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Exploring the Contributing Factors of Polycystic Ovary Syndrome (PCOS)

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ABSTRACT

Background: PCOS, a complex endocrine disorder, primarily affects those of reproductive age, emerging in late teens or early twenties. It involves hormonal imbalances, notably heightened androgen levels and insulin resistance. Clinical manifestations include irregular menstrual cycles, hirsutism, and acne. Sedentary lifestyle and poor dietary choices worsen symptoms, leading to weight gain and increased insulin resistance. Obesity often coexists, intensifying metabolic issues. A family history raises the risk. Complications encompass infertility, type 2 diabetes, cardiovascular disease, and mood disorders. A balanced diet, regular exercise, and holistic PCOS management positively impact symptoms and associated complications. **Methodology:** This study employed a cross-sectional design to collect data from 50 diagnosed PCOS patients using a pre-structured questionnaire. Participants were selected based on specific inclusion criteria from, Holy Family and DHQ Hospital Rawalpindi. **Results:** The study revealed a diverse participant distribution, with 42% aged 19-24 and 40% aged 25-34. Most were married (64%), and hormone test results varied, notably with abnormal levels in testosterone (34%) and irregular menstrual cycles affecting 92%. Insulin levels were elevated in 14%, while 74% engaged in regular exercise. Dietary habits ranged from healthy (26%) to unhealthy (12%). Stress concerned 92%, and 70% used treatments for PCOS, addressing health issues like fertility problems (62%) and skin/hair issues (90%). Family history of PCOS or hormonal disorders was reported by 46%. **Conclusion:** Our study contributes nuanced insights into the complex landscape of PCOS, emphasizing the importance of tailored interventions and holistic care. our findings provide a deeper understanding of the interconnections between demographic, clinical, and lifestyle factors, paving the way for further research and targeted interventions in PCOS management

INTRODUCTION

Polycystic ovary syndrome (PCOS) is a complex, heterogeneous endocrine disorder that predominantly affects females of reproductive age. Females between the ages of 18- 44 are usually affected [1]. It is primarily characterized by a raised level of androgens such as testosterone and a significant number (more than 10) of ovarian cysts in one or both ovaries that result in anovulation, infertility, and irregular menstrual cycles [2]. The National Institutes of Health (NIH) held a conference in 1990 that gave rise to PCOS as a syndrome and established three criteria for its diagnosis: hyperandrogenism, irregular ovulation, and absence of other known fertility diagnosis. A second expert conference 13 years later, in Rotterdam, 2003, introduced three diagnostic criteria to this definition: Amenorrhea, or the prolonged lack of a menstrual cycle, or oligo-amenorrhea, which denotes an irregular menstrual cycle, hyperandrogenism which is defined as clinical or biochemical indicators of androgen in the body, and objective evidence by ultrasound of polycystic ovaries (an ovarian PCOS phenotype, O-PCOS) [3].

According to the World Health Organization (WHO), PCOS affects 116 million women worldwide in 2012 (4%–12%), and in 2020, its prevalence increased abruptly to 26% [4]. PCOS is far more common among South Asian women (52%) than in the White population

(20–25% in the UK). This is especially true for Pakistani women. There is little local study that can provide light on the native elements triggering the illness. Genetic, environmental, and intermarriage variables are blamed for the rising occurrence. Furthermore, oligomenorrhea is a common condition in the relatives of women with PCOS [5]. Although the etiology of this syndrome is still largely unknown, mounting evidence suggests PCOS as a complex multigenic disorder with significant environmental and epigenetic influences, including dietary and lifestyle factors. It is usually associated with abdominal adiposity, insulin resistance, obesity, metabolic diseases, and cardiovascular risk factors [6].

The disorder is brought on by an imbalance in the reproductive hormones, which results in cystic ovarian follicles. The sac that holds the egg becomes a functional cyst when it becomes filled with fluid, usually water. This prevents the egg from releasing normally, which reduces the likelihood of fertilization. As a result, the disruption of ovulation causes the menstrual cycle to cease, leading to amenorrhea. Multiple ovarian cysts are a hallmark of PCOS. In some clinical circumstances, each cyst may be between 8 and 10 mm in breadth. Because the fertilization step is hindered, the restriction in egg release prevents any chance of conception. Even in cases where the fertilized egg is successfully implanted, there is a significant risk of termination in certain clinical PCOS conditions. Other clinical issues that PCOS might lead to include pre-eclampsia, gestational diabetes, hypertension, and premature birth. The hypothalamus gonadotropin-releasing hormone (GnRH), luteinizing hormone (LH), and follicle-stimulating hormone (FSH) secreted in a pulsatile manner regulate normal menstrual cycles and sexual functioning. GnRH secretion is disrupted by elevated prolactin and increased androgen levels. The ratio of LH to FSH is irregular in PCOS patients. Amenorrhea results from this, which delays or sometimes prevents the formation of eggs. A complex web of hormonal systems controls every aspect of human function. When one is disturbed, others find it harder to function [7].

The hypothalamic-pituitary-ovarian axis abnormalities, hyperinsulinemia, and other external variables all play a significant role in the pathophysiology of polycystic ovary syndrome [8]. A key feature of PCOS is hyperandrogenism, which affects 50% of women. In some patients, the cells that produce LH react strongly to GnRH, resulting in an excess of LH production, and a high GnRH release frequency will result in an enhanced release of LH and a decreased release of FSH. However, due to the high amounts of LH and a low FSH released, the ovarian follicles will not develop, leading to a lack of estrogen production. Furthermore, low aromatase activity further reduces estrogen production by blocking it. There will be more follicles due to the general lack of ovulation, and this, along with the follicles' partial development because of hyperandrogenism, will result in extremely high levels of Anti Mullarian Hormone (AMH). FSH release will be further inhibited by the elevated AMH levels [9]. Despite not being part of the diagnostic criteria, insulin resistance is yet another important factor in the pathophysiology of PCOS. Visceral obesity and adipocyte dysfunction are linked to this insulin resistance. Excessive androgen secretion raises insulin resistance, and hyperinsulinemia, which results from insulin resistance, raises androgen secretion even more. This, in turn, causes the liver to produce sex hormone-binding globulin (SHBG), which raises the level of bioactive free testosterone in the blood and exacerbates the disorders linked to hyperandrogenism. The simplest theory for this complicated and heterogeneous condition is that insulin resistance triggers the development of PCOS while hyperandrogenism acts as a risk factor [10].

