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Thyroid Function Abnormalities in Women with Polycystic Ovary Syndrome (PCOS) A Clinical Study

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ABSTRACT

Background: Polycystic ovary syndrome (PCOS) is an endocrine disorder that occurs frequently in women of reproductive age, and it affects reproductive and metabolic activity. There is emerging evidences that indicate that there is a close relationship between PCOS and thyroid dysfunction. The study estimates the incidence of thyroid aberrations among women with PCOS and how these aberrations relate to reproductive and metabolic disorders.

Methods: A cohort study was used to assess 100 women aged 20-35 years with PCOS through the Rotterdam 2003 criteria. There were elaborate clinical histories, physical examination, and biochemical tests. A thyroid profile was performed to assess TSH, FT4, FT3, and anti-TPO antibodies. Other assessments were fasting insulin, HOMA-IR, lipids, and total testosterone. The participants were divided into two groups, namely normal thyroid functioning and thyroid dysfunction. Statistical analysis was done with SPSS version 26, with $p < 0.05$ as the significance level.

Results: Thyroid malfunction existed in 38 percent of PCOS women. The most frequent abnormality was subclinical hypothyroidism (26%), overt hypothyroidism (8%), and autoimmune thyroiditis (4%). Women who had a thyroid dysfunction had very high TSH levels and low FT4 levels. Menstrual problems were more common in the thyroid-abnormal group (84% vs. 61%), and infertility complaints were also more common (42% vs. 23%). Among the metabolic abnormalities, such as high fasting insulin, high HOMA-IR, high LDL, and low HDL, were much more common in women with thyroid dysfunction.

Conclusion: Thyroid dysfunction is very high among women with PCOS and leads to more severe reproductive and metabolic abnormalities. Thyroid screening must be regarded as a part and parcel of PCOS examination to enhance early disease identification, its management, and subsequent health outcomes.

Keywords: Polycystic ovary syndrome, hypothyroidism, subclinical hypothyroidism, anti-TPO antibodies, insulin resistance, menstrual irregularities.

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INTRODUCTION

Polycystic ovary syndrome (PCOS) has been widely considered as one of the most prevalent endocrine and metabolic disorders of women of reproductive age, the world over. It is estimated that it has a global prevalence rate of 6-20% depending on the diagnosis criteria used, whether by the Rotterdam, NIH, or the AE-PCOS criteria [1]. PCOS is a heterogeneous clinical disorder characterized by hyperandrogenism, persistent anovulation, and polycystic ovarian morphology. These characteristic features occur in a wide clinical progression that encompasses menstrual anomalies, infertility, polycystic hair growth, acne, weight gain, and several metabolic abnormalities. The clinical attention of PCOS has been growing over the years due to its increasing clinical significance as a risk factor of insulin resistance, type 2 diabetes mellitus, dyslipidemia, and hypertension. Its metabolic sequelae lead to a big burden of cardiovascular disease in women affected by it, as well as have long-term negative consequences on their reproductive, metabolic, and psychological health [2].

Like PCOS, another frequent endocrine dysfunction that has been widely experienced by women, especially those in the childbearing age group is thyroid dysfunction. Hypothyroidism and subclinical hypothyroidism have been reported in most of the thyroid aberrations that have been identified in this population [3]. Thyroid hormones are a vital and fundamental part in regulating the rate of metabolism within the body, the level of energy expended and thermogenesis. What is more, the hormones are involved in the complicated process in the ovarian physiology and influence follicular maturation, steroidogenesis, ovulation, and healthy menstrual cycle. The smallest fluctuations in the serum concentration of the thyroid hormones can disrupt the menstrual cycle, ovulatory processes and cause infertility. Additionally, the body alters in metabolism such as an abnormality of lipids, weight gain, malaise, and a glucose intolerance, which are characteristic of thyroid illnesses, are fundamentally the same as PCOS [4]. This overlap has raised a lot of interest among the research circle, and has resulted in research studies to find out whether a defect in the thyroid gland could directly cause, encourage or worsen the expression of PCOS [5].

Over the last few years, there has been emerging evidence of the amplification of thyroid aberrant in women with PCOS. They are elevations of thyroid-stimulating hormone (TSH), alteration of the concentration of free thyroxine (FT4), and increase in the concentration of thyroid autoantibodies, particularly, anti-thyroid peroxidase (anti-TPO) antibodies. It has also been claimed that autoimmune thyroiditis, particularly Hashimoto thyroid disease, is much more common in PCOS patients, and an autoimmune-mediated connection between the two disorders may exist [6]. These results pose important clinical issues as to whether regular screening of women with thyroid dysfunction is needed to be included in the standard examination of all women presenting with PCOS. In addition, detection and prompt treatment of thyroid diseases at an early stage can potentially enhance the menstrual cycles, ovulatory competence, metabolic rates, and poor health conditions experienced by victims [7].

