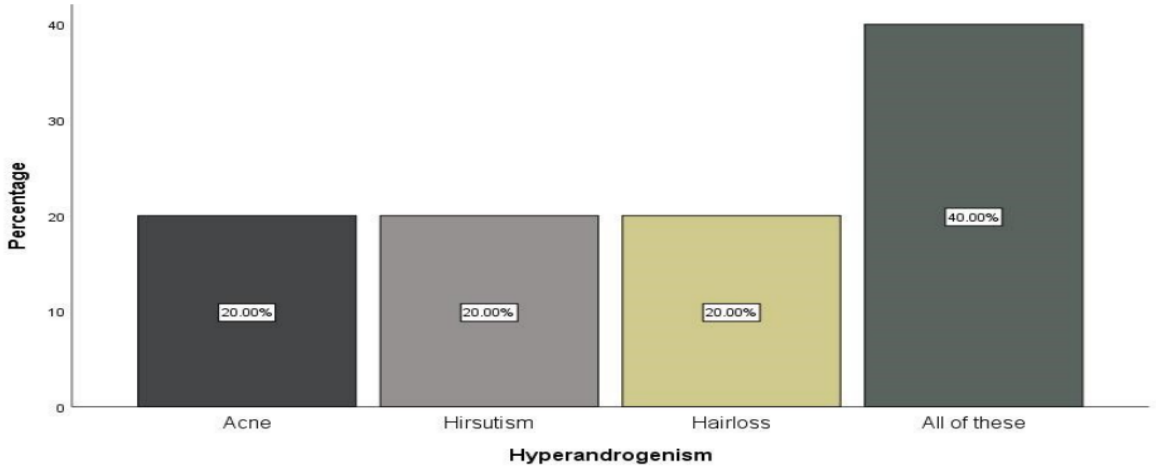

Figure 4 History of Hyperandrogenism symptoms among study participants

The bar graph shows the distribution of Body Mass Index (BMI) categories of the study participants. Their results show that 67% of participants were underweight, 20% had a normal BMI, 30% were overweight, and 43% were obese. The majority of the study population was either overweight or obese, indicating that a sizable portion had a BMI higher than normal.

