ORIGINAL RESEARCH

A Study on the Impact of Hormonal Imbalances on Acne Severity in Adult Females

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ABSTRACT

Background: Acne is one of the most common dermatological conditions, affecting individuals of all ages and genders. While it is often associated with adolescence, a significant number of adult females experience acne well beyond their teenage years. **Materials and Methods:** A prospective, observational study was conducted over 12 months at a dermatology outpatient clinic, involving 100 adult female participants aged 18-45 years diagnosed with acne. The Global Acne Grading System (GAGS) was used to assess acne severity at baseline and after six months. Hormonal profiles, including serum testosterone, estradiol, progesterone, luteinizing hormone (LH), and follicle-stimulating hormone (FSH), were measured. Pearson correlation analysis was used to evaluate the relationship between hormone levels and acne severity, and data were analyzed using SPSS version 23.0. **Results:** At baseline, 40% of participants had mild acne, 35% moderate, and 25% severe. Significant reductions were observed in both serum testosterone (50.2 ± 5.3 ng/dL to 47.5 ± 4.8 ng/dL, $p = 0.03$) and estradiol levels (120.4 ± 12.6 pg/mL to 115.6 ± 10.9 pg/mL, $p = 0.045$) after six months. GAGS scores improved significantly in all groups: mild acne decreased by 1.5 ($p = 0.02$), moderate by 2.0 ($p = 0.01$), and severe by 3.5 ($p = 0.005$). Pearson correlation showed a positive association between testosterone levels and acne severity ($r = 0.32$, $p = 0.02$), while estradiol levels had a negative correlation with acne severity ($r = -0.28$, $p = 0.03$). **Conclusion:** The study demonstrated that hormonal imbalances, particularly elevated testosterone and reduced estradiol levels, significantly influence acne severity in adult females. Hormonal therapies targeting these imbalances, combined with lifestyle modifications, may offer effective management of acne.

Keywords: Acne severity, hormonal imbalance, testosterone, estradiol, adult female

INTRODUCTION

Acne is one of the most common dermatological conditions, affecting individuals of all ages and genders. While it is often associated with adolescence, a significant number of adult females experience acne well beyond their teenage years. In fact, adult female acne is a growing concern in dermatology, as many women continue to suffer from persistent breakouts into their 20s, 30s, and even 40s. One of the key factors contributing to this condition is hormonal imbalance, which can play a pivotal role in the onset, severity, and persistence of acne in adult females. Understanding the link between hormonal fluctuations and acne is critical for developing effective treatments and improving the quality of life for those affected.[1]Hormonal imbalances can influence acne in a variety of ways, primarily through the overproduction of sebum, an oily substance secreted by the sebaceous glands in the skin. Androgens, such as testosterone, are known to stimulate sebaceous gland activity, leading to increased sebum production. When excess sebum combines with dead skin cells, it can clog hair follicles, creating an environment where acne-causing bacteria thrive. This results in the formation of various types of acne lesions, including comedones, papules, pustules, nodules, and cysts. The severity of acne can vary widely, depending on the extent of hormonal disruption and other contributing factors.[2]Adult females are particularly susceptible to acne related to hormonal changes. Hormonal fluctuations are a natural part of the female reproductive cycle, occurring during menstruation, pregnancy, and menopause. For many women, acne flare-ups are closely tied to the menstrual cycle, with breakouts often worsening in the days leading up to menstruation. This cyclical pattern of acne suggests a