It is still unknown what specifically causes PCOS. Because PCOS patients have abnormalities in the rate at which androgens and estrogen are secreted and metabolized, their serum concentrations of androgens, including testosterone, androstenedione, and dehydroepiandrosterone, are probably higher. Furthermore, the possibility of some problems developing, such as hyperinsulinemia and environmental insulin resistance, is very high. Obesity is caused by various degrees of these issues. Insulin resistance may be caused by an improper insulin receptor signaling pathway. The cell's ability to utilize insulin is thereby impaired, which causes an additional rise in insulin release to compensate for the deficiency. Adiponectin levels fall in PCOS patients with insulin resistance, which increases the impact of gonadotropins on ovarian function. When there is insulin resistance and a consequent excessive rise in insulin levels, LH/FSH levels rise and GnRH frequency increases. Theca cells and granulosa cells (GCs) can undergo hormonal changes that impair follicle growth, ovulation, and ultimately lead to an increase in androgen production and a decrease in estradiol synthesis. These changes can ultimately contribute to the development of PCOS [11].

It has been discovered that a range of environmental exposures and lifestyle choices influence the development of PCOS. These include stress, endocrine-disrupting chemicals, nutrition and diet, physical activity and sedentary behavior, sleep and circadian disturbance, direct and indirect effects of climate change, and social support networks. Changes in lifestyle and exposure to the environment can lead to dysbiosis (disturbance of the gastrointestinal microbiome), immunological dysregulation (long-term inflammation), insulin resistance (modified metabolism), hyperandrogenism (endocrine and reproductive imbalance), and dysfunction of the central nervous system (neuroendocrine and autonomic nervous system) [12].

Its already been proven that consuming junk food rapidly and frequently results in binge and overeating without reaching satiety and limiting the amount of energy consumed. Consuming junk food was found to be significantly associated with menstruation problems. Maintaining a healthy weight becomes difficult while eating junk food because it lowers the body's metabolic rate and burns less calories. Junk food indirectly affects androgen levels through Insulin resistance [13].

Long-term High Fat Diet (HFD) consumption may cause adipose tissue to accumulate in the abdomen, which will accelerate the development of obesity. This eventually causes metabolic dysregulation and insulin resistance in those who are impacted. By lowering the expression of genes linked to normal ovulation function, HFDs can also affect the ovaries' ability to produce eggs, which can result in infertility. HFDs may also interfere with the immune cells' ability to recruit to the ovary, which is necessary for ovulation. In particular, a HFD impairs ovulatory function by dysregulating the molecular factor MCP-1, which is involved in the migration of monocytes from the blood into the ovary. Ultimately, proper lipid metabolism is crucial for generating sufficient energy to support oocyte maturation and ovulation, and HFDs can impair this process, thereby worsening the metabolic and reproductive consequences of PCOS [14]. PCOS development tends to involve certain genetic and epigenetic factors also. It has been discovered that a number of genes are linked to PCOS, including those that are involved in ovarian and adrenal steroidogenesis as well as the hormonal response to gonadotrophins, hormones, and insulin. In addition, the methylation of genes and the existence of certain microRNAs (miRNAs) may contribute to the aetiology of PCOS. PCOS and other illnesses seen in adolescence and later (e.g., precocious adrenarche, atypical puberty, metabolic syndrome) may develop as a result of intrauterine exposure to androgens, glucocorticoids, and/or certain stressful situations for the fetus [15].

Increased pulsatility of gonadotropin-releasing hormone (GnRH), which is antagonistic to dopamine, is a characteristic of PCOS. In mouse models, it has been demonstrated that dopamine's suppression of GnRH neuron excitability is mediated by the dopamine receptor 2 (DRD2), which is encoded by the DRD2 gene. Furthermore, it is known that DRD2 mediates the suppression of prolactin (PRL) by dopamine, and that over one-third of women with PCOS have elevated levels of PRL in their blood. In addition to reporting that DRD2 increases risk for type 2 diabetes and depression, which can both coexist with PCOS, a recent study identified PRL as a gene contributing to PCOS risk. Polymorphisms in DRD2 may lead to the development of PCOS because DRD2 mediates the impact of dopamine on neuroendocrine profiles and is associated with metabolic-mental states related to PCOS [16]. PCOS is frequently accompanied by oligomenorrhea, amenorrhea, infertility, hirsutism, acne, and obesity. Male pattern baldness, acne, or hirsutism are some of the symptoms of hyperandrogenism while menstrual disturbances such amenorrhea, oligomenorrhea, dysfunctional uterine hemorrhage, and infertility are all signs of anovulation. Obesity is common but not frequently manifest as a symptom of PCOS. In many cases, a history of irregular menstruation usually begins during the menarche. Menarche may be delayed, and presentation with primary amenorrhea is uncommon but well-recognized. Even before menarche, hirsutism, and obesity can exist in adolescent girls. The proportional frequency of the various presenting symptoms at any institution will, of course, largely rely on the specific interests of the referral centers [17]. Long-term effects of the condition include diabetes, hypertension, infertility, metabolic problems, reduced glucose tolerance, and cardiovascular problems. These women have an increased chance of acquiring endometrial cancer in later life as a result of their unopposed estrogenic influence on the uterus and persistent anovulation. Adolescent women with PCOS may experience sleep abnormalities, and disorders related to body image [18]. The prevalence of depression and anxiety symptoms is high among individuals with PCOS. Affected women have suffered detrimental social, physical, emotional, and psychological effects that have lowered their quality of life in terms of their health. As a result their social and interpersonal interactions are hampered [19].

