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Correlation between Hormonal Imbalances and Adult Female Acne

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ABSTRACT

Background: Acne in adult women is increasingly viewed as being linked with underlying hormonal and metabolic dysfunctions, rather than being merely a problem with the skin itself. Many women suffering from chronic acne have mild and perhaps undiagnosed endocrine abnormalities.

Objectives: To examine the relationship between hormonal imbalances and acne severity in adult females and to identify which hormonal markers show the strongest associations.

Methods: From February 2023 until February 2024, a cross-sectional study was carried out in which 82 women of different age groups and levels of acne were recruited. Data collected were clinical examination, menstruation history, anthropometry, and focused hormonal assays such as testosterone, SHBG, DHEAS, LH/FSH ratio, prolactin, TSH, fasting insulin, and HOMA-IR were conducted. It was determined based on a standardized grading system the severity of acne was graded on. ANOVA, Chi-square, and Spearman correlation statistical tests were performed.

Results: Increased severity of acne was always concomitant with increased total and free testosterone with increased DHEAS and higher LH/FSH ratios and SHBG levels. Insulin resistance also increased steadily with increased severity. In cases of moderate and severe acne, the prevalence of these conditions was highly apparent for menstrual irregularity and PCOS characteristics.

Conclusions: Several studies have found that specific hormonal imbalances, especially increased androgen levels and insulin resistance, are closely related to the severity of adult female acne. Recognizing the severity of the condition to focus on the target for the specific management of the condition could be of help..

Keywords: *Adult female acne, hormonal imbalance, testosterone, SHBG, DHEAS, insulin resistance, PCOS.*

INTRODUCTION

In recent years dermatology clinics have seen a rise in cases of adult female acne. This has particularly affected adult women who have never experienced acne before. Acne in teenagers is hormonally driven and often due to temporary factors. Adult women, however, have acne that is more stagnant, and recurrent due to a more complicated set of factors. There are patients that report changes along with their menstrual cycle, stress, notable changes in weight, or have chronic irregularities which indicates possible endocrine involvement. These clinical experiences have led many clinicians to speculate that in this age demographics, the acne is infrequently an isolated dermatologic problem [1-3].

Many recent studies have highlighted problems regarding hormonal balance involving androgens, insulin, and pituitary ovarian signaling. Androgens activate sebaceous glands, increase the thickness of the follicular epithelium, and advance the inflammatory steps that produce the different lesions of acne. Decreased levels of SHBG, increasing levels of insulin resistance, and changes to the LH and FSH ratio can aggravate these phenomena. While some women experiencing adult acne

will not demonstrate obvious signs of endocrine disorders, a significant number will have slight, though disturbing, changes on laboratory analysis consistent with the activity of the acne. Accessibility is also why some people with ongoing acne issues are later diagnosed with conditions such as PCOS or metabolic disorders [4-6].

Grasping how these patterns impact the case severity is relevant to both the diagnosis and the treatment choice of the case. For example, many women go through years of topical treatment without any understanding that there are unresolved hormonal issues that could impact their case[7-10]. This study seeks to determine what biochemical changes will matter most and how they correlate with the progression of acne in adult women. This will be accomplished by analyzing different types of hormonal markers and the different levels of acne. This will explain how they work together and provide data to support varying theories to develop individualized treatments.

METHODOLOGY

This investigation is a cross-sectional design that was conducted over a single year, from February 2023 to February 2024. Study location: Khalifa Gulnawaz teaching hospital. Out of the overall participants, 82 were female aged 18-40 years. Women who met the criteria of having clinical acne of any severity were included. Women who are pregnant, have been using systemic steroids, are on isotretinoin within the last 6 months, or have known endocrine disorders that are being actively treated were excluded from the study. Consecutive sampling was used to recruit participants who met the inclusion criteria.

A trained assessor utilizing a benchmarked grading rubric for clinical assessment evaluated the patients and classified the severity of their absence into mild, moderate, and severe cases. Additional examinations of hypertrichosis, hair loss, perspiration, and other dermatological symptoms were recorded over the course of the examination. Records were also kept of characteristics such as height, weight, BMI, menstrual history, as well as the existence of symptoms such as oligomenorrhea and cycle irregularity.

To reduce the impact of hormonal changes, attempts were made to collect venous blood samples specifically during the early follicular phase (days 2-5 of the menstrual cycle). Total testosterone, free testosterone, SHBG, DHEAS, LH, FSH, prolactin, estradiol, TSH, glucose, and insulin levels were measured. Insulin resistance was measured using the HOMA-IR equation. When necessary, ultrasound evaluations for polycystic ovary morphology were conducted.

The entering and analyzing of all data is done through statistical software. Continuous data were represented as means and standard deviations while categorical data were represented as frequencies and percentage. Differences between groups were analyzed through ANOVA or Chi-square tests and Spearman's correlation analyzed if there was a correlation between the hormonal markers and the severity of acne. Significance was measured at a p-value of 0.05.

