ASSESSMENT OF HORMONAL DISORDERS IN PATIENTS WITH HIRSUTISM: DIAGNOSTIC AND THERAPEUTIC APPROACHES

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KEYWORDS

Hirsutism, hormonal abnormalities, testosterone, LH/FSH ratio, DHEAS, diagnostic challenges, Ferriman-Gallwey score, patient management

ABSTRACT

Hirsutism is a condition characterized by excessive growth of terminal hair in androgen-sensitive areas of a woman's body, often resulting from underlying hormonal imbalances, such as elevated androgens or disrupted LH/FSH ratios. This condition significantly affects physical and emotional well-being, requiring accurate diagnosis and effective management.

This study aimed to address diagnostic challenges in identifying hormonal abnormalities associated with hirsutism and to evaluate their relationship with the severity of the condition.

A total of 150 female patients with a Ferriman-Gallwey score ≥8 were included in this cross-sectional study. Hormonal analyses, including total testosterone, LH/FSH ratio, DHEAS, 17-hydroxyprogesterone, prolactin, and TSH, were conducted using ELISA methods. Patients were stratified by hirsutism severity, and statistical analyses were performed to determine relationships between hormonal levels and severity.

Elevated total testosterone and abnormal LH/FSH ratios were significantly associated with moderate and severe hirsutism (P-values = 0.01 and 0.00, respectively). In contrast, no significant relationships were observed for DHEAS, 17-hydroxyprogesterone, or prolactin levels. Overall, 52% of patients had at least one abnormal hormonal test, emphasizing the need for comprehensive hormonal evaluations in hirsutism diagnosis.

This study highlights the critical role of testosterone and LH/FSH ratio in diagnosing and understanding the severity of hirsutism. By integrating comprehensive hormonal evaluations into clinical practice, the management of hirsutism can be significantly improved. Future research is warranted to explore genetic and environmental factors contributing to hirsutism in underrepresented populations.

Introduction

Hirsutism is a condition characterized by the excessive growth of terminal hair in androgen-sensitive areas of a woman's body, such as the face, chest, and abdomen, often leading to significant distress and clinical concern. While its prevalence varies geographically, it affects approximately 5–10% of women of reproductive age and is commonly associated with underlying hormonal imbalances (Azziz et al., 2004). The condition poses diagnostic challenges, as it may be attributed to a variety of causes, including androgen excess disorders such as polycystic ovary

syndrome (PCOS), adrenal hyperplasia, or, in rare cases, androgen-secreting tumors (Carmina & Azziz, 2006).

The primary pathophysiological mechanism underlying hirsutism involves the influence of androgens, specifically testosterone and dihydrotestosterone (DHT), on hair follicle activity. Androgens stimulate the transformation of vellus hair into terminal hair, a process typically controlled by androgen levels and follicular sensitivity (Eckert & Kuttenn, 2002). In cases of hirsutism, elevated androgen levels, increased follicular responsiveness, or both contribute to the clinical presentation. Hormonal contributors may include excessive androgen production from the ovaries or adrenal glands or increased peripheral conversion of androgen precursors (Zhang et al., 2021).

Beyond its physical manifestations, hirsutism has profound psychosocial and emotional implications. Women with hirsutism frequently report feelings of shame, social withdrawal, and diminished self-esteem, compounded by cultural and societal pressures regarding feminine appearance. These issues can result in significant mental health concerns, including anxiety and depression, highlighting the importance of timely diagnosis and effective treatment (Blume-Peytavi et al., 2010).

In Iran, research addressing the specific etiological, diagnostic, and therapeutic aspects of hirsutism remains limited. Despite advancements in diagnostic techniques, many patients face delays in receiving appropriate care due to a lack of awareness and access to resources. Furthermore, there is a notable gap in localized studies that explore the role of genetic and environmental factors specific to this population (Nazari et al., 2017). Current treatment strategies often focus on symptomatic relief, such as hair removal, without adequately addressing the hormonal abnormalities underlying the condition.

This study seeks to fill these gaps by evaluating the hormonal profiles of hirsute patients in Tehran, identifying common etiologies, and assessing the efficacy of diagnostic and therapeutic strategies. By shedding light on the hormonal disturbances prevalent in this population, the research aims to contribute to improved clinical practices and better patient outcomes.

