

## Evaluation of Serum Androgen Levels and BMI in Young Female Patients with Acne Vulgaris

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### Abstract

**Background:** Acne is an inflammatory disease with a complex pathogenesis that is influenced by genetic and hormonal factors. Androgen hormones affect sebocytes proliferation, differentiation and lipid synthesis. Increased sebum excretion is considered a major factor in the pathogenesis of acne vulgaris and elevated serum androgen levels have been linked with acne resistant to conventional therapy. Another reported risk factor for developing acne is overweight or obesity.

**Methods:** This is a case-control study in which twenty- five acne female patients aged 18-24 years and another age and sex -matched healthy individuals were included. Serum Testosterone, DHEAS and BMI were measured for all participants. Statistical analysis for the collected data was performed using appropriate statistical tests.

**Results:** There was significant elevation of serum DHEAS level ( $347.4 \pm 167.8 \mu\text{g/dl}$ ) in acne patients comparing to the control, *p value* 0.016, with a non-significant elevation of serum testosterone ( $0.56 \pm 0.49 \text{ ng/ml}$ ), *p value* 0.055. Both parameters showed no significant differences among acne patients in concern with the disease severity, *P value* 0.63 and 0.2 for testosterone and DHEAS respectively. Also, no significant differences were observed in BMI (*p value* 0.94) or menstrual cycle irregularity (*p value* 0.18) between Acne patients and the control in this age group.

**Conclusion:** Acne vulgaris is a common disorder of pilosebaceous unit that mainly affects young age individuals. Hyperandrogenism, mainly DHEAS, is a potential risk for developing acne in female less than 25 years, however no significant correlation was found between body mass index (BMI), Testosterone or DHEAS and acne severity.

**Keywords:** Acne, Testosterone, DHEAS.

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### Introduction

Acne is an inflammatory disease with a complex pathogenesis that is influenced by genetic and hormonal factors.<sup>1</sup> Several factors are involved in Acne pathogenesis including altered and excessive sebum production, cutaneous dysbiosis associated with the proliferation of *Propionibacterium acnes* in the pilosebaceous unit, abnormal prolifer-

ation and differentiation of keratinocytes of the pilosebaceous unit, and activation of the innate immune response.<sup>2</sup>

Increased sebum excretion is considered a major factor in the pathogenesis of acne vulgaris. Androgen hormones affect proliferation and differentiation of sebocytes in addition to lipid synthesis process. The activity of sebaceous glands is enha-

nced by interaction of androgen hormones with their androgen receptors which have been shown to be present in the basal and differentiating sebocytes in a high density<sup>3</sup>. Uses of anti-androgen like Spironolactone demonstrated efficacy in treating acne in adolescent females<sup>4</sup> and recently Clascoterone which is a novel topical antiandrogen medication approved for the treatment of acne.<sup>5</sup> Furthermore, individuals with androgen insensitivity do not develop acne.<sup>6</sup> As free testosterone enters the cell, It is quickly reduced to 5-dihydrotestosterone (5-DHT) by the 5 $\alpha$ -reductase enzyme<sup>7</sup>; After interaction with its receptors, DHT is translocated to the nucleus and enhance the transcription of androgen responsive genes. It's worth noting that DHT is 10 folds more potent than testosterone. In addition to systemic androgen production, pilosebaceous units have all the steroid metabolizing enzymes required to convert DHEAS to the more potent androgen, DHT including 3 $\beta$ -hydroxysteroid dehydrogenase and 5 $\alpha$ -reductase <sup>8</sup>

Another reported risk factor for developing acne is overweight or obesity; positive association was found between body mass index (BMI) and acne considering a BMI >25 kg/m<sup>2</sup> as an important risk factor for acne vulgaris.<sup>9</sup> Higher BMI may be associated with higher glycemic load<sup>10</sup> and hyperandrogenism.<sup>1</sup> In this study we evaluated serum testosterone and DHEAS levels in females with acne vulgaris aged 18-24 years and its relation with acne severity, Also we compared the prevalence of menstrual irregularity and BMI index in acne patients with their age and sex - matched healthy individuals.