clear link between hormones and the condition. Additionally, pregnancy can cause significant hormonal shifts, leading to either improvement or exacerbation of acne, depending on the individual. Menopause, with its associated decline in estrogen levels, can also trigger or worsen acne in some women.[3]Aside from natural hormonal fluctuations, certain medical conditions can cause more pronounced hormonal imbalances, further exacerbating acne. Polycystic ovary syndrome (PCOS) is one of the most common endocrine disorders in women and is a well-known contributor to acne. PCOS is characterized by elevated levels of androgens, which can lead to an increase in sebum production and, consequently, acne. Women with PCOS often experience other symptoms of hyperandrogenism, such as hirsutism (excessive hair growth) and irregular menstrual cycles, alongside persistent acne. Managing the hormonal imbalances associated with PCOS is often key to controlling acne in affected individuals.[4]Another hormonal factor that plays a role in acne severity is stress. When the body is under stress, it produces cortisol, a hormone that can disrupt the balance of other hormones, including androgens. Elevated cortisol levels can trigger the sebaceous glands to produce more sebum, leading to the development of acne. For adult females, the pressures of modern life—balancing work, family, and personal responsibilities—can contribute to chronic stress, thereby worsening acne. This connection between stress and hormonal imbalance highlights the importance of addressing psychological well-being as part of a comprehensive acne treatment plan.Hormonal therapies are commonly used to treat acne in adult females, particularly when hormonal imbalances are identified as a contributing factor. Oral contraceptives, for example, are frequently prescribed to regulate hormone levels and reduce acne. These medications work by suppressing the production of androgens and increasing levels of estrogen and progesterone, which can help reduce sebum production and improve acne symptoms. Additionally, anti-androgen medications, such as spironolactone, are used to block the effects of androgens on the skin, further reducing sebum production and acne formation. These treatments can be highly effective, particularly in women whose acne is clearly linked to hormonal imbalances.[5]While hormonal therapies can offer significant benefits, they are not without risks. Oral contraceptives, for example, may cause side effects such as weight gain, mood changes, and an increased risk of blood clots. Anti-androgen medications can also have side effects, including irregular menstrual periods, breast tenderness, and fatigue. As with any treatment, it is important for healthcare providers to carefully consider the risks and benefits of hormonal therapies when managing acne in adult females.[6,7]In addition to hormonal therapies, lifestyle modifications can play an important role in managing acne related to hormonal imbalances. For example, maintaining a balanced diet, engaging in regular physical activity, and managing stress levels can help regulate hormones and improve skin health. Certain dietary factors, such as a diet high in refined carbohydrates and dairy products, have been linked to increased acne severity, possibly due to their effects on insulin and other hormones. By adopting a healthy lifestyle, adult females may be able to mitigate some of the hormonal imbalances that contribute to acne, reducing the need for medical interventions.

AIM AND OBJECTIVES

This study aimed to investigate the impact of hormonal imbalances on acne severity in adult females and evaluate the correlation between specific hormonal levels and acne severity over time.

MATERIALS AND METHODS

This study is a prospective, observational study conducted to evaluate the impact of hormonal imbalances on acne severity in adult females. The study was carried out over a period of 12 months (January 2019 –December 2019) at a dermatology outpatient clinic atDepartment of Dermatology, Venereology and Leprosy, Saraswathi Institute of Medical Sciences**,** Hapur, uttarpradesh, India. A total of 100 adult female participants, aged 18-45 years, diagnosed with acne were included in the study. The study was approved by the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to their inclusion in the study. Participants were recruited based on the following inclusion and exclusion criteria:

Inclusion Criteria

- Females aged 18-45 years.
- Diagnosed with acne of any severity (mild, moderate, or severe).
- Willing to undergo hormonal testing (including serum levels of androgens, estrogen, progesterone, luteinizing hormone, and follicle-stimulating hormone).
- Provided informed consent for participation.

Exclusion Criteria

- Pregnancy or lactation.
- Current use of hormonal contraceptives or any hormonal therapy.
- Known history of polycystic ovary syndrome (PCOS), Cushing's syndrome, or thyroid disorders.
- Use of systemic acne treatment within the past 6 months.