Literature Review

1. Overview of Hormonal Regulation of Hair Growth

Hair growth is a complex process regulated by multiple hormonal and local factors that vary significantly between individuals and body regions. Androgens, specifically testosterone and dihydrotestosterone (DHT), play a pivotal role in the transformation of vellus hair into terminal hair in androgen-sensitive areas such as the face, chest, and abdomen. This process, known as androgen-mediated hair follicle stimulation, is critical in determining hair distribution and density. The primary sources of androgens in women are the ovaries, adrenal glands, and peripheral conversion of precursors such as androstenedione and dehydroepiandrosterone sulfate (DHEAS) (Zouboulis et al., 2020).

Androgens exert their effects on hair follicles by binding to androgen receptors within the dermal papilla, triggering a cascade of gene expression changes that promote hair shaft thickening, pigmentation, and elongation. The sensitivity of hair follicles to androgens is largely determined by the activity of 5-alpha-reductase, an enzyme that converts testosterone into the more potent DHT. This enzymatic activity varies by anatomical location, explaining why certain areas, such as the upper lip and chin, are more prone to excessive hair growth in women with elevated androgen levels or increased follicular sensitivity (Blume-Peytavi et al., 2022).

Estrogen and progesterone, in contrast, are thought to counteract androgen effects to some extent. Estrogen prolongs the anagen (growth) phase of the hair cycle in scalp follicles, potentially reducing hair loss. Conversely, high levels of progesterone during pregnancy may contribute to telogen effluvium, a temporary hair shedding phase observed postpartum. These hormonal

interactions underscore the multifaceted regulation of hair growth and the complexity of diagnosing and treating conditions like hirsutism (Blume-Peytavi et al., 2022).

Key Studies on the Role of Androgens and Other Hormones in Hirsutism

Numerous studies have established a strong correlation between elevated androgen levels and the development of hirsutism. The most common condition associated with androgen excess is polycystic ovary syndrome (PCOS), which affects 70–80% of women with hirsutism. Women with PCOS exhibit elevated levels of circulating testosterone, androstenedione, and DHEAS, along with characteristic ovarian dysfunction (Teede et al., 2018). Studies have also highlighted the role of adrenal disorders, such as congenital adrenal hyperplasia (CAH), which result from enzyme deficiencies like 21-hydroxylase and lead to excessive androgen production (Merke & Bornstein, 2021).

Idiopathic hirsutism, where androgen levels appear normal but follicular sensitivity to androgens is heightened, remains a diagnostic challenge. Studies suggest that genetic factors may influence the activity of 5-alpha-reductase and androgen receptor expression in these cases (Ferriman & Gallwey, 1961; Zouboulis et al., 2020). Furthermore, conditions like hyperprolactinemia and hypothyroidism have also been implicated in hirsutism due to their indirect effects on androgen metabolism and follicular dynamics (Carmina et al., 2020).

A pivotal study by Ferriman and Gallwey (1961) established a scoring system to quantify hirsutism severity based on hair growth patterns in nine androgen-sensitive areas. This system remains widely used in clinical and research settings, enabling standardized evaluation and monitoring of hirsutism. Additional research has emphasized the importance of measuring free testosterone, DHEAS, and sex hormone-binding globulin (SHBG) to diagnose underlying hormonal disorders (Teede et al., 2018).

Methods of Diagnosing Hormonal Disorders in Hirsute Patients

The diagnosis of hormonal disorders in hirsute patients involves a systematic evaluation combining clinical, biochemical, and imaging studies. The Ferriman-Gallwey scoring system is commonly employed as an initial tool to assess the severity of hirsutism. A score of eight or higher typically warrants further investigation into potential endocrine abnormalities (Carmina et al., 2020).

Biochemical evaluation is central to diagnosing the etiology of hirsutism. Measurement of serum testosterone, DHEAS, androstenedione, and SHBG levels provides insights into androgen production and activity. In cases where hyperandrogenemia is suspected, additional tests such as 17-hydroxyprogesterone may be conducted to rule out non-classical congenital adrenal hyperplasia (NCCAH) (Merke & Bornstein, 2021). Prolactin levels are evaluated when hyperprolactinemia is suspected, and thyroid function tests are recommended for patients presenting with symptoms of hypothyroidism (Carmina et al., 2020).