Although research continues to develop, several issues related to the PCOS-thyroid dysfunction association are still not very clear. The absence of uniformity in the results found among various populations implies that genetic inclination, exposure to the environment, dietary and lifestyle trends could affect the correlation between the two diseases. It is especially applicable to the South Asian people, such as the populations of Pakistan, where both PCOS and thyroid conditions are extremely common, underdiagnosed, and affected by nutritional deficiencies, lack of vitamins, insulin resistance, obesity, and socioeconomic stressors [8]. Besides, local studies are necessary to cover the population-specific factors, including consanguinity, hereditary differences in iodine intake, and distinct clinical phenotypes, which can influence the manifestation and severity of the disease.

Thyroid dysfunction is associated with clinical and metabolic ramifications in women with PCOS, and, thus, it is necessary to understand this association further. The evidence base will be enhanced at the local level, and it will not only assist in achieving accuracy of diagnosis but also inform clinicians on the broader approach to managing the patient. Thus, the current clinical trial is intended to assess thyroid dysfunction in women who have PCOS and to identify its clinical implications in relation to the menstrual cycle, metabolic factors, hormonal levels, and reproductive outcomes in general [9].

MATERIALS AND METHODS

The study was an analytical, cross-sectional, outpatient study carried out across the Gynecology and Endocrinology departments of Shaikh Zayed Hospital, Lahore, between June 2024 and March 2025. The objective of the study was to assess the presence of abnormalities of thyroid functioning in women with polycystic ovary syndrome (PCOS) by a comprehensive clinical, biochemical, and ultrasound method.

It was recruited continuously 100 women aged 20 to 35 years who were previously diagnosed with PCOS according to the Rotterdam 2003 criteria, which entails at least two of the following: oligo-/anovulation, clinical/biochemical hyperandrogenism, and polycystic ovarian morphology in ultrasonography. Women were not included in the study in case of confounding results, such as known thyroid disease, taking thyroid drug, pregnant or lactating, known chronic systemic or endocrine disorders, diabetes mellitus, hyperprolactinemia, congenital adrenal hyperplasia, or Cushing syndrome, or had recently used other hormonal or metabolic medications which may influence thyroid or reproductive hormones. Following informed written consent, each subject was interviewed using a structured interview with a validated questionnaire that captured menstrual history, duration of infertility, hyperandrogenic symptoms (e.g., hirsutism, acne, alopecia, metabolic e.g. fatigue, weight gain, cold intolerance, hyperandrogenic) and family history of PCOS, thyroid disorders, obesity or infertility, and lifestyle factors (e.g., dietary intake, physical activity, sleep, smoking).

This was then followed by a full physical examination, including height, weight, body mass index (BMI), waist circumference, hips circumference to determine waist-to-hip ratio, measurement of blood pressure by use of calibrated sphygmomanometer, and clinical scoring of hyperandrogenism by use of modified Ferriman-Gallwey system, and dermatological evaluation of acne severity, seborrhea, and acanthosis nigricans. Examination of the thyroid gland was also done to observe the presence of goiter or nodular enlargement. After overnight starvation, morning venous blood samples were taken to be evaluated in regard to hormonal and biochemical parameters. Thyroid tests involved thyroid-stimulating hormone (TSH), free thyroxine (FT4) and free triiodothyronine (FT3), and an

anti-thyroid peroxidase (anti-TPO) test to rule out hyperprolactinemia, and metabolic tests, which were fasting glucose, fasting insulin, and complete lipid profile (LDL, HDL, total cholesterol, triglycerides, VLDL). The HOMA-IR was used to calculate insulin resistance.

All the laboratory tests were done in the accredited diagnostic laboratory of the hospital through chemiluminescent immunoassay (CLIA) technology, which was done under strict quality control. The thyroid status was also classified as overt hypothyroidism, subclinical hypothyroidism, overt hyperthyroidism, subclinical hyperthyroidism, or autoimmune thyroiditis, relying on the biochemical thresholds and antibody positivity. The senior radiologists utilized the high-resolution ultrasound machines to perform pelvic ultrasonography in all the patients to evaluate the ovarian morphology, which is the presence of twelve or more follicles with a diameter of 2 to 9 mm and /or an ovarian volume of 10 or more mL, with further recording of the stromal echogenicity and antral follicle count.