**Methods**

This is a case-control study carried out from January - April 2024. Twenty-five acne female patients aged 18-24 years with different grades of severity and another twenty -five age- and sex-matched individuals were included in this study. After informed consent and ethical approval, patients were categorized into three categories: mild, moderate and severe acne according to the IAA grading of acne severity. Also, Body mass index (kg/m<sup>2</sup>) was measured for both groups and classified according to the WHO weight classification into four categories: underweight, normal, overweight and obese. Associated menstrual cycle disturbance were recorded and serum testosterone and Dehydroepiandrosterone Sulphate (DHEAS) were measured using Tosoh AIA Automated Immunoassay System according to the manufactures' protocol for all participants. Severity was tested in relation with serum Testosterone, DHEAS levels and BMI score. Quantitative variables were expressed as mean and standard deviation while Categorical data were presented as percentages. Statistical significance was performed using T-test and ANOVA test for quantitative variables, and chi-square test was used for categorical data. P value of < 0.05 was considered statistically significant.

**Results**

In this study, 25 Acne female patients with different grades of severity aged 18-24 year with a mean age of (21.08 $\pm$  1.6 y) and another 25 sex and age - matched healthy control were included, *p value* > 0.05. Acne duration varies from 3 month to 10 years with an average of (3 .75  $\pm$  2.27 y). Stu-

dy results showed that 4 (16%), 17 (68%) and 4(16%) of patients had mild, moderate and severe acne respectively. The mean BMI in the acne patients was 24.2  $\pm$  3.56 while in the control group was 24.3 $\pm$ 6.4 with no significant differences, *p value* 0.94; table 1, and figure 1.

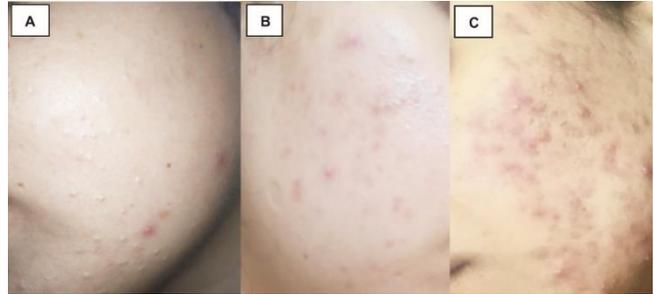
No significant differences were found in BMI score among mild, moderate and severe acne patients, *p value* 0.85, how-

**Table1: Demographic characteristics of all Participants.**

	Acne patients	Healthy control	<i>p value</i>
Age (years)	21.08 $\pm$ 1.6	21.68 $\pm$ 1.82	0.11
Duration (years)	3 .75 $\pm$ 2.27		
BMI	24.2 $\pm$ 3.56	24.3 $\pm$ 6.4	0.47
Mild Acne (%)	4(16%)		
Moderate Acne (%)	17(58%)		
Severe acne (%)	4(16%)		

ever, 13 out of 25(52%) of acne patients were normal weight and 11 (44%) were overweight in comparison with healthy control group which showed that the majority of them 16 (64%) were normal weight and only 7 (28%) were overweight and one obese individual (4%); table 2, 3 and figure 2.

To identify the effect of Testosterone level on acne, serum Testosterone was measured for both groups. Study results showed an increase in testosterone level in acne group with a mean level



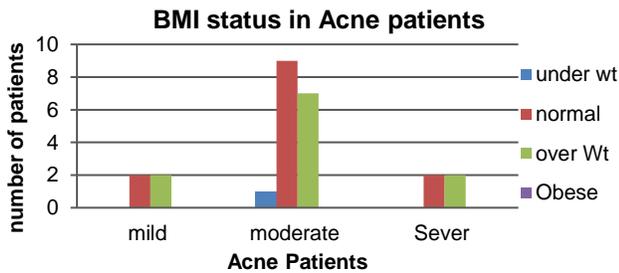
**Figure 1:** Acne severity. (A): Mild. (B): Moderate. (C): Severe acne Vulgaris.