Imaging studies, including pelvic ultrasound, play a crucial role in identifying ovarian pathology such as PCOS or androgen-secreting tumors. Adrenal imaging, such as CT or MRI scans, is indicated in cases of markedly elevated DHEAS levels or rapid-onset hirsutism to exclude adrenal neoplasms. Genetic testing may be considered in rare cases to identify enzyme deficiencies contributing to androgen excess (Merke & Bornstein, 2021).

4. Treatment Options: Medical and Cosmetic Approaches

The management of hirsutism is tailored to the underlying cause, severity of the condition, and patient preferences. Treatment typically combines medical therapy to address hormonal imbalances with cosmetic interventions to reduce unwanted hair.

Medical Approaches:

- **Anti-androgens**: Drugs such as spironolactone and cyproterone acetate block androgen receptors and reduce androgen-mediated hair growth. These are commonly prescribed for patients with PCOS or idiopathic hirsutism (Carmina et al., 2020).
- **Oral Contraceptives**: Combination oral contraceptives containing estrogen and progestin are first-line treatments for hirsutism associated with PCOS. They suppress ovarian androgen production and increase SHBG levels, reducing free testosterone (Teede et al., 2018).
- **GnRH Agonists**: For severe cases of androgen excess, gonadotropin-releasing hormone (GnRH) agonists suppress ovarian function and androgen production (Blume-Peytavi et al., 2022).
- **Insulin Sensitizers**: Metformin, commonly used in PCOS, improves insulin sensitivity and reduces hyperinsulinemia, which indirectly decreases androgen production (Teede et al., 2018).
- **Topical Treatments**: Eflornithine cream inhibits hair follicle enzyme activity, slowing the growth of facial hair and providing cosmetic benefits (Shapiro et al., 2021).

Cosmetic Approaches

- **Laser Hair Removal**: This widely used method targets melanin in hair follicles, providing semi-permanent hair reduction. It is most effective for patients with light skin and dark hair (Shapiro et al., 2021).
- **Electrolysis**: This method destroys individual hair follicles using an electric current and is effective for smaller areas of hirsutism (Blume-Peytavi et al., 2022).
- **Temporary Hair Removal**: Techniques such as waxing, shaving, and depilatory creams provide immediate but short-term relief (Blume-Peytavi et al., 2022).

Emerging treatments, such as selective androgen receptor inhibitors (SARIs) and novel hormonal therapies, hold promise for addressing hirsutism with fewer side effects. Despite these advancements, patient education and individualized care remain central to achieving optimal outcomes in managing this multifactorial condition (Shapiro et al., 2021).

Methods

1. Study Design and Population

This study employs a cross-sectional design to investigate hormonal abnormalities in patients with hirsutism. The study population comprises women diagnosed with hirsutism who sought medical care in Tehran.

Inclusion Criteria:

- Women aged 16 to 45 years with clinically evident hirsutism, defined by a Ferriman-Gallwey score ≥ 8.
- Patients with persistent symptoms for at least six months.
- Those willing to provide written informed consent for participation.

Exclusion Criteria:

- Patients with temporary hair growth due to medications such as corticosteroids or other external factors.
- Presence of systemic diseases, such as uncontrolled thyroid disorders or Cushing's syndrome, that could independently influence hair growth.
- Pregnant or lactating women, as hormonal levels during these phases can affect androgen-related metrics.
- Individuals undergoing ongoing treatment for hirsutism (e.g., anti-androgen therapy) within six months prior to enrollment.

Demographics and Clinical Characteristics: Participants were evaluated for:

- Age, weight, height, and body mass index (BMI).
- Menstrual history, including cycle regularity and associated symptoms such as oligomenorrhea or amenorrhea.

- Clinical features of androgen excess, such as acne, seborrhea, or alopecia.
- Family history of hirsutism or related endocrine disorders.

2. Diagnostic Tools and Hormonal Assays

Comprehensive clinical and laboratory assessments were conducted to determine the underlying etiology of hirsutism.