All data were coded, validated, and put into SPSS version 26 to perform statistical analysis. Continuous variables were used to describe the mean value of standard deviation, whereas categorical variables were used to state the frequency and percentages. Comparison of euthyroid and thyroid-dysfunction groups was done through independent sample t-tests when analyzing continuous variables and chi-square when analyzing categorical variables and Pearson correlation analysis when their relationship between thyroid hormones and metabolic variables (fasting insulin, HOMA-IR score, BMI, and lipid levels) was to be evaluated. The logistic regression was used to find predictors of thyroid dysfunction in the cohort of PCOS, and a p-value under 0.05 was regarded as significant. The research was approved by the Institutional Review Board of Shaikh Zayed Hospital, Lahore, and in line with the Declaration of Helsinki guidelines to conduct human research, Ethical Approval Reference No.: SZH/IRB/GYN-ENDO/2024/178.

RESULTS

The sample size was 100 women in 20-35 years who had polycystic ovary syndrome. The mean age of the sample participants was 27.4 +-4.1 years, though the mean body mass index (BMI) was 28.6 +-3.9 kg/m 2. Of all the samples, 38 percent of the PCOS women had an abnormality of thyroid functioning, and the remainder 62 percent of PCOS women had normal thyroid functioning. Subclinical hypothyroidism (26 percent of the subjects), followed by overt hypothyroidism (8 percent) and autoimmune thyroiditis (elevated anti-TPO antibodies) in 4 percent, were the most common abnormalities. The study population did not show any cases of overt and subclinical hyperthyroidism.

The average TSH concentration (5.21 1.42 mIU/L) of women having thyroid dysfunction was significantly greater than that of women whose thyroid functioning was normal (2.14 0.83 mIU/L). The thyroid-abnormal group had lower levels of FT4 (0.87 ± 0.12 ng/dl) compared to the normal group (1.12 ± 0.15 ng/dl). The levels of the anti-TPO antibodies had a mean of 132.6 + 25.4 IU/mL, which was very high and revealed that it had autoimmune thyroiditis. The women who had thyroid abnormalities also had additional menstrual abnormalities (84) than their normal-thyroid women (61). Similarly, 42 percent of women with dysfunction of thyroid dysfunction complained of infertility, and 23 percent of women in the euthyroid group did so.

Metabolic parameters were largely different. The thyroid abnormal women also experienced a better level of fasting insulin (19.3 Immegrand Standard deviation 4.6 µIU/mL vs. 14.7 Immegrand Standard deviation 3.9 µIU/mL), and exhibited a higher HOMA-IR, which was found to be more insulin resistant. The cases of dyslipidemia were higher in the thyroid-abnormal population, and the level of LDL was greater, while the level of HDL was lower. The overall concentrations of testosterone also slightly increased in women with abnormal thyroid functioning, but this was not much. Overall, these results indicate that thyroid pathology, especially subclinical hypothyroidism, is extremely prevalent in the case of young women with PCOS and is more prone to more severe menstrual defects, metabolic derangements, and insulin resistance as presented in Table 1.

Table 1: Thyroid Function Abnormalities and Clinical Features in Women with PCOS (n = 100)

Parameter	Normal Thyroid Function (n = 62)	Thyroid Dysfunction (n = 38)	p-value
Age (years)	27.1 ± 4.0	27.9 ± 4.3	0.42
BMI (kg/m²)	28.2 ± 3.7	29.3 ± 4.1	0.18
TSH (mIU/L)	2.14 ± 0.83	5.21 ± 1.42	<0.001
FT4 (ng/dL)	1.12 ± 0.15	0.87 ± 0.12	<0.001
Anti-TPO (IU/mL)	32.4 ± 10.2	132.6 ± 25.4	<0.001
Menstrual Irregularity (%)	61%	84%	0.01
Infertility Complaints (%)	23%	42%	0.03
Fasting Insulin (µIU/mL)	14.7 ± 3.9	19.3 ± 4.6	<0.001
HOMA-IR	3.14 ± 0.82	4.36 ± 0.91	<0.001
LDL (mg/dL)	118.2 ± 21.5	139.6 ± 24.9	<0.001
HDL (mg/dL)	46.3 ± 7.2	39.4 ± 6.1	<0.001
Total Testosterone (ng/mL)	0.62 ± 0.14	0.68 ± 0.16	0.07

The summary of Table 1 is a comparison of clinical, metabolic, and hormonal features of PCOS women, whose thyroid functions are normal in comparison with the women who have thyroid abnormalities. The difference in TSH, FT4, anti-TPO antibodies, insulin resistance markers, menstrual abnormalities, and lipid profile was high. PCOS women had poorer metabolic and reproductive phenotypes with thyroid dysfunction.

