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Prevalence of Thyroid Dysfunction in Polycystic Ovarian Syndrome Among Indian Women: A Cross-Sectional Study

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ABSTRACT
Polycystic ovarian syndrome (PCOS) is the most frequent endocrine disorder affecting young women and is recognized as a complex condition with multifactorial causes, also linked to heightened metabolic and cardiovascular risks. Both PCOS and thyroid dysfunction share multiple overlapping clinical features and have significant implications for fertility and reproductive health. Hypothyroidism can trigger, exacerbate, or sustain PCOD. This research was designed to assess the prevalence of thyroid abnormalities among PCOS patients. The study included 89 female participants aged 18-30 years who met the Rotterdam criteria for PCOS diagnosis. Participants were instructed to undergo fasting for the following assessments: fasting glucose, fasting insulin, serum luteinizing hormone (LH), follicle-stimulating hormone (FSH), thyroid-stimulating hormone (TSH), serum testosterone, dehydroepiandrosterone and serum prolactin. FSH and LH levels were evaluated on the second or third day of the menstrual cycle. Gynecological ultrasonography was performed to assess ovarian morphology and the presence of multiple cysts. SIn 62% of the cases, the LH/FSH ratio exceeded 2 and 68.54% (61 subjects) showed insulin resistance. Elevated serum testosterone was detected in 65% of cases. The mean TSH level was 4.22±1.78. Subclinical hypothyroidism was observed in 26.97% (24 cases), while overt hypothyroidism occurred in 20.22% (18 cases). Overall, thyroid dysfunction (both clinical and subclinical) was found in 47.19% (42 cases). Thyroid dysfunction is highly prevalent among PCOS patients, suggesting that thyroid screening should be a routine part of PCOS management.

INTRODUCTION

Polycystic ovarian syndrome (PCOS), also known as polycystic ovarian disease (PCOD), represents the most prevalent endocrine disorder among young women, often manifesting through chronic anovulatory cycles in conjunction with androgen excess. It affects an estimated 5-10% of women of reproductive age. PCOS is considered a heterogeneous condition with a multifactorial origin and is associated with elevated metabolic and cardiovascular risks. These health risks are frequently tied to insulin resistance (IR), which is further aggravated by obesity, although IR can also occur in women with PCOS who are not obese. Additional clinical features include infertility, abnormal uterine bleeding and increased rates of pregnancy loss. Polycystic ovaries are diagnosed by the presence of 12 or more follicles in each ovary, measuring between 2-9 mm and/or an ovarian volume exceeding 10 mL. The hyperandrogenic environment is thought to contribute to impaired follicular maturation[1-4].

Thyroid dysfunction affects numerous metabolic processes. Even in its early stages, it can subtly alter ovulation and endometrial receptivity, which may significantly impact fertility. If left untreated, thyroid dysfunction can delay the onset of puberty and lead to anovulatory cycles. Furthermore, subclinical hypothyroidism can have a negative effect on fertility[5-7].

It is clear that both PCOD and thyroid dysfunction share multiple clinical presentations and have a significant impact on reproductive health. Interestingly, hypothyroidism has been found to initiate, perpetuate, or exacerbate PCOD[1]. Consequently, several studies in recent years have investigated the relationship between thyroid disorders and PCOS, aiming to elucidate this interface. Most findings suggest an increased prevalence of elevated thyroid-stimulating hormone (TSH) levels and a fourfold higher occurrence of autoimmune thyroiditis in patients with PCOS[8-9]. In light of this, the present study seeks to examine the prevalence of thyroid disorders in PCOS patients.

MATERIALS AND METHODS

This cross-sectional study involved the random selection of 89 diagnosed PCOS patients from those attending the outpatient department (OPD) for menstrual irregularities or hirsutism. The participants were women aged 18-30 years who consented in writing and fulfilled the Rotterdam criteria for PCOS diagnosis. Exclusion criteria included patients on oral contraceptives or hormone replacement therapy, those with liver or kidney diseases, congenital adrenal hyperplasia (either simple virilizing or severe forms), adrenal insufficiency, Cushing's syndrome, primary amenorrhea due to any cause, Sheehan syndrome, pregnancy, lactation, infertility treatment, premature ovarian failure, or hyperprolactinemia.