To control the symptoms and lower the associated health risks, early diagnosis of PCOS is crucial. A high level of androgen hormones, ovulation failure, and polycystic ovaries on the ultrasound imaging (PCOM) are among the Rotterdam criteria that support the diagnosis. Currently, ovarian ultrasonography is used by doctors and radiologists to manually perform PCOM identification. They accomplish this by assessing the volume and number of follicles present in the ovaries, which is one of the challenging PCOS diagnostic criteria. Moreover, in addition to the patient's symptoms, these doctors request additional tests and scans for biochemical/clinical indicators to determine the PCOS diagnosis. Additionally, when examining patients, professionals do not use a single diagnostic tool or specific technique. The data set that this research offers contains an ultrasound image of the ovary and clinical information about patients who have been categorized as having PCOS or not having PCOS. Next, they put forth a deep learning model that, when used with the Inception model, could accurately identify the PCOM based on the ultrasound image. Then, they put forth a fusion model that uses the ultrasound image along with clinical information to determine whether or not the patient has PCOS. The best model that has been developed achieved

82.46% accuracy by extracting the image features using MobileNet architecture and combining them with clinical features [20].

PCOS is mostly treated symptomatically with drugs such as metformin, oral contraceptives, and antiandrogens, as well as lifestyle changes. However, PCOS management is difficult, and the effects of this syndrome cannot be treated with the present methods. The treatment involves the use of a variety of innovative medications, such as the more recent insulin sensitizers known as inositols, glucagon-like peptide-1 (GLP-1) agonists, dipeptidyl peptidase-4 (DPP-4) inhibitors, and sodium-glucose transport protein 2 (SGLT2) inhibitors. However, a number of indications also point to the use of statins, vitamin D, and letrozole as new treatments for PCOS. Non-pharmacological therapies like acupuncture and herbal medicine are also utilized in PCOS care. New cosmetic procedures like electrolysis, laser therapy, and the use of topically administered Eflornithine to treat the most upsetting aspect of facial hirsutism associated with PCOS are also used [21].

In international evidence-based guidelines for PCOS, weight management and lifestyle management (diet, physical activity, and behavioral changes) are the first lines of therapy. There is ongoing interest and research into the potential benefits of including psychological and sleep interventions, as well as a variety of traditional, complementary, and integrative medicine (TCIM) approaches, for the best management of PCOS, even though these recommend adherence to population-level dietary and physical activity guidelines. With methods like changing protein, carbohydrate, or fat quality or amount generally having similar impacts on the presentations of PCOS, there isn't enough information to propose a specific diet composition for PCOS. The provision of vigorous aerobic exercise, which has been demonstrated to enhance body composition, cardiorespiratory fitness, and insulin resistance, is supported by promising research in the area of physical activity. Women with PCOS are increasingly using TCIM strategies, in particular the usage of supplements and herbal medications. The most encouraging results from research on inositol supplementation reveal improved metabolic profiles and decreased hyperandrogenism. Further study in specified PCOS groups (e.g., defined age and BMI ranges) and consistent approaches to intervention administration, duration, and comparators are required to reduce variability and inconsistent findings for additional supplements, herbal remedies, acupuncture, and yoga. Robust clinical trials are required to add to the very little body of knowledge addressing holistic lifestyle therapy, even though a variety of lifestyle factors in addition to population- recommended food and exercise guidelines may be beneficial in PCOS [22].

LITERATURE REVIEW

A study was conducted by Alfaina Wahyuni and the colleagues in Indonesia. They performed this study to identify the risk factors in developing PCOS. A descriptive cross-sectional study was conducted on 92 patients (46 PCOS and 46 non- PCOS). Data including, nutritional status, physical activity, carbohydrate diet, fiber diet, family history of diabetes, age of menarche, and family history of PCOS were collected by the patient's medical records and also questionnaire. Nutritional status is measured by BMI (Obesity: >30; Overweight: 25-30, normal :< 3 times/week). Carbohydrate diet is assessed by the frequency of consuming high- carbohydrate foods (high: >3 times/week; low: <3times /week), a high fiber diet is assessed with frequency consuming high-fiber foods (high: >3 times/ week; low: <3times /week). The findings showed that there were significant differences between the two groups ($p<0.05$) in terms of obesity, low physical activity, low fiber diet, and family history of PCOS. In conclusion family history of PCOS, obesity, low physical exercise, a low-fiber diet were major PCOS risk factors [23].

A study was conducted by Ferdousi Begum in Bangladesh. This study aims to find out the clinical features, biochemical and hormonal profile of PCOS patients. A case control and cross – sectional study was conducted on 78 PCOS patients and 33 as the control group. . BMI >25 was 67% among cases and 19% among controls.). Mean BMI of cases was 28.2 + 4.5 and that of cases was 21.05 + 4.1; mean fasting glucose among cases was 5.93 + 1.08 and among controls was 4.4 + 1.11 mmol/L ($P<0.01$); mean fasting serum insulin level was 32.15+ 12.13 among cases was 11.32 +10.02 µU/ml among controls(P6.8) was 42.32% in cases and 12% in control ($P<.001$). At day 3 of menstrual cycle mean serum LH was 12.79+7.1 µ/ml, serum FSH was 5.23 + 2.5 miu/ml and serum prolactin was 415.15+ 180.5 µiu/ml; 30% had high androgen levels. In conclusion, data shows that most of the PCOS patients are obese, hirsute, hyperandrogenemic, insulin resistant, family history of diabetes mellitus and have altered LH to FSH ratio (LH : FSH <2) [24].

A study was conducted by Salma U and her colleagues at the Jouf University, Sakaka, Saudi Arabia. The aim was to study the Impact of Mental health and Blood Pressure in PCOS Women. This questionnaire cross sectional study involved 60 PCOS patients, ten were discovered to be between the ages of 17 and 25, five were between the ages of 26 and 35, and just three were found to be between the ages of 36 and 45. Results: PCOS women have an estimated 30% loneliness, 36.6% anxiety, and 33.3% depressive disorder. PCOS also had an impact on their blood pressure, indicating a connection between PCOS and high blood pressure. In

conclusion, PCOS women are more likely to experience mental illness, because of their demographics, psychological, physiological, and social difficulties [25].