**Table 2: BMI distribution in acne and control group.**

	Acne patients (%)		Healthy control (%)	
<b>Under weight</b>	1	4%	1	4%
<b>Normal</b>	13	52%	16	64%
<b>Over weight</b>	11	44%	7	28%
<b>Obese</b>	0	0%	1	4%

**Table 3: BMI distribution in acne patients according to the severity.**

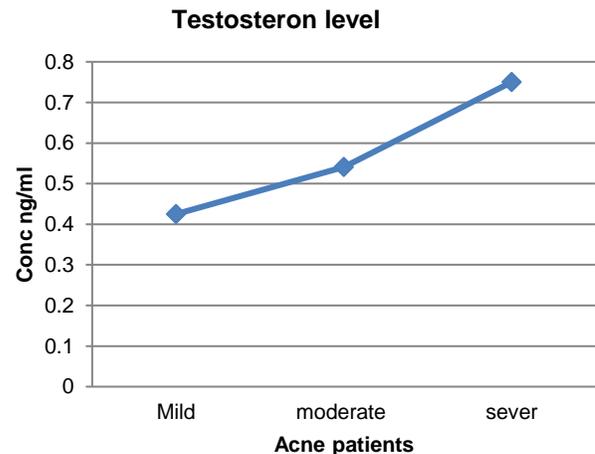
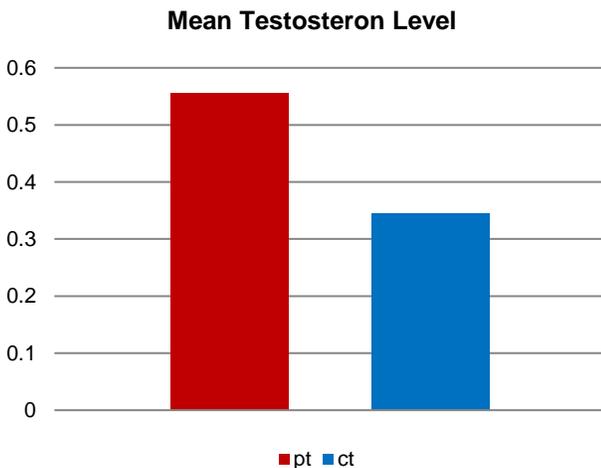
Acne	N(%)	BMI (mean±SD)	Anova , p value
<b>mild</b>	4(16%)	23.25±3.03	0.85
<b>Moderate</b>	17(58%)	24.44± 3.86	
<b>Sever</b>	4(16%)	24.23± 3.32	



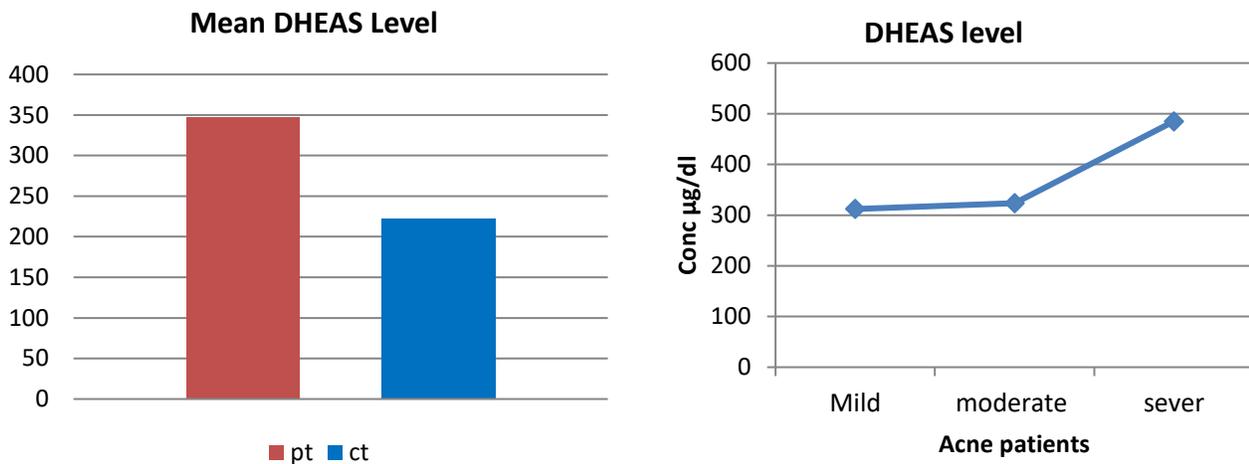
**Figure 2:** Distribution of BMI status with acne severity.