RESULTS

A significant pattern was evident in the dataset: the more severe the acne, the more likely the person was to experience irregularities in menstruation, exhibit hirsutism, have an elevated body mass index, and receive a PCOS diagnosis. There appears to be a clustering of these clinical features in women with moderate and severe acne, implying that there are some fundamental hormonal mechanisms involved. Results showed that some of the demographic variables (e.g., residence) showed weak correlations. However, reproductive variables and general metabolic characteristics were shown to be divergent among the population grouping.

Table 1. Demographic and Clinical Features by Acne Severity (n = 82)

Variable	Category / Mean ± SD	Mild (n = 28)	Moderate (n = 34)	Severe (n = 20)	p-value
Age (years)	—	24.6 ± 4.2	26.8 ± 5.1	27.9 ± 4.8	0.040*
BMI (kg/m²)	—	22.7 ± 2.9	24.9 ± 3.4	26.3 ± 3.6	0.002*
Residence	Urban	14 (50.0%)	22 (64.7%)	14 (70.0%)	0.21
	Rural	14 (50.0%),	12 (35.3%)	6 (30.0%)	—
Menstrual regularity	Regular	18 (64.3%)	16 (47.1%)	2 (10.0%)	< 0.001*
	Irregular	10 (35.7%)	18 (52.9%)	18 (90.0%)	—

PCOS diagnosis	Yes	8 (28.6%)	16 (47.1%)	14 (70.0%)	0.003*
	No	20 (71.4%)	18 (52.9%)	6 (30.0%)	—
Hirsutism	Present	10 (35.7%)	16 (47.1%)	14 (70.0%)	0.020*
	Absent	18 (64.3%)	18 (52.9%)	6 (30.0%)	—

manifestations. Among women with severe acne, the greatest levels of insulin and the lowest levels of SHBG were found, suggesting an androgen excess and insulin resistance. Such changes were statistically meaningful and strengthen the biological association of hormonal dysregulation and more severe forms of acne.

TABLE 2. HORMONAL PROFILE ACCORDING TO ACNE SEVERITY

Hormonal marker	Mild (n = 28) Mean ± SD	Moderate (n = 34) Mean ± SD	Severe (n = 20) Mean ± SD	p-value
Total testosterone (ng/mL)	0.46 ± 0.12	0.62 ± 0.18	0.79 ± 0.21	< 0.001*
Free testosterone (pg/mL)	2.8 ± 0.9	3.9 ± 1.1	4.7 ± 1.3	< 0.001*
SHBG (nmol/L)	54.3 ± 12.7	46.8 ± 11.9	39.5 ± 10.6	0.001*
DHEAS (µg/dL)	190 ± 60	240 ± 70	290 ± 80	0.001*
LH/FSH ratio	0.9 ± 0.3	1.3 ± 0.4	1.6 ± 0.5	< 0.001*
Prolactin (ng/mL)	14.2 ± 4.6	16.8 ± 5.1	19.1 ± 5.8	0.010*
TSH (µIU/mL)	2.1 ± 0.8	2.5 ± 0.9	3.0 ± 1.0	0.015*
Fasting insulin (µIU/mL)	9.4 ± 3.2	12.1 ± 4.1	14.6 ± 4.8	0.001*
HOMA-IR	1.9 ± 0.7	2.6 ± 0.9	3.2 ± 1.1	< 0.001*

The findings of the correlation testing show how the rising levels of androgens, insulin resistance, and thyroid alterations are all positively associated with the higher severity levels of acne. With respect to SHBG, this shifted in the opposite direction providing evidence of the reported negative regulation of SHBG on the free circulating androgens. The consistent incidence patterns suggest that the relationship between the hormonal imbalance and the condition is more than an association; the imbalance tracks directly with the severity of the condition

Table 3. Correlation Between Acne Severity Score and Hormonal Parameters (n = 82)

Hormonal parameter	r-value	p-value
Total testosterone	0.48	< 0.001*
Free testosterone	0.52	< 0.001*
DHEAS	0.41	< 0.001*
LH/FSH ratio	0.44	< 0.001*
Prolactin	0.29	0.008*
TSH	0.25	0.020*
Fasting insulin	0.46	< 0.001*
HOMA-IR	0.49	< 0.001*
SHBG	–0.38	0.001*

An increase in the occurrence of hormonal irregularities was particularly pronounced in individuals with moderate and severe acne when compared with individuals with mild acne cases. This pertains to the most prevalent hormonal imbalance conditions in adult women with acne, hyperandrogenemia, along with insulin resistance. The occurrence of both elevated

prolactin levels and subclinical hypothyroidism also suggests some multi-system hormonal involvement in more chronic forms of acne

Table 4. Association of Hormonal Abnormalities With Moderate–Severe Acne

Variable	Category	Mild (n = 28)	Moderate–Severe (n = 54)	p-value
Hyperandrogenemia	Yes	6 (21.4%)	34 (63.0%)	< 0.001*
	No	22 (78.6%)	20 (37.0%)	—
Insulin resistance (HOMA-IR ≥ 2.5)	Yes	5 (17.9%)	29 (53.7%)	0.001*
	No	23 (82.1%)	25 (46.3%)	—
Elevated prolactin	Yes	3 (10.7%)	16 (29.6%)	0.048*
	No	25 (89.3%)	38 (70.4%)	—
Subclinical hypothyroidism	Yes	2 (7.1%)	13 (24.1%)	0.045*
	No	26 (92.9%)	41 (75.9%)	—