A study was designed by Mariya Khmil and its colleagues in Ukraine. The aim of this study was to find a correlation between body mass index (BMI) and sex hormone levels as well as LH/FSH ratio in PCOS patients. A cross-sectional study was conducted on 100 women aged 25–39 years with PCOS and 30 women as a control group. In women with PCOS, the levels of anti-Müllerian and luteinizing hormones, estradiol, and testosterone were elevated compared to the control group. At the same time, the concentration of FSH was significantly reduced (by 35.9%). The LH/FSH ratio was significantly higher (1.5 times) in PCOS group compared to the control group. PCOS was significantly more frequent in overweight and obese patients compared to those with normal BMI. BMI had a weak inverse correlation with FSH levels ($r = -0.28$, $p < 0.05$), as well as direct correlation with the LH/FSH ratio ($r = 0.40$, $p < 0.05$) and the levels of LH ($r = 0.25$, $p < 0.05$), prolactin ($r = 0.32$, $p < 0.05$), estradiol ($r = 0.43$, $p < 0.05$), and testosterone ($r = 0.68$, $p < 0.05$). In conclusion, the relationship between the concentration of reproductive hormones and BMI showed a weak inverse relationship between BMI with FSH levels, as well as a direct correlation with the levels of LH, prolactin, estradiol, and testosterone, and LH/FSH ratio [26].

Rationale

By examining hormone imbalances, lifestyle factors, and genetic predispositions, this study aims to thoroughly investigate the contributing elements of PCOS. The research attempts to provide a deeper knowledge of PCOS etiology by revealing the complex interactions between these components. The results of this study will contribute to our understanding of this complicated illness and establish a foundation for tailored therapies, which will ultimately improve treatment approaches and reproductive health outcomes for PCOS patients.

Objectives

1. To investigate selected contributing factors (demographics, lifestyle, diet) leading to PCOS.
2. To explore female hormonal profile among the sample population.
3. To explore menstrual irregularities and severity of symptoms**.**

MATERIALS AND METHODS

Study Design: This was an observational study conducted retrospectively on pre-structured questionnaire, conducted from 15th September 2023 to 15th December 2023.

Study Setting: This study was conducted at Holy Family Hospital and DHQ Hospital Rawalpindi.

Sampling Technique: This was convenient sampling technique.

Sample Size: Sample size for this study was 50 patients.

Data Collection Procedure

Data was collected through a pre-structured questionnaire administered to PCOS patients during their hospital visits. The questionnaire covers demographic information, medical history, lifestyle factors, and specific PCOS-related symptoms and complications.

Data Analysis and Presentation

Data was analyzed through SPSS and data was presented in tabular and graphic form.

Inclusion Criteria

Participants included in the study must be diagnosed with PCOS by a qualified medical professional, aged between 18 and 55 years, and willing to provide informed consent for participation.

Exclusion Criteria

Individuals with other underlying endocrine disorders, pregnant women, and those unwilling or unable to participate in the study will be excluded to ensure the specificity of PCOS-related factors.

Possible Outcomes

The study aims to identify key contributing factors to PCOS, including but not limited to hormonal imbalances, lifestyle choices, and genetic predispositions. The outcomes will contribute to a comprehensive understanding of the multifaceted nature of PCOS and may inform targeted interventions and treatments.

RESULTS

In this study involving 50 PCOS patients, our analysis encompasses various aspects, including age groups, marital statuses, hormonal profiles, dietary habits, lifestyle choices, body weight, menstrual health, family medical history, stress and mental health, individual medical histories, and potential complications among PCOS patients. This extensive dataset provides valuable insights into the multifaceted factors associated with PCOS and its impact on the lives of those affected.

Demographics

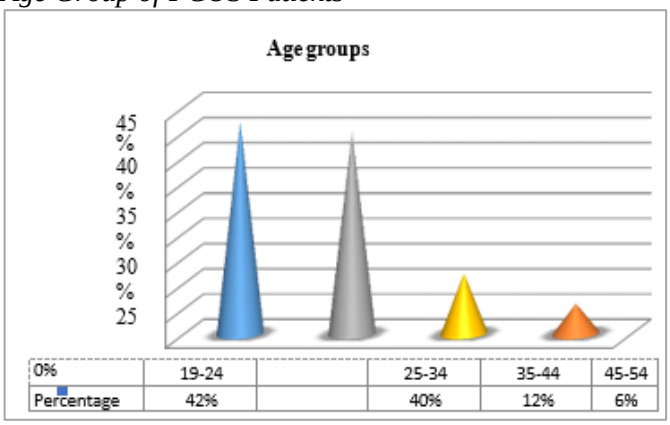
(a) Age Group of PCOS Patients

In this study involving 50 PCOS (Polycystic Ovary Syndrome) patients, our analysis revealed key insights on age distribution ,the findings revealed that the majority fell within the 19-24 and 25-34 age groups, constituting 42% and 40% of the sample of 50 patients, respectively. A smaller proportion of participants, 12% and 6%, were in the 35-44 and 45-54 age groups,

respectively. The chart that represents the age groups of PCOS patients are given below in Figure 1.

Figure 1

Age Group of PCOS Patients



Marital Status of PCOS Patients

The marital status of individuals with Polycystic Ovary Syndrome (PCOS) presents an interesting distribution. In the surveyed population, a majority of PCOS patients, constituting 64%, were married. This suggests that a significant portion of those with PCOS had entered into marital relationships. Conversely, 36% of PCOS patients remained unmarried. The chart that represents the marital status of PCOS patients are given below in Table 1.

Table 1

Marital status of PCOS patients

Marital status	Percentage
Married	64%
Un married	36%

PCOS Diagnosis

In this study involving 50 PCOS (Polycystic Ovary Syndrome) patients, regarding the duration since PCOS diagnosis, the data showed that 50% had been diagnosed within the last 1 to 5 years, while 22% received a diagnosis less than 6 months ago, 16% within the past 6 months to 1 year, and only 10% had been diagnosed for more than 5 years. The chart that represents the duration since PCOS diagnosis are given below in **Table 2.**

Table 2

Duration since PCOS diagnosis

Diagnosis	Percentage
Less than 6 months ago	22%
6 months to 1 year ago	16%
1 to 5 years ago	50%
more than 5 years ago	12%

Hormonal Profiles of PCOS Patients

In this study involving 50 PCOS (Polycystic Ovary Syndrome) patients, 56% of participants had undergone hormonal tests as part of their diagnosis, while 44% had received diagnoses primarily based on ultrasounds, without comprehensive hormonal assessments.