of  $0.56 \pm 0.49$  ng/ml, in comparison with  $0.34 \pm 0.22$  ng/ml in the control group with no significant differences; *p* value 0.055, figure (3A).

In addition, 6(24%) of acne patients had high testosterone level and 19 (76%) had normal level, whereas only 2(8%) of the control group had high testosterone level. The mean Testosterone level in mild acne patients was 0.43 ng/ml, while it was more elevated in moderate and severe acne



**Figure 3: (A):** Mean Testosterone level in the patients and the control group. **(B):** Testosterone level in association with acne severity.

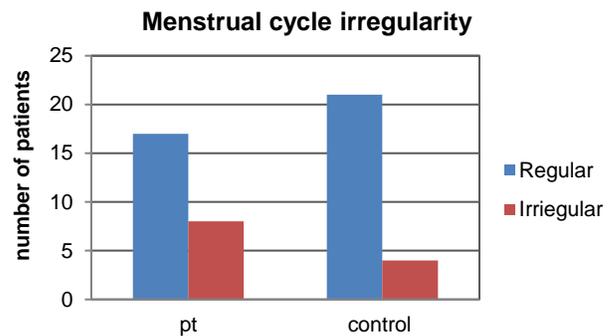


**Figure 4(A):** Mean DHEAS level in the patients and the control. **(B):** DHEAS level in association with acne severity.

patients at 0.58 and 0.75 ng/ml respectively, with no significant differences among patients' groups in concern with the severity; *P value* 0.63, figure (3B).

DHEAS, as precursor for more potent androgenic hormone was assessed in both groups. Our study results revealed a significant increase of DHEAS level in patients' group with a mean value of 347.4 ± 167.8 µg/dl in comparison with 222.2 ± 187.8 µg/dl in the control group; *p value* 0.016, figure (4A). In addition, high DHEAS level was found in 13(53%) of acne patients comparing to 6(24%) individuals in the control group. The mean DH-EAS level in mild acne patients was 312 µg/dl while it was more elevated in moderate and severe acne patients at 323.3 and 485 µg/dl respectively, with no significant differences among patients groups; *P value* 0.2, figure (4B).

In order to identify whether acne is associated with menstrual cycle irregularity, menstrual cycle irregularity was included in the questionnaire for both groups. The results revealed that 8 (32%) of acne patient had irregular cycle in comparison with only 4 (16%) of the control group. No significant differences were found, *p-value* 0.18, figure 5. Also, three out of the six patients (50%) who had elevated testosterone and only 4 out of the 13 patients (30.8%) who had elevated DHEAS reported menstrual irregularity including one patient had elevation in both parameters.



**Figure (5):** Menstrual cycle irregularity in the patients and the control group.

### Discussion

Acne vulgaris is a common skin disorder affecting the pilosebaceous units and ranking eighth among skin diseases.<sup>12</sup> It mostly affects adolescent, however it can occur between 11 and 30 years of age. It is estimated to affect 9.4% of the global population.<sup>8</sup>

In this study, the mean age of acne females was 21.08 years with a mean duration of 3.7 years. Moderate acne was the most common grade of acne found in 68% of participants. This result agrees with the findings of other previous studies.<sup>13, 14</sup>

