

Prevalence Of Hyperandrogenism And Androgen Status In Women With Polycystic Ovary Syndrome

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Abstract

Background: Polycystic ovary syndrome (PCOS) is a common endocrine disorder affecting reproductive-aged women and is characterized by a spectrum of clinical features, including hyperandrogenism. Hyperandrogenism contributes significantly to the clinical manifestations and long-term health implications associated with PCOS.

Aim of the study: This study aimed to assess the prevalence of hyperandrogenism and androgen status in women with polycystic ovary syndrome.

Methods: This cross-sectional observational study was conducted at the Department of Obstetrics & Gynecology, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh from Jan 2022 to Dec 2022. The study encompassed 78 women diagnosed with polycystic ovary syndrome (PCOS) as participants. A purposive sampling technique was used for sample selection, and data were gathered through a semi-structured predesigned questionnaire. MS Office tools were employed for data analysis.

Results: In this study, the prevalence of hyperandrogenism among participants was found 71%. Among participants, androgen levels varied: 29.00% fell within the normal range. Notably, 19.40% exhibited high levels of both total testosterone (TT) and free testosterone (FT), while 17.20% had elevated FT alone. Furthermore, 13.90% showed heightened dehydroepiandrosterone sulfate (DHEAS) levels, and 8.50% displayed elevated levels of both FT and DHEAS.

Conclusion: Approximately three-fourths of women with polycystic ovary syndrome (PCOS) experience hyperandrogenism. Within this group, notable occurrences include high levels of both total testosterone (TT) and free testosterone (FT), elevated FT alone, and heightened dehydroepiandrosterone sulfate (DHEAS) levels.

Keywords: Prevalence, Hyperandrogenism, Androgen, Women, Polycystic ovary syndrome

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I. INTRODUCTION

Polycystic ovary syndrome (PCOS) is a complex disorder affecting 6–20% of women in their reproductive age [1]. Characterized by hyperandrogenism, ovulatory dysfunction, and enlarged ovaries, PCOS poses risks of insulin resistance, type 2 diabetes, infertility, psychological disorders, cardiovascular diseases, and gynecological cancers [2]. Hyperandrogenism, a key feature, results from disrupted ovarian or adrenal function, leading to excess androgen production [1]. Elevated androgens in PCOS disrupt folliculogenesis, increasing primordial and small antral follicles [3]. Neuroendocrine dysregulation induces hypothalamic–pituitary–ovarian axis imbalance, elevating gonadotrophins, particularly LH over FSH [4]. This results in the characteristic elevated LH/FSH ratio in PCOS. Excessive LH stimulation leads to the arrest of numerous follicles in the preantral and antral stages, causing the hyperplasia of theca cells. The accumulation of follicular fluid forms cyst-like structures, giving the ovary a string of pearls-like appearance [5]. In PCOS, the excess follicles and heightened expression of androgen-synthesizing enzymes result in an overproduction of androgens. The hyperandrogenic state is also influenced by insulin, as increased insulin secretion mimics LH's tropic action on ovarian theca cells, further elevating androgens [6]. Improved insulin resistance correlates with decreased hyperandrogenism in PCOS women [7]. Biochemically, hyperandrogenism is characterized by elevated levels of testosterone, free testosterone (FT), and free androgen index (FAI). Testosterone exists in either a free form or bound to proteins like SHBG and albumin. Typically, 80% of testosterone binds to sex hormone-binding globulin (SHBG), 19% to albumin, and only 1% circulates freely [8]. Measuring testosterone and SHBG concentrations aids in calculating the free androgen index (FAI), which is more informative than measuring total testosterone alone [9]. According to the Rotterdam consensus, detecting hyperandrogenism in PCOS women should involve measuring circulating free testosterone (cFT) or FAI rather than serum total testosterone [10]. Elevated levels

of total testosterone or free testosterone are key diagnostic indicators of biochemical hyperandrogenism. Other androgens such as dehydroepiandrosterone (DHEA) and androstenedione can also aid in diagnosing biochemical hyperandrogenism. Androstenedione, DHEA, and dehydroepiandrosterone sulfate are all bound to albumin with low affinity [11]. Dehydroepiandrosterone sulfate (DHEAS) is abundantly present in the circulation and, due to its sulfate group, is easily detectable by commercial assays. Elevated levels of DHEA are observed in approximately 25% of PCOS patients [12], while high androstenedione levels are found in 18% of PCOS women [13].