The findings showed varied testosterone levels. Only 2% had low testosterone, while 18% had normal levels. Surprisingly, 34% had elevated testosterone. Alarmingly, 46% hadn't been tested.

FSH (follicle stimulating hormone) levels are also varied among PCOS patients. 10% had low FSH, 14% had normal levels, and 28% had high FSH. Worryingly, 48% hadn't been tested.

Diverse LH (luteinizing hormone) levels among PCOS patients are seen. Only 4% had low LH, while 14% had normal levels. Notably, 32% had high LH. Alarmingly, 50% hadn't been tested, emphasizing the need for thorough hormonal assessments in managing PCOS.

The findings also revealed that 70% of patients had not been tested for DHEA-S (Dehydroepiandrosterone sulfate) levels, indicating a lack of comprehensive assessment. Of those tested, 8% had normal levels, while 22% showed elevated DHEA-S.

A significant 82% of patients had not been tested for AMH (Anti-Müllerian Hormone) levels, revealing a substantial gap in assessment. Among those who were tested, only 12% had normal AMH levels, and a mere 6% exhibited elevated AMH levels in PCOS.

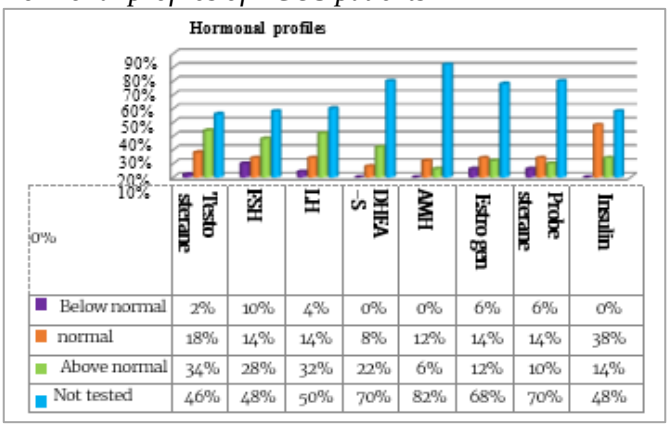
It has found that a significant 68% had not been tested for estrogen levels. Among those tested, only 6% had low estrogen, 14% had normal levels, and 12% had elevated estrogen.

A significant 70% of patients had not been tested for progesterone levels. Among those tested, only 6% had low progesterone, 14% had normal levels, and 10% had elevated progesterone.

The findings also showed that, a significant 48% of patients had not been tested for insulin levels, indicating a lack of comprehensive assessment. Among those tested, 38% had normal insulin levels, and 14% showed elevated insulin levels. These results underscore the importance of more thorough evaluation of hormone levels in managing PCOS. The chart that represents the hormonal profiles of PCOS patients are given below in **figure 2.**

Figure 2

Hormonal profiles of PCOS patients



Lifestyle and habits of PCOS patients:

In this study involving 50 PCOS (Polycystic Ovary Syndrome) patients, the levels of physical activity among individuals with PCOS demonstrate a diverse range of lifestyle choices. It was found that 10% of PCOS patients were categorized as "active," indicating that they engaged in regular physical activity. A larger proportion, 48%, fell into the "moderate" category, suggesting they maintained a moderate level of physical activity in their daily lives. Notably, 42% of PCOS patients were categorized as "sedentary," reflecting a significant portion who had relatively low physical activity levels.

It was found that daily sedentary habits of PCOS patients varied. Only 6% reported spending less than an hour per day in a sedentary state, indicating a small active group. A larger 30% spent 1-2 hours being sedentary, and 24% were sedentary for 2-4 hours daily, representing a moderate sedentary pattern. Surprisingly, 22% admitted to more than 6 hours of daily inactivity, showing a significant proportion with extended periods of sedentary behavior. 74% reported regularly engaging in exercise, demonstrating a strong commitment to physical activity and its potential benefits for managing PCOS. However, 26% did not participate in regular exercise, indicating a minority with room for improvement in this aspect of their lifestyle. Among those who engaged in exercise, only 4% exercises daily, while a larger 26% work out 3-5 times a week. Furthermore, 44% exercises 1-2 times a week, indicating a majority with consistent but less frequent activity. These routines involve various activities such as cycling, cardio workouts, weight lifting, walking, and general workouts Sadly, 26% do not engage in regular exercise.The chart that represents the lifestyle and habbits of PCOS patients are given below in the Table 3.

Table 3

Lifestyle of PCOS patients

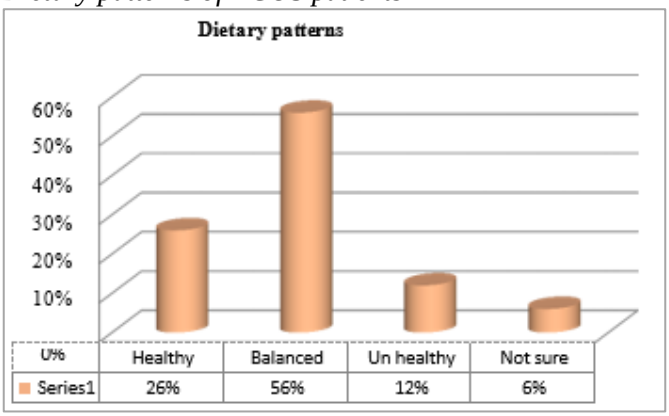
Physical activity	**Active: 10%** **Moderate: 48%** **Sedentary: 42%**
Time spend per day being sedentary	Less than 1 hr: 6% 1-2 hrs: 30% 2-4 hrs: 24% 4-6 hrs: 18%
Exercise	Yes: 74% No: 26%
Exercise frequency	Daily: 4% 3-5 times per week: 26% 1-2 times per week: 24% Do not engage in regular exercise: 26%

Diet of PCOS patients

In this study involving 50 PCOS patients, it was found that dietary patterns generally lean toward healthy choices, with 56% following a balanced diet and 26% describing their diet as healthy. However, 12% mentioned an unhealthy diet, indicating room for improvement in nutritional choices for a minority. Additionally, 6% were unsure about their diet characterization, suggesting potential benefit from dietary guidance. The chart that represents the dietary patterns of PCOS patients are given below in figure 3.