Hormonal Assays:

- **Testosterone:** Total and free testosterone levels were measured using immunoassays to evaluate ovarian or adrenal androgen production.
- **DHEAS (Dehydroepiandrosterone sulfate):** Measured to assess adrenal contribution to androgen excess.
- **LH/FSH Ratios:** Evaluated to detect ovarian dysfunction, particularly in cases of suspected polycystic ovary syndrome (PCOS).
- **Prolactin Levels:** Tested to rule out hyperprolactinemia as a cause of androgen excess.
- **17-Hydroxyprogesterone:** Performed in patients with clinical suspicion of non-classical congenital adrenal hyperplasia (NCCAH).
- **Thyroid Stimulating Hormone (TSH):** Measured to exclude thyroid dysfunction as a contributing factor.

Imaging Studies:

- **Pelvic Ultrasound:** Conducted to identify polycystic ovarian morphology or ovarian tumors. Ovarian volume and the presence of antral follicles were documented.
- **Adrenal Imaging:** Abdominal CT or MRI scans were used when adrenal tumors or hyperplasia were suspected based on elevated DHEAS levels.

3. Analytical Approach

Statistical analyses were conducted to correlate hormonal levels with clinical features of hirsutism and to identify potential diagnostic markers.

Data Analysis:

- Descriptive statistics, including mean, median, and standard deviation, were calculated for demographic and clinical variables.
- Hormonal levels were compared between patients with varying severity of hirsutism using the Ferriman-Gallwey score.
- Correlation analyses were performed to examine relationships between hormonal profiles and clinical features such as BMI, menstrual irregularities, and the presence of acne or alopecia.
- Multivariate regression analysis was conducted to identify independent predictors of hirsutism severity.
- A significance threshold of $p < 0.05$ was applied for all statistical tests.

Ethical approval for the study was obtained from the relevant institutional review board, and all participants provided informed consent before undergoing diagnostic evaluations.

This methodological framework ensures a comprehensive evaluation of the hormonal and clinical characteristics associated with hirsutism while maintaining the rigor required for reliable and reproducible results.

Results:

In this study, 359 patients referred to the laser center at Najmieh Hospital in Tehran for hair removal were evaluated. Of these, 150 patients with a Ferriman-Gallwey score of ≥8, consistent with the definition of hirsutism, were selected and included in the study. Due to the nature of the condition, which is specific to women, all participants were female.

The mean age of the participants was 31.00 years. The youngest participant was a 16-year-old girl, and the oldest was a 53-year-old woman (**Table 1**).

Oldest (years)	Youngest (years)	Mean Age (years)
53	16	31.00

Table 1: Age Characteristics of the Study Group

The patients were divided into four age groups as follows:

1. Age group 16–25 years: 49 patients (32.66%)
2. Age group 26–35 years: 63 patients (42.00%)
3. Age group 36–45 years: 26 patients (17.33%)
4. Age group >46 years: 12 patients (8.00%)

A total of 84 participants (56.00%) were married, while 66 participants (44.00%) were single

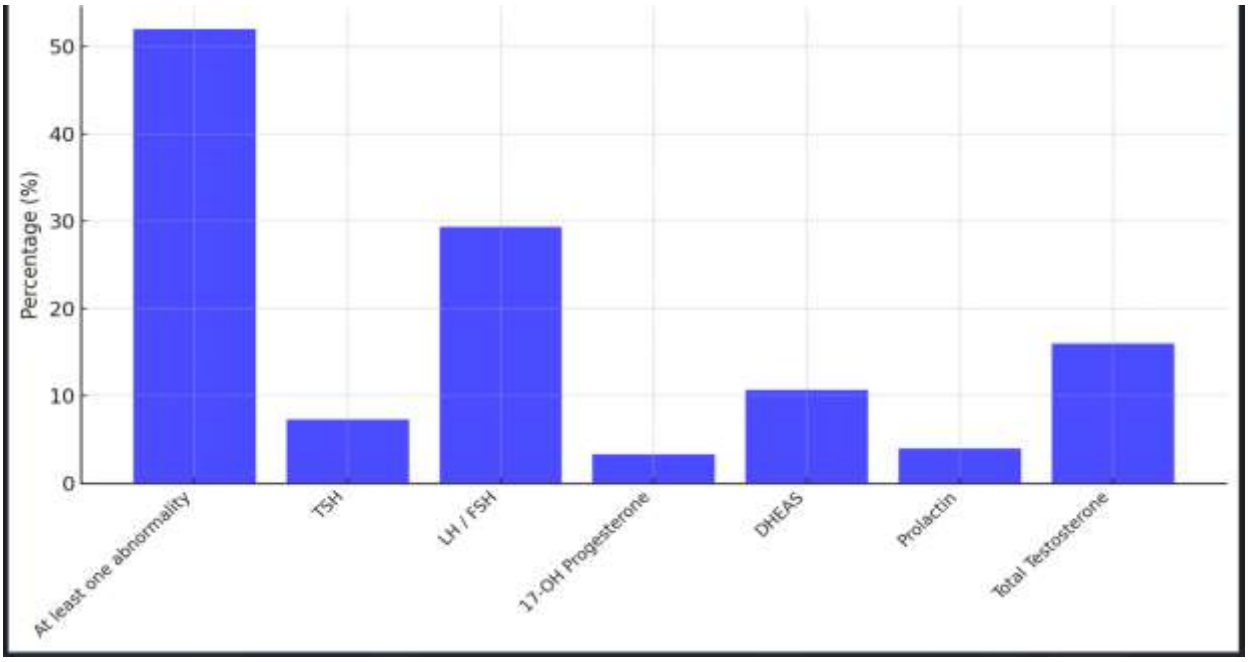
Associated Symptoms with Hirsutism:

- **Acne:** 58 patients (38.66%) had acne in addition to excessive hair growth.
- **Male-pattern Baldness:** 31 patients (20.66%) exhibited male-pattern baldness.
- **Family History:** 79 patients (52.66%) had a positive family history of hirsutism.
- **Irregular Menstrual Cycles:** 81 patients (54.00%) reported irregular menstrual cycles

Serum Hormone Levels:

The serum hormone levels were measured on the 5th to 9th days of the menstrual cycle (follicular phase) using the ELISA method. For patients with irregular cycles, the tests were conducted regardless of menstrual timing.

- **Testosterone:**
  Total testosterone levels in the range of 0.1–1.2 ng/mL were considered normal, while levels exceeding 1.2 ng/mL were classified as abnormal. Among the 150 patients with hirsutism, 24 patients (16.00%) had elevated total testosterone levels.
- **Prolactin:**
  Serum prolactin levels above 25 ng/mL were considered abnormal. Based on this criterion, 6 patients (4.00%) out of 150 had abnormal prolactin levels.
- **DHEAS (Dehydroepiandrosterone Sulfate):**
  DHEAS levels above 4.1 µg/mL were deemed abnormal. Among the 150 patients with hirsutism, 16 patients (10.66%) had elevated DHEAS levels.
- **17-Hydroxyprogesterone:**
  Normal levels of 17-hydroxyprogesterone in the follicular phase were between 0.1–0.8 ng/mL and 0.6–2.3 ng/mL in the luteal phase. Based on this criterion, 5 patients (3.33%) out of 150 had abnormal levels of 17-hydroxyprogesterone.
- **LH/FSH Ratio:**
  An LH/FSH ratio of ≤2 was considered normal, while a ratio >2 was considered abnormal. Among the participants, 44 patients (29.33%) had an abnormal LH/FSH ratio, while 106 patients (70.66%) had a normal ratio.
- **TSH (Thyroid-Stimulating Hormone):**
  TSH levels in the range of 0.3–4 mIU/L were classified as normal, while levels above 4 mIU/L were considered abnormal. Based on this definition, 11 patients (7.33%) had elevated TSH levels. In total, 78 patients (52.00%) out of 150 with hirsutism exhibited at least one abnormal hormonal test result (**Figure 1**).



Hirsutism Severity

Based on the Ferriman-Gallwey score, patients were categorized into three groups to assess the severity of hirsutism:

1. **Mild Hirsutism:** Ferriman-Gallwey score between 8 and 16.
2. **Moderate Hirsutism:** Ferriman-Gallwey score between 17 and 25.
3. **Severe Hirsutism:** Ferriman-Gallwey score of 26 or higher.

According to this classification:

- 125 patients (83.33%) had mild hirsutism.
- 23 patients (15.33%) had moderate hirsutism.
- 2 patients (1.33%) had severe hirsutism.