Patients who had not undergone prior treatment and met the inclusion and exclusion criteria were enrolled in the study. A comprehensive clinical examination was performed and a detailed menstrual history was recorded. PCOS diagnosis followed the Rotterdam criteria, which identifies PCOS if two out of three conditions are met: oligoovulation and/or anovulation, elevated androgen levels (either clinically or biochemically) and the presence of polycystic ovaries (detected via gynecological ultrasound showing multiple cysts measuring 2-9 mm in size). Hirsutism was evaluated using the Ferriman-Gallwey scoring system, which allows classification of hirsutism as mild, moderate, or severe based on the clinical findings.

Additionally, patients were asked about symptoms suggestive of hyperthyroidism or hypothyroidism and information was gathered regarding any history of primary or secondary infertility. The participants were required to present in a fasting state for the following laboratory tests: fasting blood glucose, fasting insulin, serum luteinizing hormone (LH), follicle-stimulating hormone (FSH), thyroid-stimulating hormone (TSH), serum testosterone, dehydroepiandrosterone and serum prolactin. FSH and LH measurements were obtained on the second or third day of the menstrual cycle. A gynecological ultrasound was conducted to evaluate the ovarian structure and the presence of multiple cysts.

Descriptive statistics were presented as mean±standard deviation. Statistical analysis was done using SPSS version 22.

RESULTS AND DISCUSSIONS

The average age of the participants was 19.2 years, with a standard deviation of 4.58 years. The mean Body Mass Index (BMI) was 26.47 kg/m² (SD=4.36), indicating that the majority of participants were overweight. Serum testosterone levels exhibited considerable variability with a mean of 21.73 ng/ml (SD =51.75), reflecting the heterogeneity in androgen levels among the PCOS cohort. Serum dehydroepiandrosterone sulfate (DHEAS) had a mean value of 3.57 µg/ml (SD=1.66), which is within the range commonly associated with PCOS. Hirsutism, assessed through the Ferriman-Gallwey score, had a mean of 16.15 (SD=4.76), suggesting a notable prevalence of excessive hair growth. A substantial proportion of participants (69.66%) reported hirsutism. Luteinizing hormone (LH) levels averaged 12.61 mIU/ml (SD=5.65), while follicle-stimulating hormone (FSH) levels were 5.75 mIU/ml (SD=2.21). Prolactin (PRL) levels had a mean of 6.81 ng/ml (SD=4.17). Fasting glucose levels were relatively normal with a

mean of 88.89 mg/dl (SD=11.16), whereas fasting serum insulin levels were elevated, averaging 22.27 µU/ml (SD=8.31). The Homeostasis Model Assessment of Insulin Resistance (HOMA-IR) was 3.91 (SD=2.78), indicative of insulin resistance in the participants (Table 1). In 62% of the cases, the LH/FSH ratio exceeded 2 and 68.54% (61 subjects) showed insulin resistance. Elevated serum testosterone was detected in 65% of cases.

Table 1:Values of Various Variables Among PCOS Participants

Variables	Values (Mean±SD)
Age (years)	19.2±4.58
BMI (kg/m²)	26.47±4.36
Serum testosterone (ng/ml)	21.73±51.75
Serum DHEAS (µg/ml)	3.57±1.66
Hirsutism	62 (69.66%)
Ferriman-Gallwey score	16.15±4.76
LH (mIU/ml)	12.61±5.65
FSH (mIU/ml)	5.75±2.21
PRL (ng/ml)	6.81±4.17
Fasting sugar (mg/dl)	88.89±11.16
Fasting serum insulin (µU/ml)	22.27±8.31
HOMA-IR	3.91±2.78

As shown in Table 2, Thyroid function tests revealed mean levels of free triiodothyronine (FT3) at 2.93 pg/ml (SD = 1.46), free thyroxine (FT4) at 1.58 ng/dl (SD =1.09) and thyroid-stimulating hormone (TSH) at 4.22 mIU/ml (SD = 1.78).