II. METHODOLOGY

This was a cross-sectional observational study that was conducted at the Department of Obstetrics & Gynecology, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh from Jan 2022 to Dec 2022. The study involved 78 women diagnosed with polycystic ovary syndrome (PCOS) as participants. Purposive sampling was employed for sample selection. Properly written consent was obtained from all participants prior to data collection. The evaluated patients included those presenting with symptoms such as oligo/amenorrhea, ovulatory dysfunction, excess hair growth, virilization, alopecia, or acne. Out of the 78 patients evaluated, those who were pregnant or had a positive history of prolactinoma, hypogonadotropic hypogonadism, premature ovarian failure, congenital adrenal hyperplasia, an androgen-secreting tumor, Cushing's syndrome, chromosomal anomalies, or ovarian tumors were excluded based on the study's exclusion criteria. Demographic and clinical information of the participants was recorded, and all data were processed, analyzed, and disseminated using MS Office tools.

III. RESULT

In this study, based on the demographic profile of the study subjects (N=78), it was observed that the mean \pm SD age was 27.87 ± 7.36 years, the mean \pm SD BMI was 33.29 ± 9.32 kg/m², and the mean \pm SD waist-to-hip ratio was 0.86 ± 0.08 . The study participants displayed a clinical profile with a mean total testosterone (TT) level of 90.28 ng/dl, sex hormone-binding globulin (SHBG) level of 181 nmol/liter, free testosterone (FT) level of 0.93 ng/dl, and dehydroepiandrosterone sulfate (DHEAS) level of 2349.7 ng/ml. The modified Ferriman-Gallwey (mFG) score averaged 8.4, indicating a moderate hirsutism severity with a standard deviation of 4.7. Acne was observed in 14.70% of the subjects. All subjects were oligo-ovulatory, and 33.10% were identified as infertile. A high prevalence of hirsutism (72.40%) and obesity (61%) was also noted among the study population. In this study, the prevalence of hyperandrogenism among participants was found 71%. Among the participants, androgen levels varied, with 29.00% falling within the normal range. A significant portion exhibited elevated androgen levels, with 19.40% having high levels of both total testosterone (TT) and free testosterone (FT), while 17.20% had high FT alone. Additionally, 13.90% of participants showed elevated dehydroepiandrosterone sulfate (DHEAS) levels, and 8.50% had high levels of both FT and DHEAS. A smaller percentage, 6.90%, presented with high FT and DHEAS individually. High TT levels were observed in 3.10% of participants, and 2.00% had elevated DHEAS alone.

Table 1: Demographic profile of participants (N=78)

| Age (years) | 27.87 \pm 7.36 |
|--------------------------|------------------|
| BMI (kg/m ²) | 33.29 \pm 9.32 |
| Waist-to-hip ratio | 0.86 \pm 0.08 |

Table 2: Clinical profile of participants

| Clinical profile | Mean/% |
|-------------------|---------------|
| TT (ng/dl) | 90.28+55.67 |
| SHBG (nmol/liter) | 181+69 |
| FT (ng/dl) | 0.93+.56 |
| DHEAS (ng/ml) | 2349.7+1291.8 |
| mFG score | 8.4+4.7 |
| Acne | 14.70% |
| Oligo-ovulatory | 100% |
| Infertile | 33.10% |
| Hirsute | 72.40% |
| Obesity | 61% |

TT: Total testosterone, SHBG: Sex hormone binding globulin, FT: Free testosterone, DHEAS: Dehydroepiandrosterone sulfate, mFG: Modified Ferriman-Gallwey.