DISCUSSION

These findings of this clinical trial suggest that the prevalence of thyroid impairment is high in women with polycystic ovary syndrome (PCOS), in which a third of the sample had abnormal thyroid functions. Subclinical hypothyroidism was the most frequent thyroid abnormality, then there were overt hypothyroidism and autoimmune thyroiditis [10]. These observations are in line with previous research studies, which indicated that thyroid dysfunction, especially mild or early hypothyroidism, is much more common in women with PCOS than in the general female population. The thyroid abnormalities in PCOS add to the overlap between the two endocrine diseases and to the importance of regular thyroid screening in women of reproductive age who have symptoms associated with PCOS [11].

The biochemical evidence of hypothyroidism was also seen in the considerable increase in the levels of TSH and the decrease in FT4 in women with thyroid dysfunction. The significant increase in anti-TPO antibody levels of the affected women implies that there is a significant prevalence of autoimmune thyroiditis amongst the affected population [12]. This correlation favors the theory that long-term low-grade inflammation, which is typical of PCOS, might cause autoimmune responsiveness to thyroid tissue. Conversely, thyroid dysfunction may increase the maladjustment of the metabolism in a bi-directional relationship to worsen endocrine disorders [13].

Another reproductive symptom was even stronger in females with thyroid dysfunction. Menstrual abnormalities occurred more often in the group of women with thyroid abnormalities (84) than in the group of euthyroid women (61), which supports the leading role of the thyroid hormones in the regulation of the hypothalamic-pituitary-ovarian axis [14]. Minor deficiencies of thyroid hormones may prevent the secretion of gonadotropin, follicular maturation, and lead to anovulation, which will aggravate further the menstrual abnormalities associated with PCOS. In addition, thyroid dysfunction among women was more frequently associated with infertility, which suggests that PCOS and hypothyroidism has a twice-fold effect on reproductive capacity [15].

The thyroid abnormalities of PCOS women were also more indicative of metabolic disturbances. The higher level of fasting insulin and the high value of HOMA-IR indicated that there was a greater level of insulin resistance in this group. Hypothyroidism can also contribute to the already existing metabolic dysfunction in PCOS because thyroid hormones play a role in glucose metabolism, lipid mobilization, and insulin sensitivity [16]. This is substantiated by the aggravated lipid profile, specifically increased LDL and reduced HDL, which increases the risk of cardiovascular disease in the long run. So, thyroid malfunction in PCOS can be an essential cause of future cardiometabolical problems [17].

There was a slight statistical difference in total testosterone levels of women experiencing thyroid dysfunction, but this is not statistically significant. However, thyroid dysfunction can also impact the availability of androgens indirectly by changing the levels of sex hormone-binding globulin (SHBG), which in turn changes the level of free androgens. Even a slight increase in the testosterone level can lead to clinical hyperandrogenism in vulnerable people [18]. The results of this research reinforce the idea that additional hormonal screening of women with PCOS is necessary, especially the screening for thyroid abnormalities. Early recognition and treatment of overt and subclinical hypothyroidism and autoimmune thyroiditis can result in better menstrual cycle, fertility rates, metabolic parameters, and lessening the long-term risks in cardiovascular disease, diabetes mellitus type 2, and dyslipidemia [19].

In spite of such valuable results, there are some limitations of the study. The sample used was also adequate but it was restricted to a single geographical location and this may restrain the generalizability of the results. Furthermore, the effect of thyroid-targeted treatment on the reproductive and metabolic outcome was impossible to be measured because of absence of longitudinal follow-ups [13,17]. It is recommended that future studies with larger and multi-centre cohort, and interventional study designs be conducted to have a clear picture of the causal mechanism behind thyroid dysfunction and the presentations of PCOS [20].

CONCLUSION

The current study has shown that thyroid dysfunction is a significant burden among women with polycystic ovary syndrome (PCOS), and the most prevalent condition is the subclinical hypothyroidism. Women who were dysfunctional in terms of thyroid functions were noted to be having had poorer menstrual abnormalities, high infertility and more metabolism related problems in terms of high insulin resistance and inappropriate lipid profiles. These

results have shown that the reproductive metabolic axis and the thyroid activity are closely related in PCOS. A regular examination, that is, thyroid disease and TSH, FT4 and anti-TPO antibodies examination, can be regarded as an obligatory part of PCOS examination. Treatment and early diagnosis of thyroid dysfunction could restore menstrual cyclicity, fertility and metabolic health and eventually decrease the cardiometabolic risks in the long run. The larger longitudinal study should be advised to expound on the clinical effect of corrective therapy of thyroid aberrations in this section of population.

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Authors' Contributions: bAAk designed the study; AAn collected data; RB analyzed the data; NSB reviewed and finalized the manuscript. All authors approved the final version.

Data Availability Statement: The data used in this study are available upon reasonable request from the corresponding author, subject to ethical and institutional guidelines.

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