Figure 3

Dietary patterns of PCOS patients



The study revealed that the vegetable consumption habits of PCOS patients varied. A significant 66% reported including vegetables in their daily meals, showing a commitment to a healthy diet. Another 14% had vegetables 3-5 times a week, while 16% had them 1-2 times a week, reflecting occasional choices. Notably, 4% rarely or never included vegetables, suggesting a need for nutritional guidance and awareness in this group Dietary habits among PCOS patients regarding fruit consumption also vary. A significant 60% consume fruits daily, reflecting a strong commitment to a health-conscious diet. Additionally, 18% have fruits 3-5 times a week, and 10% do so 1-2 times a week, indicating different frequency patterns. However, 12% rarely or never include fruits, suggesting the need for more awareness and guidance on the importance of fruit in a balanced diet.

About 16% incorporate whole grains in their diet daily. A substantial 28% include whole grains 3-5 times a week, while a larger 34% do so 1-2 times a week, indicating different consumption frequencies. Notably, 22% rarely or never include whole grains.

Lean proteins consumption among PCOS patients also vary. A minority, 10%, incorporate them daily, emphasizing their importance for a balanced diet. A substantial 24% have lean proteins 3-5 times a week, while 32% do so 1-2 times a week, showing different consumption frequencies. Worryingly, 34% rarely or never include lean proteins, indicating a need for increased awareness and education about their significance in managing PCOS and overall well-being.

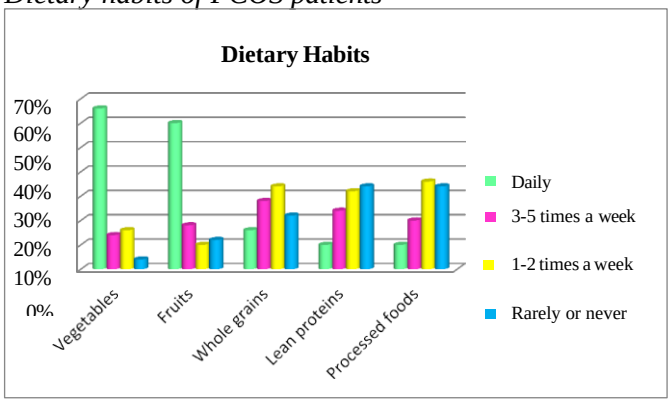
A small 10% consume processed foods daily, possibly requiring guidance toward a more nutritious

diet. A higher 20% have processed foods 3-5 times a week, and a substantial 36% do so 1-2 times a week, indicating different consumption frequencies. It's reassuring that 34% rarely or never include processed foods, reflecting an effort to maintain a healthier diet and lifestyle.

Moreover, 46% reported consuming dietary supplements or vitamins to manage their condition, while 54% indicated that they did not use such supplements. This suggests that a significant portion of PCOS patients seek additional support through supplements, potentially to address specific nutritional deficiencies or manage their symptoms. The chart that represents the dietary habits of PCOS patients are given below in the Figure 4.

Figure 4

Dietary habits of PCOS patients

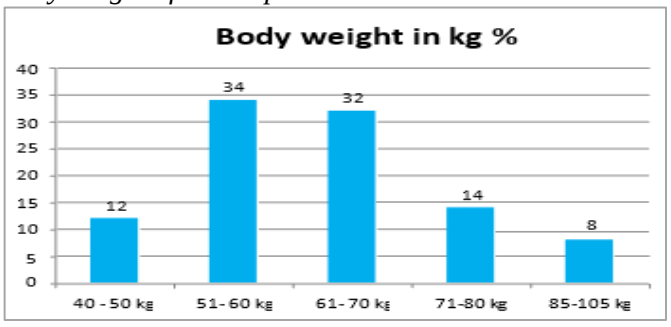


Body Weight of PCOS Patients

In terms of body weight among 50 PCOS (Polycystic Ovary Syndrome) patients, the survey revealed a diverse distribution. Approximately 12% of patients fall within the 40-50 kg range, while the majority, 34%, have a weight between 51-60 kg. A significant portion of 32% falls within the 61-70 kg range, and 14% have a weight of 71-80 kg. A smaller proportion, 8%, falls in the range of 85-105 kg. This data reflects the varied body weight patterns within the PCOS patient population, emphasizing the need for personalized healthcare and management strategies tailored to individual needs. The chart that represents the body weight among different age groups of PCOS patients are given below in the Figure 5.

Figure 5

Body weight of PCOS patients



Weight Fluctuations among PCOS Patients

In this study involving 50 PCOS patients, weight fluctuations are a common concern among patients, as revealed by the survey. A significant majority of 70% reported experiencing weight gain, highlighting one of the challenges associated with the condition. Conversely, 20% of patients indicated they have experienced weight loss, possibly through lifestyle changes or medical interventions. However, 10% of respondents reported no significant weight fluctuation, underlining the variability in how PCOS affects individuals. The chart that represents the weight fluctuations in PCOS patients are given below in Table 4.