Table 2: Data on Hirsutism Severity

Number of Patients	Ferriman-Gallwey Score	Hirsutism Severity
125 (83.33%)	$8 \leq ... \leq 16$	Mild
23 (15.33%)	$17 \leq ... \leq 25$	Moderate
2 (1.33%)	$26 \leq$	Severe

This classification provides a clear representation of the distribution of hirsutism severity among the study participants. Let me know if you need a corresponding chart for this data!

Hormonal Levels Based on Hirsutism Severity

The relationship between hormonal levels and the severity of hirsutism (moderate and severe) was evaluated as follows:

- **Total Testosterone:**

  Among 25 patients with moderate and severe hirsutism, 11 patients (45.83%) had elevated total testosterone levels above the normal range. The mean total testosterone level in these patients was significantly higher than the overall mean among all hirsutism patients, indicating a significant relationship between total testosterone levels and hirsutism severity (**p-value = 0.01**).

- **Prolactin:**

  Only 1 patient (4.00%) among the 25 patients with moderate and severe hirsutism exhibited abnormal prolactin levels. The mean prolactin level in this group was not significantly higher than

the overall mean among all patients, showing no significant relationship between prolactin levels and hirsutism severity (**p-value = 0.75**).

- **DHEAS (Dehydroepiandrosterone Sulfate):**
  Elevated DHEAS levels were observed in 5 patients (20.00%) with moderate and severe hirsutism. The mean DHEAS levels in this group were not significantly higher than the overall mean among all hirsutism patients, indicating no significant relationship between DHEAS levels and hirsutism severity (**p-value = 0.07**).
- **17-Hydroxyprogesterone:**
  Three patients (12.00%) with moderate and severe hirsutism had abnormal 17-hydroxyprogesterone levels. The mean levels in this group were not significantly higher than the overall mean, suggesting no significant association between 17-hydroxyprogesterone levels and hirsutism severity (**p-value = 0.06**).
- **LH/FSH Ratio:**
  Abnormal LH/FSH ratios (>2) were found in 11 patients (44.00%) with moderate and severe hirsutism. The mean LH/FSH ratio in this group was significantly higher than the overall mean among all hirsutism patients, demonstrating a significant association between LH/FSH ratio and hirsutism severity (**p-value = 0.00**).
- **TSH (Thyroid-Stimulating Hormone):**
  Elevated TSH levels were observed in 2 patients (8.00%) with moderate and severe hirsutism. The mean TSH levels in this group were not significantly higher than the overall mean among all hirsutism patients, indicating no significant association between TSH levels and hirsutism severity (**p-value = 0.29**).

Overall Abnormal Hormonal Tests

Out of 25 patients with moderate and severe hirsutism, 19 patients (76.00%) had at least one abnormal hormonal test. A significant relationship was found between the presence of hormonal abnormalities and hirsutism severity (**p-value = 0.00**).

Figure 2compares the percentage of patients with abnormal hormonal levels across different hormonal parameters in patients with moderate and severe hirsutism. Let me know if you'd like the figure recreated in English!