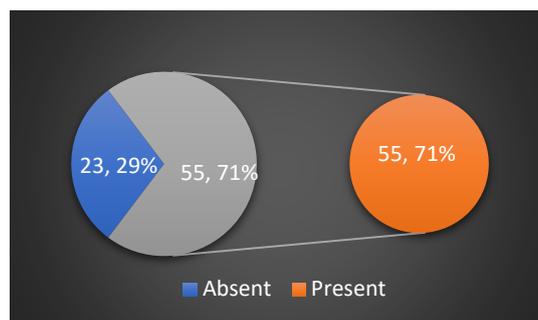


Figure 1: Prevalence of hyperandrogenism among participants

Table 3: Androgen levels among participants

| Androgen Levels | % |
|-------------------|--------|
| Normal | 29.00% |
| High TT and FT | 19.40% |
| High FT | 17.20% |
| High DHEAS | 13.90% |
| High FT and DHEAS | 8.50% |
| High FT and DHEAS | 6.90% |
| High TT | 3.10% |
| High DHEAS | 2.00% |

IV. DISCUSSION

This study aimed to assess the prevalence of hyperandrogenism and androgen status in women with polycystic ovary syndrome. In this study, among the study subjects (N=78), the demographic profile showed a mean \pm SD age of 27.87 ± 7.36 years, a mean \pm SD BMI of 33.29 ± 9.32 kg/m², and a mean \pm SD waist-to-hip ratio of 0.86 ± 0.08 . The prevalence of hyperandrogenism among participants was found 71%. In a parallel study conducted by Andy Huang et al [14], it was discovered that hyperandrogenemia in polycystic ovary syndrome (PCOS) was present in 75.3% of cases. Supranormal levels of free testosterone (FT) were observed in 57.5%, total testosterone (TT) in 33.0%, and dehydroepiandrosterone sulfate (DHEAS) in 32.7% of PCOS patients. Our study participants demonstrated a clinical profile with a mean total testosterone (TT) level of 90.28 ng/dl, sex hormone-binding globulin (SHBG) level of 181 nmol/liter, free testosterone (FT) level of 0.93 ng/dl, and dehydroepiandrosterone sulfate (DHEAS) level of 2349.7 ng/ml. The modified Ferriman-Gallwey (mFG) score averaged 8.4, indicating a moderate severity of hirsutism with a standard deviation of 4.7. Acne was observed in 14.70% of the subjects. All subjects were oligo-ovulatory, with 33.10% identified as infertile. The study population exhibited a high prevalence of hirsutism (72.40%) and obesity (61%). Clinical hyperandrogenism was defined by hirsutism with a modified Ferriman-Gallwey (mFG) score greater than 6 [15]. Hyperandrogenemia was defined by androgen values exceeding the 95th percentile of 98 race-matched eumenorrheic control women from the same population, as reported by Knochenhauer et al [16], with total testosterone (TT) >88 ng/dL, free testosterone (FT) > 0.66 ng/dL, or dehydroepiandrosterone sulfate (DHEAS) >2750 ng/mL. In 2006, the Androgen Excess Society convened a task force to review all available data and recommend an evidence-based definition for polycystic ovary syndrome (PCOS), aiming to guide clinical diagnosis and future research [17]. Their recommendation for androgen evaluation in PCOS was to measure free testosterone (FT) concentration using high-quality assays, primarily either directly by equilibrium dialysis or to calculate FT based on total testosterone (TT) and sex hormone-binding globulin (SHBG) levels measured accurately (i.e., TT by mass spectrometry or after extraction and chromatography; and SHBG by competitive binding or specific ELISA assays). Free testosterone was found to be much more sensitive than either TT or dehydroepiandrosterone sulfate (DHEAS) in detecting hyperandrogenemia.

Limitation of the study:

This study was single-centered and had a small sample size. Additionally, it was conducted over a brief period. Consequently, the findings may not fully capture the comprehensive scenario of the entire country.

V. CONCLUSION & RECOMMENDATION

The prevalence of hyperandrogenism among women with polycystic ovary syndrome (PCOS) is a significant aspect that warrants attention. Approximately three-fourths of women diagnosed with PCOS exhibit manifestations of hyperandrogenism, which encompasses various hormonal imbalances. This includes instances where both total testosterone (TT) and free testosterone (FT) levels are elevated, indicating an excess of androgen hormones in circulation. Some individuals showcase elevated levels of both TT and FT, emphasizing the multifaceted hormonal dysregulation characteristic of PCOS. Others may experience heightened levels of FT alone, underscoring the importance of assessing not only total testosterone but also the bioavailable fraction that can exert physiological effects. In addition to testosterone, elevated dehydroepiandrosterone sulfate (DHEAS) levels are also noteworthy in this context.

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