Although the mean value of BMI was not increased in acne group comparing to the control and no significant differences was found between both groups, higher prevalence of overweight

individuals was found in acne group than that in the control group. These results demonstrate that female individuals with high weight is more liable to have acne than normal weight individuals; nevertheless, the severity of acne did not associate with increase BMI as nearly equal number of mild and severe acne patients had normal and overweight status and around half of moderate acne had normal weight (52%) with no significant differences among acne groups. Similar finding were reported by other studies<sup>15,16</sup>

In this study, at least one androgenic parameter was elevated in 68% of the acne group comparing to 8% of female individuals in the control group. The majority of patients had only DHEAS elevation. The status of basal serum androgens in patients of acne vulgaris is controversial. Some studies have reported increased both serum DHEAS and testosterone,<sup>17</sup> only DHEAS<sup>18</sup> or neither a significant elevation nor association with severity of acne.<sup>19</sup>

In this study, the mean Testosterone level in both groups was within normal, and the elevation in the acne group was not significant comparing to the control. Although serum testosterone was more elevated in moderate and severe acne than mild cases, however there were no significant differences with acne severity. It's worth noting that in this study only six patients had high testosterone level. In the other hand, DHEAS which is a precursor for more potent androgen hormone (DHT) was elevated in a half of acne patients and showed a significant elevation comparing to the control, with a one and half time higher value than the control. Whereas DHEAS level in mild acne group was still within normal range, both moderate and severe group showed higher values. However, there was no significant elevation among acne groups in concern with the disease severity. Similar findings observed by other study where no positive relationship was found between grades of acne severity and hyperandrogenism.<sup>20</sup>

Furthermore, most of acne patients in this study had increase in DHEAS level alone with no increase in testosterone. Similar findings were observed by Seirafi et al, in their study they found

elevated DHEAS in acne female patient without hirsutism while both DHEAS and testosterone were elevated in acne patients with hirsutism.<sup>21</sup>

This result primarily confirms the effect of hyperandrogenism in females as a stimulant factor for sebaceous gland activity; however, it didn't explain the variation of acne severity in this age range. Acne severity variation however could be related to the differences in skin sensitivity to androgens. DHEAS as an adrenal secreted hormone may be in part a significant contributor of developing acne in this age group when no other signs of hyperandrogenism are observed including hirsutism or menstrual cycle irregularity.

Associated Menstrual cycle disturbances were found in other studies,<sup>22</sup> in our study, although higher prevalence of patients reported a menstrual irregularity, no significant difference was found between both groups in this age range of patients. Similar findings were found in a previous study conducted on young college female students with similar age range.<sup>23</sup> Menstrual disturbance could be part of a generalized condition of polycystic ovary syndrome (PCO) along with hirsutism and seborrhea, a condition that needs more hormonal assessment like LH and FSH ratio and ultrasound investigations, in addition to androgen hormone, that were not included in our study.

Hyperandrogenism should be considered as a risk factor for the development of acne in females whose acne, of sudden onset, severe and associated with irregular menstrual cycle or hirsutism.<sup>21</sup> Hence, performing both test in addition to thorough medical history and pelvic ultrasound to exclude polycystic ovary syndrome (PCO) is recommended. If increase androgen levels are detected, patients may benefit from various methods of hormonal therapy, including antiandrogens or inhibitors of androgen production by the adrenal gland or ovaries.<sup>24</sup>

### Conclusion

Acne vulgaris is a common disorder of pilosebaceous unit that mainly affects young age individuals. Hyperandrogenism, mainly DHEAS, is a potential risk for developing acne in female less

than 25 years, however no significant correlation was found between body mass index (BMI), Testosterone or DHEAS and acne severity, further studies with larger sample size is recommended.

**Ethical Approval:** The Ethical Committee, University of Basrah, College of Sciences approved this study vide No. 1305T/T.

**Conflict of Interest:** There was no conflict of interest to be declared by any author.

**Funding Source:** None.

#### Author's Contribution

**ANAH:** Conception & design, acquisition of data, drafting of article, final approval of the version to be published.

**MJA:** Analysis & interpretation, analysis & interpretation, critical revision of the article.

**GLJ:** Analysis & interpretation, analysis & interpretation, drafting of article.

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