Table 4

Weight fluctuations in PCOS patients

Weight fluctuations in the past	
Weight gain	**70%**
Weight loss	**20%**
No fluctuations	**10%**

Menstrual Health of PCOS Patients

In this study involving 50 PCOS patients, a striking 92% reported experiencing irregular menstrual cycles, which is a common hallmark of the condition. Among them a significant 38% reported slightly irregular cycles, while 26% noted moderate irregularity. Additionally, 32% of patients reported highly irregular menstrual cycles, emphasizing the substantial impact of PCOS on this aspect of their health. Notably, 4% of respondents reported amenorrhea, meaning they have not had a menstrual period for the past year, However, 8% of respondents indicated that they did not have irregular menstrual cycles. This underlines the significant impact of PCOS on menstrual regularity for the majority of patients, while a minority do not face this particular symptom. It underscores the heterogeneity of PCOS presentations among individuals. The chart that represents the menstrual health of PCOS patients are given below in **Table 5.**

Table 5

Menstrual health of PCOS patients

Menstrual Health	
Have you ever experienced Irregular menstrual cycle If yes, how irregular	
Yes	92%
No	8%
Slightly irregular	38%
Moderately irregular	26%
Highly irregular	32%
Amenorrhea since last year	4%

Family History of PCOS

In this study involving 50 PCOS patients, only 46% of respondents reported having a family history of PCOS indicating a genetic link within their families. However, a majority of 54% reported no such family history. This data suggests that while genetics may play a role in some

cases of PCOS, there are also instances where the condition occurs without a clear family history, reflecting the complexity of its origins and the diverse experiences of individuals affected by PCOS. The chart that represents family history of PCOS are given below in the Table 6.

Table 6

Family history of PCOS

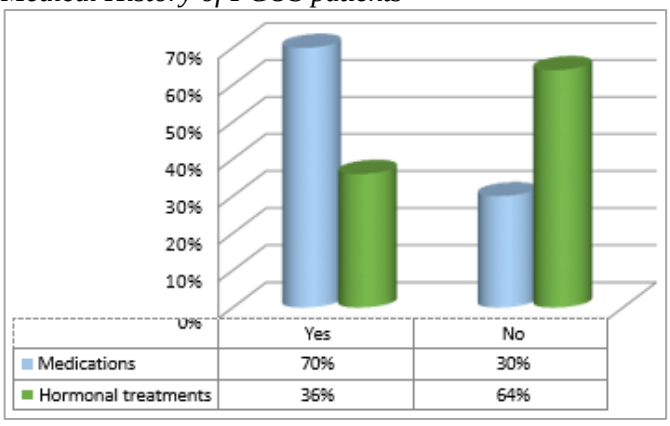
Family history of PCOS	
Yes	46%
No	54%

Medical History

In this study involving 50 PCOS patients, the findings indicates that a significant majority, 70%, are actively taking medications or undergoing treatments for PCOS or related conditions. This suggests a proactive approach to managing their health and symptoms. However, 30% of respondents reported not currently using medications or treatments, potentially indicating a preference for lifestyle modifications, or they may be managing their condition through other means. The findings also revealed that 36% of PCOS patients are undergoing hormonal treatments or therapies as part of their management. These treatments are commonly used to regulate hormonal imbalances associated with PCOS. However, a significant majority of 64% of respondents are not currently undergoing hormonal therapies, potentially opting for alternative approaches to address their condition or not requiring such treatments at this time. This data reflects the variability in treatment strategies employed by individuals with PCOS. The chart that represents the patients taking medications and undergoing hormonal treatments are given in the figure 6.

Figure 6

Medical History of PCOS patients



Complications among PCOS Patients

In this study involving 50 PCOS patients, it was found that a significant majority of PCOS (Polycystic Ovary Syndrome) patients, specifically 62%, reported experiencing fertility issues as a complication of their condition. This underscores the well-documented link between PCOS and reproductive challenges. However, 38% of respondents mentioned not facing fertility issues, suggesting that some individuals with PCOS may not encounter this particular complication.

The findings also indicate that 26% of patients have experienced complications related to insulin resistance and diabetes. This underscores the common association between PCOS and metabolic issues. On the other hand, 74% of respondents do not report such complications, emphasizing that not all PCOS patients necessarily develop insulin resistance or diabetes as part of their condition.

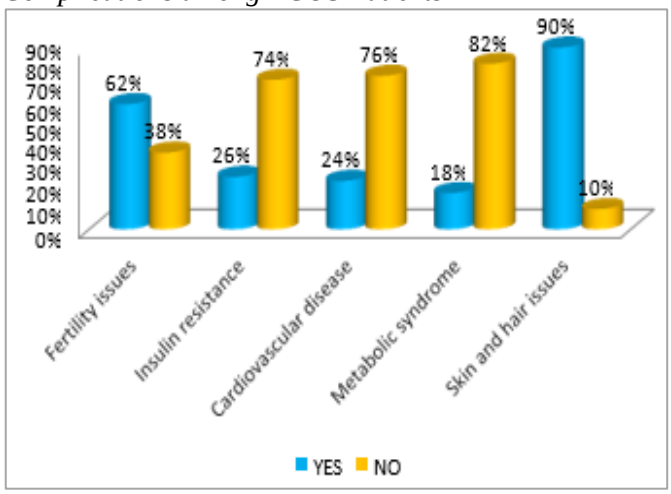
A significant 24% of patients reported experiencing complications related to cardiovascular diseases. This highlights the potential increased risk of heart-related issues in some individuals with PCOS. However, the majority, 76%, mentioned not facing such complications, indicating that cardiovascular diseases are not universally prevalent among PCOS patients, underscoring the variability in health outcomes associated with the condition.

18% of patients have experienced complications related to metabolic syndrome. However, the majority, 82%, of respondents do not report such complications, underlining the fact that metabolic syndrome is not a universal outcome of PCOS and may vary among individuals.

The survey underscores that a significant 90% of patients have experienced complications related to skin and hair issues. These complications often include acne, hirsutism (excessive hair growth), and other dermatological concerns commonly associated with PCOS. Only 10% of respondents did not report experiencing such complications, emphasizing the widespread impact of PCOS on skin and hair health among the majority of patients. The chart that represents the complications among PCOS patients are given below in the figure 7.