Methodology

Upon recruitment, participants underwent an initial evaluation of acne severity using the Global Acne Grading System (GAGS) to establish baseline levels. A structured questionnaire was administered to gather

comprehensive medical histories, focusing on menstrual cycle regularity and symptoms indicative of hormonal imbalances, such as hirsutism and irregular cycles. Blood samples were collected from each participant to analyze their hormonal profile, including measurements of serum testosterone, estradiol (estrogen), progesterone, luteinizing hormone (LH), and follicle-stimulating hormone (FSH). Each participant also received a detailed dermatological examination, during which photographs of acne-affected areas were taken to document the extent and distribution of acne at the study's outset. The primary outcome of the study was acne severity, assessed both at baseline and after six months. The study aimed to investigate the relationship between hormonal imbalances and acne severity by correlating serum hormone levels with GAGS scores. This approach provided valuable insights into how fluctuations in hormone levels may influence the progression and severity of acne in adult females over time.

Statistical Analysis

Data were analyzed using SPSS version 16.0. Descriptive statistics were used to summarize participant characteristics. Pearson correlation analysis was used to assess the relationship between hormone levels and acne severity. A p-value of <0.05 was considered statistically significant. Continuous variables were expressed as mean ± standard deviation, while categorical variables were expressed as frequencies and percentages.

RESULTS

Table 1: Participant Demographics and Baseline Characteristics

Characteristic	Value (n)	Percentage (%)
Mean Age (± SD)	28.5 ± 6.5	—
Acne Severity at Baseline (Mild)	40	40%
Acne Severity at Baseline (Moderate)	35	35%
Acne Severity at Baseline (Severe)	25	25%
Regular Menstrual Cycle	65	65%
Irregular Menstrual Cycle	35	35%
Participants with Hirsutism Symptoms	28	28%

Table 1 show thatthe outlines the demographic and baseline characteristics of the study participants. A total of 100 female participants, aged between 18 and 45 years, were included in the study, with a mean age of 28.5 ± 6.5 years. The severity of acne at baseline was distributed as follows: 40% of participants had mild acne, 35% had moderate acne, and 25% had severe acne. A majority of the participants, 65%, reported having regular menstrual cycles, while 35% had irregular menstrual cycles. Additionally, 28% of the participants presented with hirsutism, indicating the presence of symptoms related to hormonal imbalances. This baseline information helps provide context for the analysis of acne severity in relation to hormonal factors.

Table 2: Hormonal Profile of Participants (Baseline vs 6 Months)

Hormone	Baseline Levels (Mean ± SD)	6-Month Levels (Mean ± SD)	P-Value
Serum Testosterone (ng/dL)	50.2 ± 5.3	47.5 ± 4.8	0.03
Estradiol (pg/mL)	120.4 ± 12.6	115.6 ± 10.9	0.045
Progesterone (ng/mL)	6.8 ± 1.2	6.4 ± 1.0	0.09
Luteinizing Hormone (LH) (mIU/mL)	7.9 ± 0.8	7.4 ± 0.7	0.06
Follicle-Stimulating Hormone (FSH) (mIU/mL)	8.2 ± 1.1	7.9 ± 1.0	0.08

Table 2 show that the comparison of key hormonal levels between baseline and six months. At baseline, the mean serum testosterone level was 50.2 ± 5.3 ng/dL, which significantly decreased to 47.5 ± 4.8 ng/dL after six months ($p = 0.03$), indicating a statistically significant change. Similarly, estradiol levels also decreased from 120.4 ± 12.6 pg/mL at baseline to 115.6 ± 10.9 pg/mL at the six-month follow-up ($p = 0.045$), showing a statistically significant reduction. Progesterone levels showed a slight decrease from 6.8 ± 1.2 ng/mL to 6.4 ± 1.0 ng/mL, though this change was not statistically significant ($p = 0.09$). Likewise, the changes in luteinizing hormone (LH) and follicle-stimulating hormone (FSH) were not statistically significant, with LH decreasing from 7.9 ± 0.8 to 7.4 ± 0.7 mIU/mL ($p = 0.06$) and FSH decreasing from 8.2 ± 1.1 to 7.9 ± 1.0 mIU/mL ($p = 0.08$). These results suggest that testosterone and estradiol levels significantly changed over time, which may contribute to the observed changes in acne severity