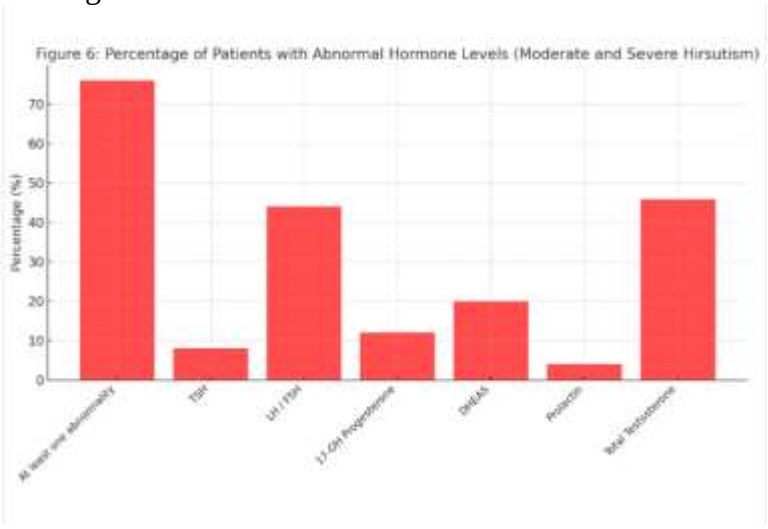
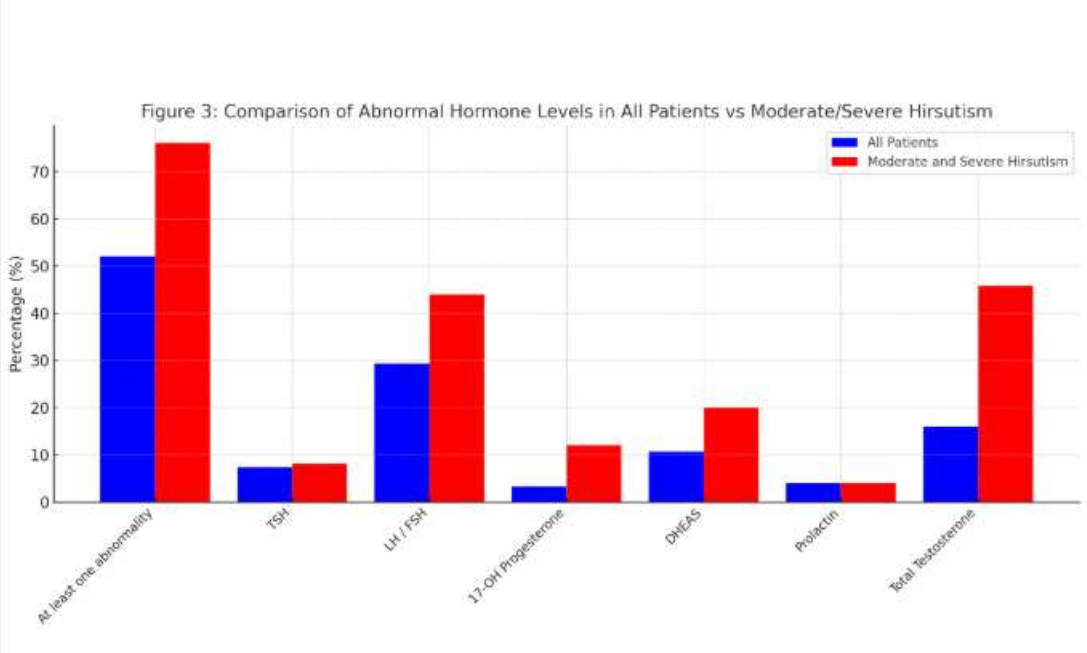


Figure 2: Percentage of individuals with abnormal hormone levels for various hormones in patients with moderate and severe hirsutism.

In **Figure 3**, Figures 1 and 2 have been combined for easier comparison of the percentage of individuals with abnormal hormone levels for various hormones across all patients and those with moderate and severe hirsutism.



The chart above compares the percentage of patients with abnormal hormone levels across all patients (blue bars) and those with moderate and severe hirsutism (red bars). This visual representation helps in understanding the differences between these two groups

Table 3: Relationship Between Variables and Hirsutism Severity with Corresponding P-Values

Row	Variable	P-Value	Significant Relationship
1	Total Testosterone	0.01	Yes
2	Prolactin	0.75	No
3	DHEAS	0.07	No
4	17-Hydroxyprogesterone	0.06	No
5	LH/FSH	0.00	Yes
6	TSH	0.29	No
7	Presence of at least one abnormality	0.00	Yes

Discussion

One of the significant findings of this study was the strong association between elevated total testosterone levels and the severity of hirsutism (**P-value = 0.01**). This contrasts with a study conducted by Brodell L. and Mercurio M. in 2010 at the University of Rochester, New York, which concluded that androgens were not associated with the severity of hirsutism (11). However, our findings refute this, as the mean total testosterone level in patients with moderate and severe hirsutism was significantly higher than the mean across all hirsutism patients. Additionally, various studies have reported elevated testosterone levels in different percentages of patients with hirsutism (3, 4, 5, 7, 8, 9).

A significant association between the LH/FSH ratio and the severity of hirsutism was also observed in this study (**P-value = 0.00**). These findings underscore the fact that advances in diagnostic tools have made the role of hormonal disorders in hirsutism more apparent (4).

In a study conducted by Dr. Farshad Farnoqi at Razi Hospital in Tehran from 1379–1380 (2000–2001), it was concluded that laboratory tests should also be performed for hirsutism patients with regular menstrual cycles (12). This highlights the necessity of laboratory evaluation in the 46% of participants in our study who had regular menstrual cycles.