Figure 7

Complications among PCOS Patients



DISCUSSION

Our study delves into the intricate web of factors influencing Polycystic Ovary Syndrome (PCOS), a complex endocrine disorder affecting women's hormonal, gynecological, metabolic, and psychological well-being. Stein and Leventhal's initial description in 1935 marked the beginning of our understanding of PCOS, yet its etiology remains elusive due to its multifaceted nature. The prevalence, varying from 5% to 15% among reproductive-aged women, underscores the challenge of diagnosing and managing this condition [27]. In our study, a comprehensive analysis of various aspects, including demographic factors, hormonal profiles, lifestyle choices, and complications, revealed valuable insights into the multifaceted nature of PCOS and its impact on individuals' lives. The age distribution within our sample highlighted a significant concentration in the 19-34 age groups, emphasizing the prevalence of PCOS among young to middle-aged individuals. This aligns with previous studies that have consistently identified PCOS as a common condition in reproductive-aged women [28]. Marital status also emerged as a noteworthy factor, with a majority of PCOS patients being married. This finding may suggest the potential influence of PCOS on family planning decisions or conversely, the impact of marital status on PCOS development. While our study provides a snapshot of marital status among PCOS patients, further research is warranted to explore the intricate relationship between PCOS and relationship dynamics. Genetic predisposition intertwines with environmental factors and lifestyle choices, contributing to the intricate tapestry of PCOS development [29] [30]. According to our study, there is a correlation between the occurrence of PCOS and a family history of the condition; 46% of participants had a family history of PCOS. The results are also consistent with Wahyuni and colleagues' 2022 study conducted in Indonesia, which discovered that hereditary factors contribute to the pathophysiology of PCOS in at least 10% of cases and that PCOS is influenced by genetic variables. On the other hand, poor diet is also associated with PCOS. The amount, diversity, proportion, or mix of various meals and beverages, together with the regularity of their consumption, are all included in the diet under consideration. There are a few PCOS females in our study who eat more than their bodies needs. The risk of insulin resistance, which can lead to PCOS, is increased by dietary practices including overindulging in processed foods, consuming macronutrients in excess of what the body needs, and eating a diet heavy in carbohydrates, calories, and low in fiber. Low levels of physical activity have been linked to the development of PCOS, according to our research [31]. Irregular menstrual cycles, a hallmark of PCOS, were reported by a significant majority of participants, aligning with established literature. The study also revealed a complex interplay between PCOS and family history, mental well-being, and complications such as fertility issues, insulin resistance, cardiovascular diseases, metabolic syndrome, and skin and hair problems. Our study also confirmed Insulin resistance (IR) as an important contributor to PCOS and 26% of our participants experience insulin resistance and diabetes. Some studies found that percentage of IR among PCOS patients was as high as 50%–70% [32]. In our study hormonal assessments unveiled variations in testosterone, FSH, LH, DHEA-S, AMH, estrogen, and progesterone levels among PCOS patients. While these hormonal imbalances are associated with PCOS, establishing causation is complex. Hormonal irregularities may be both a cause and consequence of PCOS. Among these hormones, testosterone and serum LH concentrations are significantly elevated in PCOS women. This is due to an increased amplitude and frequency of LH pulses. Elevated LH Concentrations (above 95th percentile of normal) can be observed in approximately 40-60% of PCOS women [33]. Elevated testosterone levels play a pivotal role in disrupting the delicate balance of follicle-stimulating hormone (FSH), potentially impairing ovarian function [34]. In our study, the levels of stress hormones serum DHEA levels were found to be significantly elevated in PCOS and did not find cortisol levels. The findings of this study is comparable to the study conducted in India in 2023 where they described the hypothesis that stress is positively associated with PCOS syndrome. Increased DHEA level is considered a clinical hallmark of psychosocial stress, depression, anxiety, acne, and infertility [35]. There is currently no cure for PCOS, but the associated comorbidities can be addressed to improve the quality of life and minimize the adverse effects associated with PCOS. The metabolic abnormalities worsen with time, and the prognosis becomes poor gradually over time. The time period between the onset of symptoms and diagnosis of PCOS encompasses to be lessened to reduce the deleterious effects that include infertility, glucose intolerance, insulin resistance, obesity, cardiovascular diseases and endometrial cancer among others [36]. According to our research, 70% of women with PCOS were obese or overweight due to a lack of physical activity, which caused an uneven distribution of body fat. Body weight distributions highlighted the diversity within the PCOS population, reinforcing the importance of individualized healthcare strategies. Weight fluctuations, a common concern among PCOS patients, were prevalent, underscoring the need for holistic approaches considering both physical and mental well-being. It was found in another study that suggests a healthy diet and regular physical exercise to obese PCOS patients in order to drastically alleviate symptoms like excessive hair and irregular menstruation and within three months, patients may notice significant improvements in

metabolism and internal secretion if they combine medicine with kinesiotherapy and individualized nutrition therapy [37]. Our study highlights the perception of women in the community with PCOS and describes their self-reported dietary, exercise, lifestyle, behaviors and evaluations of effectiveness. Almost all women reported adjusting their dietary and physical activities with the aim to improve their health and manage PCOS This study contributes to our understanding of women with PCOS living in the community, and their experiences using lifestyle interventions to manage symptoms and maintain health. The present study gives a voice to community based women with PCOS and identifies significant regulating factors that might need to be taken into consideration in future clinical practice recommendations [38]. We emphasize the significance of expanding knowledge in the prognosis of PCOS and identifying its associated risk factors. A timely diagnosis of PCOS in symptomatic adolescent girls is important for the initiation of appropriate treatment and management strategies. However, this can be achieved by spreading awareness through educational interventions and other measures such as educating the susceptible population regarding the symptoms, etiology, age of onset, and PCOS-related health care services [39].

There are some limitations in our study, the most important is relatively small sample size. This can affect the significance of some results, and we suggest that additional research is needed to confirm our findings. It is conducted only in one city of Pakistan and only on educated females due to unavailability of sources so the results cannot be generalized to whole country. So there is need of further research in other areas and also on uneducated females. The PCOS prevalence rates observed in this study do not necessarily reflect the real prevalence. A selected age group of participants were enrolled (adolescents and young girls), and other women of different ages and those who reached menopause were excluded from the study. Furthermore Due to lack of facilities the diagnosis was made on the basis of signs and symptoms and was not performed based on definitive diagnostic criteria.

CONCLUSIONS AND RECOMMENDATIONS

In conclusion, our study contributes nuanced insights into the complex landscape of PCOS, emphasizing the importance of tailored interventions and holistic care. While aligning with established knowledge, our findings provide a deeper understanding of the interconnections between demographic, clinical, and lifestyle factors, paving the way for further research and targeted interventions in PCOS management.

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