Table 3: Acne Severity (GAGS Scores) at Baseline and 6-Month Follow-Up

Acne Severity (GAGS Score)	Baseline (Mean ± SD)	6-Month Follow-Up (Mean ± SD)	Mean Change in GAGS Score	P-Value
Mild	8.2 ± 1.5	6.7 ± 1.2	-1.5	0.02
Moderate	16.3 ± 2.0	14.3 ± 1.7	-2.0	0.01
Severe	24.6 ± 3.1	21.1 ± 2.6	-3.5	0.005

Table 3 show that the mean acne severity scores (GAGS) at baseline and at the 6-month follow-up, categorized by mild, moderate, and severe acne groups. Participants with mild acne showed a decrease in their GAGS score from 8.2 ± 1.5 at baseline to 6.7 ± 1.2 after six months, with a mean change of -1.5 ($p = 0.02$), indicating a statistically significant improvement. Participants with moderate acne had a mean baseline GAGS score of 16.3 ± 2.0, which decreased to 14.3 ± 1.7 at the 6-month follow-up, resulting in a mean change of -2.0 ($p = 0.01$). Those with severe acne showed the most substantial improvement, with their GAGS score decreasing from 24.6 ± 3.1 at baseline to 21.1 ± 2.6 after six months, with a mean change of -3.5 ($p = 0.005$). These findings indicate that participants across all acne severity groups experienced significant reductions in their acne severity over the course of the study.

Table 4: Correlation between Hormonal Levels and Acne Severity (Pearson Correlation)

Hormone	Correlation with Acne Severity (r)	P-Value
Serum Testosterone	0.32	0.02
Estradiol	-0.28	0.03
Progesterone	-0.12	0.15
Luteinizing Hormone (LH)	0.21	0.05
Follicle-Stimulating Hormone (FSH)	0.18	0.08

Table 4 show that the Pearson correlation coefficients between hormonal levels and acne severity. Serum testosterone was positively correlated with acne severity ($r = 0.32$, $p = 0.02$), indicating that higher testosterone levels were associated with more severe acne. Estradiol, on the other hand, showed a negative correlation with acne severity ($r = -0.28$, $p = 0.03$), meaning lower estradiol levels were linked to more severe acne. Progesterone had a weak, non-significant negative correlation with acne severity ($r = -0.12$, $p = 0.15$). LH and FSH also demonstrated positive but non-significant correlations with acne severity, with r-values of 0.21 ($p = 0.05$) for LH and 0.18 ($p = 0.08$) for FSH. These results suggest that testosterone and estradiol are the most important hormonal factors influencing acne severity, while the roles of progesterone, LH, and FSH are less clear based on these correlations.

Table 5: Adverse Events or Side Effects Reported During Study

Adverse Event/Symptom	Number of Participants (n)	Percentage (%)
Mild Headaches	12	12%
Skin Dryness	9	9%
Menstrual Irregularity	15	15%
Weight Gain	7	7%

Table 5 show thatthe adverse events or side effects experienced by the participants during the study. Mild headaches were reported by 12% of the participants, while 9% experienced skin dryness. Menstrual irregularities were noted in 15% of the participants, and 7% reported weight gain. Although these side effects were relatively mild and occurred in a small proportion of the participants, they are important to consider when evaluating the overall safety of treatments or interventions used during the study.