In another study conducted by Zahra Suki and colleagues in Tehran in 1378 (1999), it was reported that 21.5% of the study population had ovarian or adrenal disorders, confirming the role of ovarian and adrenal hormonal abnormalities in the development of hirsutism (4). Similarly, Dr. Ali Rabani's study in winter 1381 (2003) indicated that endocrine disorders, including adrenal gland abnormalities, are major causes of hirsutism in women (6).

In our study, a significant association was found between elevated testosterone levels and the severity of hirsutism. The same was true for the LH/FSH ratio, showing a significant relationship between abnormal testosterone and LH/FSH levels and the severity of hirsutism. However, this was not the case for DHEAS and 17-hydroxyprogesterone, as no significant relationship was found between elevated levels of these hormones and the severity of hirsutism. Similarly, no significant association was observed between elevated prolactin levels and hirsutism severity.

In a study conducted by Dr. Davood Keshavarz in Qazvin in 1379 (2000), it was reported that 42.5% of individuals in a sample of 100 patients had abnormalities in at least one hormone (5). However, in our study with a larger sample size, 52% of participants were found to have at least one hormonal abnormality, and a significant relationship was observed between having at least one hormonal abnormality and the severity of hirsutism. This suggests that hormonal abnormalities may play a greater role in the onset or exacerbation of hirsutism.

While elevated DHEAS levels have been reported in varying percentages of hirsutism patients across studies (2, 3, 4, 8), in our study, 10.66% of participants had elevated DHEAS levels. However, no significant association was found between elevated DHEAS levels and the severity of hirsutism (**P-value = 0.07**). This aligns with the fact that DHEAS levels are naturally elevated in 16% of women and that its measurement is more useful in cases of extremely high levels (≥ 700 µg/dL), which are often indicative of adrenal tumors (2).

These findings highlight the importance of evaluating multiple hormonal parameters in patients with hirsutism and emphasize the role of testosterone and LH/FSH ratio in understanding its severity. However, other factors, such as the context of DHEAS and prolactin levels, require further exploration.

Conclusion

This study identified significant relationships between hormonal abnormalities and the severity of hirsutism. Elevated total testosterone levels and an abnormal LH/FSH ratio were strongly associated with moderate and severe hirsutism, underscoring their role in the pathogenesis of this condition. In contrast, no significant relationships were observed between the severity of hirsutism and elevated levels of DHEAS, 17-hydroxyprogesterone, or prolactin. Furthermore, 52% of the patients in the study had at least one hormonal abnormality, highlighting the importance of comprehensive hormonal evaluations. These findings emphasize the critical role of hormonal dysregulation in the development and progression of hirsutism, with a focus on testosterone and LH/FSH ratio as key diagnostic markers.

Clinical Recommendations

Based on the findings, the following recommendations are proposed to improve the diagnosis and management of hirsutism:

- **Comprehensive Hormonal Evaluation:** Hormonal assessments, including total testosterone, LH/FSH ratio, DHEAS, and prolactin, should be part of the diagnostic workup for all hirsutism patients, regardless of menstrual cycle regularity.
- **Early Identification of Hormonal Disorders:** Screening for elevated testosterone and abnormal LH/FSH ratios can facilitate early identification of the underlying causes of hirsutism, leading to better-targeted interventions.
- **Individualized Treatment Plans:** Management strategies should be tailored to the severity of hirsutism and the underlying hormonal abnormalities, incorporating both medical therapies (e.g., anti-androgens, oral contraceptives) and cosmetic treatments.
- **Patient Education:** Educating patients about the hormonal basis of hirsutism and the importance of consistent follow-up can improve adherence to treatment and long-term outcomes.

Call for Further Research

There is a need for further research to enhance our understanding of the hormonal and genetic factors contributing to hirsutism, particularly in underrepresented populations. Larger, multi-center studies should be conducted to:

- Explore the genetic predispositions and environmental influences specific to different populations.
- Investigate the efficacy of emerging diagnostic tools and therapies, such as selective androgen receptor inhibitors.
- Examine the psychosocial impacts of hirsutism to develop holistic management approaches addressing both physical and emotional well-being.

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