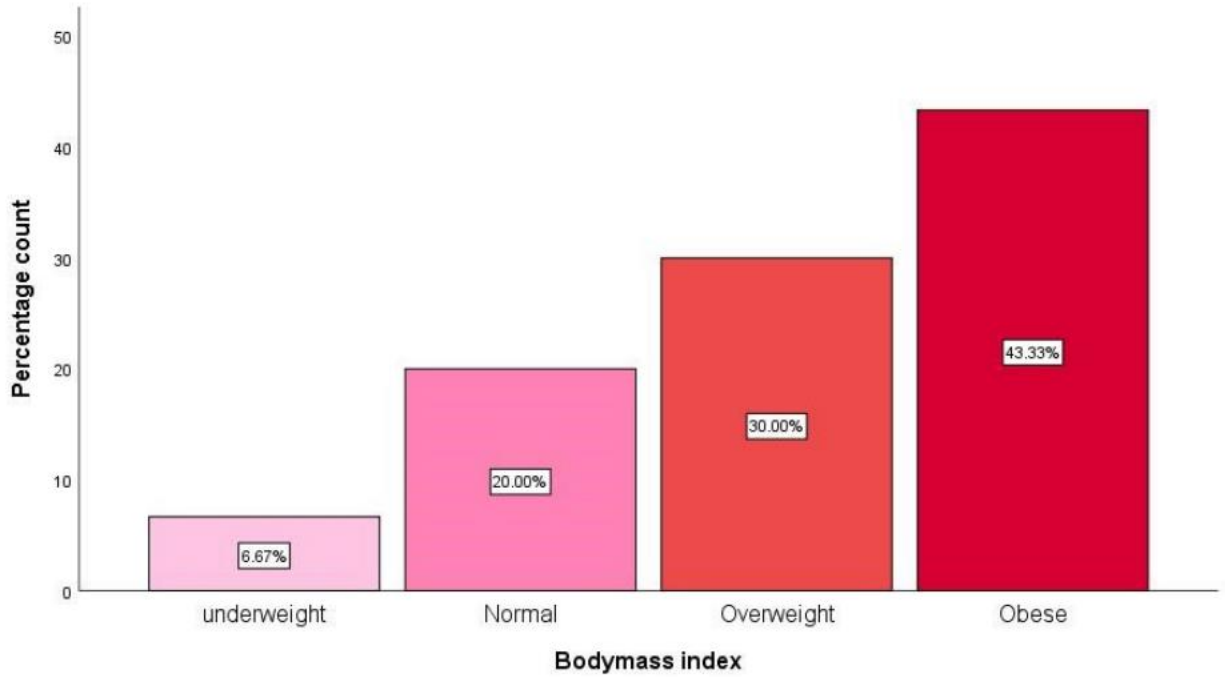

Figure 5 Distribution of Body Mass Index (BMI) among Study Participants

Graph illustrates the distribution of menstrual history among the study participants, categorized into "Regular" and "Irregular" groups. The results show that 86.67% of participants had a regular menstrual history, while 13.33% had an irregular menstrual history. This suggests that the majority of the study population had a regular menstrual cycle.

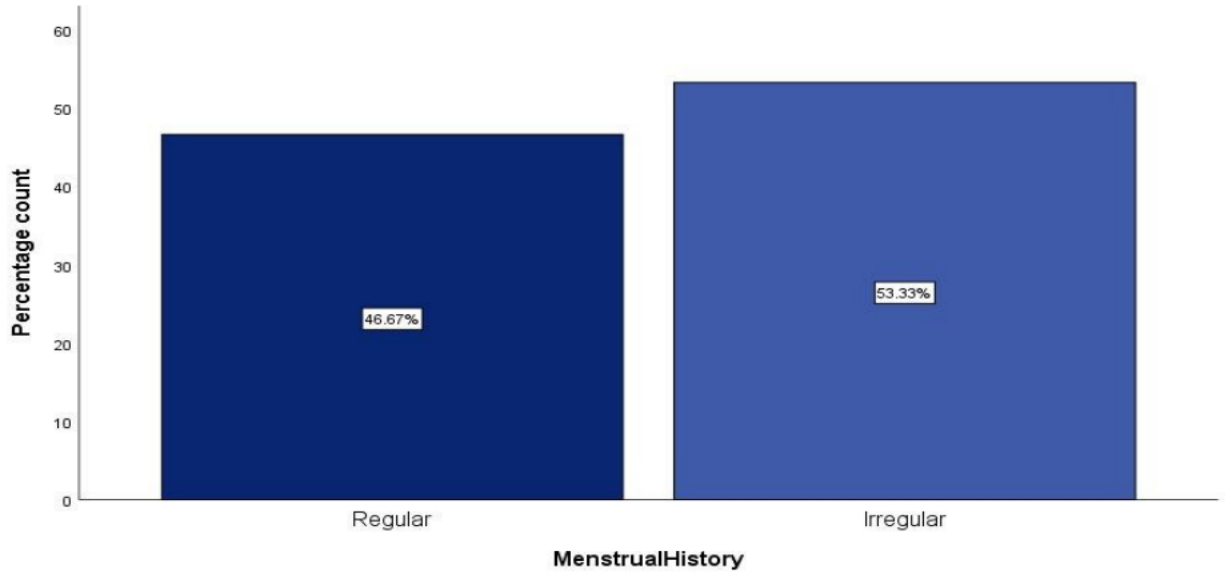

Figure 6 Menstrual History Distribution among Study Participants

Graph displays the distribution of diet types, with "High in Fat" at 41.30%, "High in carbohydrates" at 27.50%, and "Balance" at 31.20%. The percentages add up to 100%, indicating a comprehensive representation of the data. The graph effectively illustrates that "High in Fat" is the most prevalent diet type, followed by "Balance" and then "High in carbohydrates.