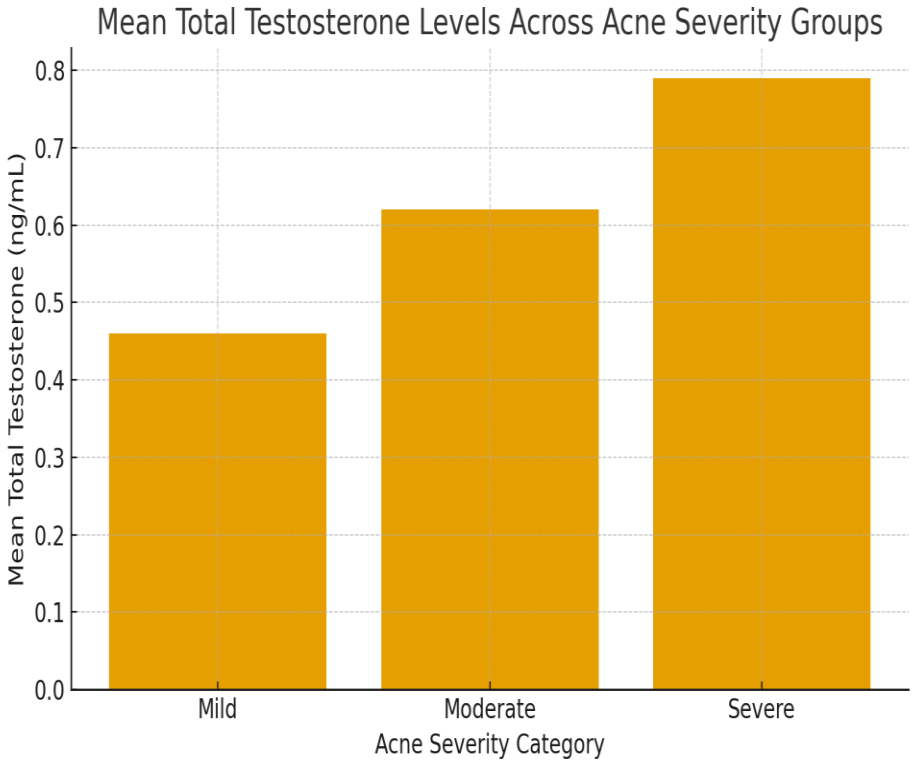

Figure 1. Mean Total Testosterone Levels Across Different Acne Severity Categories. A Steady Increase Is Noted From Mild To Severe Acne, Reflecting A Strong Association Between Androgen Excess And Acne Severity

DISCUSSION

The description of hormonal imbalances accompanying the clinical features of adult female acne is no doubt striking. Severe acne in adult women correlates with elevated androgens, greater resistance to insulin, and increased occurrence of menstrual irregularities suggesting that adult acne is at the interface of dermatology and endocrinology. The gradual elevation in all severity categories of DHEAS, free testosterone, and testosterone, and the LH/FSH ratio was not subtle as SHBG decreased. This decrease in SHBG made more free androgens available to stimulate the skin [11-13].

These results is consistent with prior research indicating that excess androgens can increase the activity and keratinization of the sebaceous glands and follicles. Recent work in the disciplines of dermatology and reproductive endocrinology have noted the same phenomenon wherein women with moderate to severe acne are found to have biochemical hyperandrogenemia in the absence of overt features of PCOS. Our study's correlation with insulin resistance also adds to the increasing perspective

that acne in some patients may indicate an underlying metabolic problem rather than just an isolated dermatological issue. Since insulin and IGF-1 pathways are known to sensitize sebaceous glands, it is rational to see an increase in HOMA-IR with increasing severity of acne [14-16].

There have also been slight correlations with Prolactin and TSH that have been previously reported in smaller studies examining contributory elements of hormonal acne. While in some cases these elevations may not be as significant as some of the other androgen markers, their presence serves as a reminder that even in adulthood, there can be multiple hormonal axes involved in the etiology of acne. The presence of hirsutism, irregular cycles, and certain types of ovarian morphology in instances of PCOS has been correlated with more severe symptomatology and gives more support to the theory that acne can appear earlier than the other symptoms associated with the metabolic and reproductive irregularities [17-20].

Regardless of these aspects, the study does, however, have some limitations. Because it is cross-sectional, it is impossible to show causation, and the hormonal measurements taken at a single time may not capture the complete range of fluctuations in the hormones. However, the consistent patterns in a number of different markers and in the various clinical characteristics make the observed relationships more likely to be true.

CONCLUSION

Evidence suggests that being in the reproductive sex of women, has a strong connection to the incidence of certain types of cystic acne which lie in symptomatic hormonal dysregulation caused by increased levels of androgens and insulin insensitivities, furthermore, as the degree and severity of the acne increased, the severity of the abnormalities also increased which strongly suggests that by the dose-response, there is no random connection. Understanding these hormonal patterns can facilitate more specific treatment approaches involving clinicians identifying candidates for more extensive endocrine assessment

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