DISCUSSION

The distribution of acne severity among participants in this study, with 40% having mild acne, 35% moderate acne, and 25% severe acne, is consistent with prior research, which indicates a wide variation in acne severity across populations. In a similar study by Lucky et al. (1997), it was found that acne severity varied significantly among adolescents, with hormonal fluctuations contributing to this variation.[8] Additionally, the prevalence of irregular menstrual cycles (35%) and hirsutism (28%) in the current study mirrors findings from studies like that of Azziz et al. (2004), which reported hirsutism in 5-10% of females, often linked to hormonal imbalances such as elevated testosterone.[9] This suggests that hormonal imbalances related to reproductive function may be closely tied to acne severity, reinforcing the relevance of evaluating menstrual and endocrine factors in acne studies.The significant reduction in serum testosterone (from 50.2 ± 5.3 ng/dL to 47.5 ± 4.8 ng/dL) and estradiol (from 120.4 ± 12.6 pg/mL to 115.6 ± 10.9 pg/mL) observed in this study parallels findings in previous studies. Thiboutot et al. (1998) emphasized the role of

androgens, particularly testosterone, in promoting sebaceous gland activity and increasing acne severity. By reducing serum testosterone, acne severity can diminish, as noted in this study. Similarly, decreased estradiol levels over time were also linked to improvements in acne severity, likely due to the hormone's complex relationship with sebum production.[10] A study by Housman and Reynolds (2006) highlighted the protective role of estrogen in acne by modulating sebaceous gland activity, where lower estrogen levels might reduce sebum production and lessen acne severity.[11] The non-significant changes in LH and FSH are consistent with studies by Lolis et al. (2009), which suggest that these hormones play a less direct role in acne compared to androgens and estrogens.[12]The reduction in Global Acne Grading System (GAGS) scores across all acne severity groups (mild, moderate, and severe) highlights the effectiveness of addressing hormonal imbalances in acne treatment. For participants with severe acne, the GAGS score decreased by a mean of 3.5, which is a significant reduction compared to milder cases. This aligns with the study by Lucky et al. (1997), which showed that targeted hormonal treatments, particularly in patients with high androgen levels, significantly improved acne outcomes.[8] Moreover, Strauss et al. (1989) emphasized the relationship between hormone therapy and acne improvement, particularly when therapy reduced circulating androgen levels. The significant improvements in GAGS scores in this study further support the idea that managing hormone levels can have substantial impacts on acne severity, particularly in severe cases.[13]

The positive correlation between serum testosterone and acne severity ($r = 0.32$, $p = 0.02$) in this study confirms the findings of previous studies that implicate androgens, such as testosterone, in acne pathogenesis. In a study by Thiboutot et al. (1995), a similar positive correlation between testosterone and acne severity was observed, with higher testosterone levels being linked to more severe acne.[14] The negative correlation between estradiol and acne severity ($r = -0.28$, $p = 0.03$) supports the theory that estradiol may counteract the effects of androgens on sebaceous glands, as also suggested by studies like Lolis et al. (2009).[12]Interestingly, the weak correlations between progesterone, LH, and FSH with acne severity reflect similar findings in previous literature, where these hormones were not found to be significant contributors to acne pathogenesis compared to androgens and estrogens.The reported side effects, including mild headaches (12%), skin dryness (9%), menstrual irregularities (15%), and weight gain (7%), are in line with the known side effects of hormonal treatments and lifestyle changes. Previous studies, such as those by Zaenglein et al. (2016), documented similar adverse effects in patients undergoing hormonal therapy for acne treatment.[15] In particular, menstrual irregularities are a common side effect of therapies targeting androgen levels, as also reported by Koulouri and Conway (2009). However, the mild nature of these side effects and their low incidence (mostly under 15%) suggests that hormonal treatment for acne remains a viable and generally well-tolerated option for reducing acne severity.[16]

CONCLUSION

In conclusion, this study demonstrates a clear link between hormonal imbalances and acne severity in adult females, with elevated testosterone and reduced estradiol levels being significant contributors. The reduction in acne severity observed with the stabilization of these hormones highlights the importance of targeting hormonal pathways in treatment. Hormonal therapies, while effective, should be balanced with consideration of potential side effects. Additionally, lifestyle modifications can help regulate hormonal imbalances and improve outcomes. Addressing both medical and lifestyle factors offers a comprehensive approach to managing acne in adult women.

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