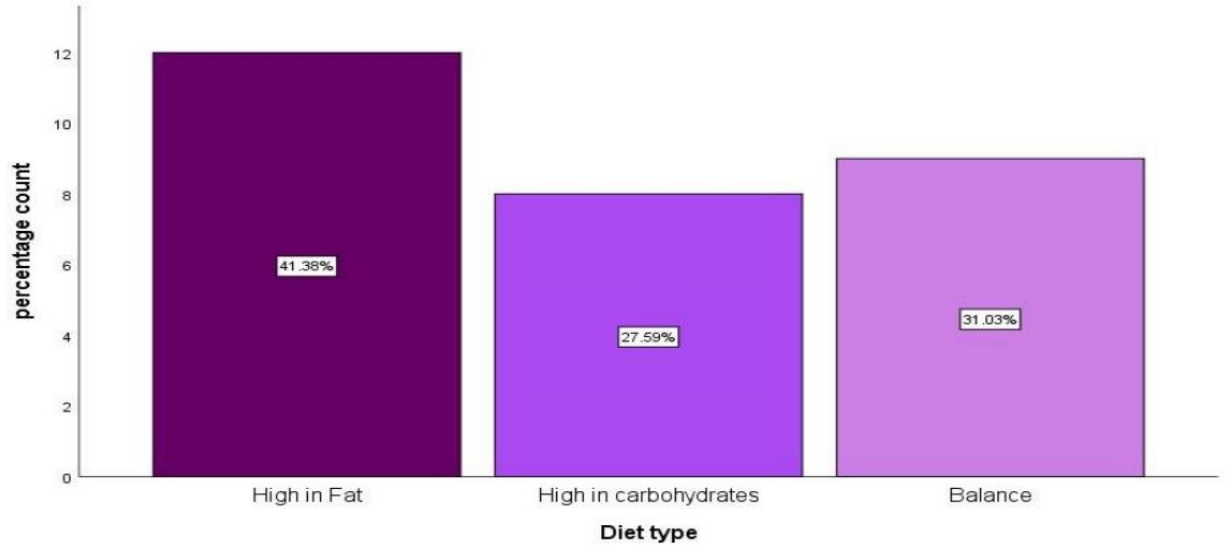

Figure 7 Figure 7 Distribution of Diet Types among Participants

Graph displays the distribution of physical activities among participants, with "Cardio" at 23.33%, "Yoga" at 18.87%, "Strength Training" at 6.67%, and "None" at 51.13%. The graph effectively illustrates that the majority of participants (51.13%) do not engage in any physical activity, while "Cardio" is the most common activity among those who do exercise.