Table 2: Thyroid Function Tests Among PCOS Participants

Tests	Mean±SD
FT3 (pg/ml)	2.93±1.46
FT4 (ng/dl)	1.58±1.09
TSH (mIU/ml)	4.22±1.78

As depicted in Table 3, In terms of thyroid abnormalities, 26.97% of the participants had subclinical hypothyroidism and 20.22% had overt hypothyroidism. Goiter was present in 6.74% of the participants. No cases of Grave's disease or multinodular goiter were observed in this cohort.

Table 3:Thyroid Abnormalities Among PCOS Participants

Thyroid Abnormality	n	%
Subclinical Hypothyroidism	24	26.97
Overt Hypothyroidism	18	20.22
Goiter	6	6.74
Grave's Disease	0	0
Multinodular Goiter	0	0

Our study reveals a significant proportion of thyroid dysfunction among individuals diagnosed with PCOS. Specifically, we identified that majority of the participants exhibited either clinical or subclinical hypothyroidism, with no cases of hyperthyroidism reported. Comparatively, the overall prevalence of thyroid dysfunction in the general female population has been estimated to be around 11.4%, as per an epidemiological study conducted in India[10]. Similar findings have been reported in other studies, which highlight a notably higher incidence of thyroid dysfunction in PCOS patients[9-11]. For instance, Sinha[11] documented 22.5% subclinical hypothyroidism and 2.5% clinical hypothyroidism, results closely aligned with our study. Janssen[9] also reported a significant prevalence of autoimmune thyroid disorders in PCOS, although our study did not specifically investigate the autoimmune aspect of thyroid dysfunction.

It has been suggested that an elevated estrogen and estrogen/progesterone ratio may play a key role in the increased levels of antithyroid peroxidase in individuals with PCOS[11]. Both genetic predispositions and environmental factors are believed to contribute to the development of thyroid disorders in the context of PCOS. Hypothyroidism, in particular, is known to produce ovaries with PCOS-like characteristics and exacerbate both PCOS symptoms and insulin resistance (IR)[12-13]. Normally, estrogen's immune-stimulating effects are balanced by the anti-inflammatory actions of progesterone. However, due to the anovulatory cycles in PCOS, progesterone levels are nearly undetectable, leading to immune overstimulation and a heightened occurrence of autoimmune thyroid disorders[14]. Ghosh *et al.* conducted a comparative analysis, indicating that hypothyroidism is associated with reduced sex hormone-binding globulin (SHBG) levels and elevated testosterone levels[15].

All of our study participants experienced menstrual irregularities, including oligomenorrhea, irregular cycles, or secondary amenorrhea. These findings align with previous studies, where menstrual disturbances were reported in 60-93% of cases[11-16-17]. Additionally, the high prevalence of obesity and insulin resistance, as indicated by HOMA-IR, in our cohort is consistent with similar research outcomes[11-17].

In 60% of the subjects, we observed a LH/FSH ratio greater than 2. Similar ratios were found in 55% of cases reported by Sinha *et al.* and 56% by Anwary[11] while Anlakash[18] reported this ratio in 64% of cases.

A prevailing hypothesis suggests that hypothyroidism worsens PCOS by reducing SHBG levels, leading to increased conversion of androstenedione to testosterone and decreased metabolic clearance of androstenedione and estrone. Since thyroid hormones influence gonadotropin-stimulated estradiol and progesterone secretion by granulosa cells, hypothyroidism may impair ovarian function and fertility[19].

CONCLUSION

The prevalence of thyroid dysfunction among individuals with PCOS was notably elevated, highlighting a critical association between the two conditions. Given the substantial overlap in symptoms and the potential for thyroid dysfunction to influence reproductive and metabolic outcomes, comprehensive

screening for thyroid abnormalities-including measurements of thyroid-stimulating hormone (TSH) and free thyroid hormone levels-should be considered an integral part of the diagnostic and management process for all patients diagnosed with PCOS. Early detection and treatment of thyroid disorders in this population may improve clinical outcomes, including metabolic control, reproductive function and overall quality of life.

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