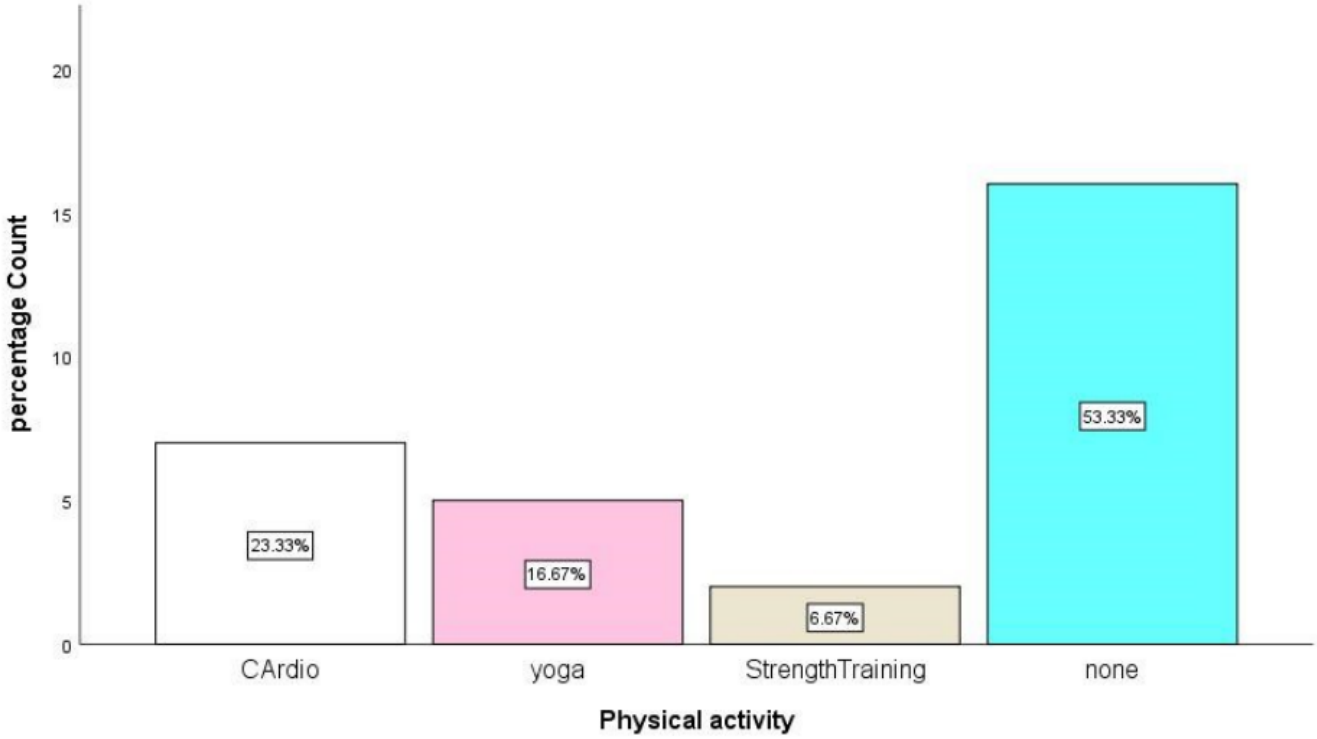

Figure 8 Distribution of Physical Activities among Participants

Table 1 presents distribution of patients according to age in both study groups. Out of 30 participants, the majority were aged more than 35 years (40%), followed by 22–25 years (26.6%).Participants aged 26–30 years and 30–35 years each accounted for 16.6% of the total sample. The findings indicate that most patients in the study were above 35 years of age.

Table 1: Age –wise distribution of Patients

Age group	No of patients (30)		
	Group A	Group B	Total (%)
	High BMI (n =20)	Normal BMI (n= 10)	
22 -25	7	1	8 (26.6)
z26-30	3	2	5(16.6)
30 - 35	4	1	5(16.6)
more than 35	6	6	12(40)

The table presents descriptive statistics for seven hormonal parameters: T3, TSH, T4, FSH, LH, Prolactin, and Testosterone. The mean and standard deviation (SD) are provided for each parameter, along with the maximum and minimum values, and the p-value. The data suggests that the hormonal parameters have varying levels of dispersion, with Prolactin showing the highest SD (142.44904) and Testosterone showing the lowest SD (.13997). The p-values range from 0.215 to 0.677, indicating no important variation between the groups being compared. Overall, the table provides a summary of the central tendency and variability of the

hormonal parameters, which can be useful for understanding the characteristics of the data.

Table 2 Descriptive statistics of hormonal parameters

Clinical Variables	Mean±SD	Maximum	Minimum	*P value*
T3	1.1487±.16182	1.61	0.90	0.521
TSH	2.4120±2.18378	8.79	0.02	0.215
T4	9.4733±3.34528	23.17	1.07	0.677
FSH	8.2633±3.08991	18.18	3.48	0.297
LH	6.7257±4.09288	21.10	4.10	0.456
Prolactin	71.9137±142.44904	725.80	16.90	0.246
Testosterone	0.3438±.13997	0.51	.04	0.353

The table shows that most participants were married and from urban areas. A considerable proportion had a family history of PCOS, hormonal imbalance, irregular cycles, and high-fat diet habits. Hyperandrogenic features were common, with 40% experiencing acne, hirsutism, and hair loss together. Most participants had a menstrual duration of 3–4 days.

Table 3 Clinical characteristics of PCOS patients

Variabl	es	Frequency	Percentage%
Marital status	Married	16	53.3%
	Unmarried	14	46.7%
Family history Of PCOS	Yes	12	40.0%
	No	18	60.0%
Medical history Of hormonal Imbalance.	Yes	14	46.7%
	N0	16	53.3%

Exercise	Yes	14	46.6%
	No	16	53.4%
Diet	High in fat	20	66.6%
	Balance	10	33.3%
Menstrual history	Regular	14	46.7%
	irregular	16	53.3%
Hyperandrogenism	Acne	6	20.0%
	Hirsutism	6	20.0%
	Hairloss	6	20.0%
	All of these	12	40.0%
Period duration	2 Days	8	26.7%
	3 to 4 days	12	40.0%
	5 to 6 days	5	16.7%
	7 or more	5	16.7%
Age	Urban	16	53.3%
	Rural	14	46.7%

Table 4 shows the correlation among LH/FSH ratio, BMI, hirsutism, and period duration. A moderate supportive coefficient was observed between LH/FSH ratio and BMI (r = 0.661). However, the correlations among other variables were weak and positive, indicating minimal association between BMI, hirsutism, and period duration.

Table 4 Correlation among LH/FSH ratio, BMI, Hirsutism, Period duration

Person Correlation	LH/FSH	BMI	Hirsutism	Period duration
LH/FSH	0.661	0.124	0.155	0.085
BMI	0.124	1.000	0.121	0.094
Hirsutism	0.155	0.121	1.000	0.103
Period duration	0.085	0.094	0.103	1.000

Table 5 compares the hormonal parameters between high BMI (n = 20) and low BMI (n = 10) groups. Although slight differences were observed in T3, TSH, T4, LH, FSH, testosterone, and prolactin levels between the groups, all p-values were more than 0.05. This show that there was no data point important difference in hormonal levels between high and low BMI participants.

Table 5 Comparison of Hormonal Profile between High BMI and Low BMI Groups

Variable	High BMI (n = 20)	Low BMI (n =10)	P value
T3	1.12±1.53	1.19±0.17	0.31

TSH	**2.70±2.40**	**1.82±1.59**	**0.30**
T4	**8.77±2.46**	**10.86±4.46**	**0.10**
LH	**7.07±4.92**	**6.02±1.40**	**0.51**
FSH	**7.87±2.93**	**9.05±3.40**	**0.33**
Testrosterone	**0.32±0.14**	**0.37±0.13**	**0.39**
Prolactin	**80.92±164.41**	**53.90±88.17**	**0.63**

DISCUSION

PCOS is a complicated endocrine condition that manifests as hormonal, metabolic, and reproductive abnormalities. Assessing hormonal dysregulation in PCOS patients and investigating its correlation with body mass index (BMI), clinical manifestations, and lifestyle factors were the goals of the current study. Understanding the syndrome's multifactorial nature and its diverse clinical presentation is made possible by the findings(31).

In this study, the relative quantity of participants were above age of 35, followed by those aged 22–25 years. Although PCOS is commonly identified during adolescence and early reproductive years, its persistence into later reproductive age groups reflects its chronic endocrine and metabolic impact.(32). Over fifty percent of the respondents were married, which cannot be different considering that PCOS is commonly diagnosed during infertility or menstrual cycle abnormalities evaluation after marriage (11, 21).

The percentage of those who had a positive history of thyroid disease was quite high. Thyroid dysfunction has often been implicated in PCOS because of similarities in the regulation through the hypothalamic-pituitary ovary axis(33). Although no statistically significant changes in serum T3, T4 and TSH levels were observed between the BMI groups, the characteristics of thyroid history of a significant percentage of patients demonstrate the significance of regular thyroid screening in PCOS women(34).

Over 50 percent of the study participants were found to have menstrual irregularity, which is in line with the underlying pathophysiology of PCOS that is typified by chronic anovulation and impaired follicular development. The most reported menstrual period was 3-4 days, which is within the physiological normal range. This shows that menstrual cycle itself might not be a good indication of hormonal disbalance and cycle regularity ought to be evaluated along with biochemical levels(35).

The study population had hyperandrogenic manifestations. The systemic effects of excess androgens were also present with a considerable number of participants reporting acne, hirsutism, and hair loss.Although the serum testosterone levels of the high BMI group were significantly higher in comparison to the low BMI group, the difference was also not significantly high. This implies that clinical hyperandrogenism is not necessarily directly proportional to the levels of circulating androgen and could be affected by peripheral androgen sensitivity or local tissue conversion (11).

The distribution of BMI showed that the contestant were either fat. The problem of obesity is commonly known to be one of the factors that worsen insulin resistance and production of ovarian androgens in PCOS. The lifestyle trends identified in the present study, such as a high-rate of high-fat foods consumption and lack of exercise, can further contribute to metabolic disruptions. Although the incidence of high BMI is high, the comparison of hormonal parameters

in low and high BMI showed no statistically significant differences. This may be attributed to very-less size of sample, which limits to find harmful hormonal variations. Correlation analysis incontestible a moderate optimistic association between LH/FSH ratio and BMI. High LH/FSH ratio is an endocrine characteristic of PCOS, which is related to increased ovarian androgen production. The correlation observed indicates that adiposity can have an effect on the patterns of secretion of gonadotropins. Nevertheless, poor associations between BMI, hirsutism and menstrual period suggest that clinical presentation is probably caused by a combination of interacting endocrine and metabolic mechanisms and not BMI itself. The hormonal parameters were analyzed descriptively, and the variability was observed, especially in prolactin levels with the greatest standard deviation.

However, all the hormonal variables showed no statistically significant differences between BMI groups. These results indicate that although obesity can add to the deterioration of clinical manifestations, basal hormonal levels might not be significantly different in BMI groups in all patients with PCOS. All in all, our result support the idea that PCOS is a disparate condition that is determined by endocrine, metabolic, and lifestyle factors. The lack of data of significant group difference in secretion patterns across BMI groups does not imply that weight management is not clinically important, since obesity is a known aggravating factor in the development of disease. The management of PCOS is complex and should include clinical, biochemical and lifestyle features. In future studies, larger samples would be desirable to clarify the relationships between BMI and hormonal dysregulation in PCOS, as the metabolic markers (e.g. indices of insulin resistance) were included.

Conclusion

In this study, the aim was to assess the extent of hormonal imbalance in polycystic patients. Examine and discuss the link between ovary syndrome (pcos) and lifestyle, body mass index (bmi) and clinical symptoms. These findings indicate that pcos is a complex endocrine disorder that has complex hormonal relationships and significant clinical diversity.

An advanced rate of weight gain was noted between the contestant in the study, as well as sedentary lifestyle habits and high fat diets. Hyperandrogenic symptoms such as acne, hair loss and hirsutism were typical in the clinical effects of excess androgen. In a significant proportion of patients, menstrual abnormalities were also in support of ovulatory dysfunction as a major symptom of pcos.

Some variations in hormonal parameters were shown in overweight and underweight but none of the variations were proven to be statistically significant. This implies that bmi might not predict the basal hormonal levels of pcos women independently. However, a moderate positive parametric test value of lh/fsh ratio and bmi suggest the possible interaction between adiposity and gonadotropin regulation, and the influence of metabolic factors on reproductive endocrinology.

The study overall found that the hormonal imbalance in pcos is not only a bmi issue, but it is a hormonal, metabolic and lifestyle issue. It is crucial to conduct a thorough clinical assessment, which involves hormone testing and a lifestyle evaluation, for accurate identification and impressive establishment. If caught early and treated properly, it is possible to minimise long-term complications that can occur with pcos, such as reproductive and metabolic issues. More extensive research including metabolic markers is suggested to make sense of the decomposable association between metabolic imbalance and obesity in pcos.

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