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BMI and Fasting blood glucose in Acne vulgaris

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Abstract

Acne vulgaris, the most prevalent inflammatory condition of the pilosebaceous unit, is characterised by comedones, papules, pustules, nodules, and pseudocysts, as well as a variety of other lesions. Most often affecting the face (93.30 percent) but also the chest (50 percent) and the back (both 50 percent), acne may occur as non-inflammatory or inflammatory lesions, or as a combination of the two (41.7 percent). Scars were seen in 65 percent of the patients, and PIH was found in 75 percent. Since 35% of patients tested responded positively to stress as a risk factor for acne vulgaris, it's possible that stress plays a role in the development of acne vulgaris. Analyzing the BMI and fasting blood glucose levels of acne vulgaris patients was the goal of this study, which correlated them with disease severity. Patients were separated into three groups (mild, moderate, and severe acne vulgaris) with a total of 60 patients in each of the three categories. A second group of 60 people, all of whom seemed to be in good health, served as a control. Patients from Benha University Hospitals' outpatient clinic for dermatology, andrology and venereal disease were included from July 2021 to February 2022 for the study. Results: Patients' IR, HOMA1-IR, fasting glucose, fasting insulin, and IR were all considerably higher in the patients than they were in the control participants. The patient group had considerably lower HOMA1-percent S and QUICKI scores than the control group. Severe acne vulgaris had substantially higher serum mean FG, FI, HOMA2-IR, and HOMA1-IR values than mild or moderate groups, but serum mean adipsin and QUICKI values were lower in the severe and moderate groups. FG, FI, IR, and HOMA1-IR were considerably greater in severe acne vulgaris compared to mild and moderate severity groups, but adipsin and QUICKI were significantly lower than their counterparts in the mild and moderate groups in the saliva. BMI, FG, FI, HOMA2-IR, and HOMA1-IR all had negative relationships with serum adipsin. GAGS, HOMA1-percent S, DI, and QUICKI were all shown to have a positive correlation with it. There was a negative correlation between BMI, GAGS, Ir and HOMA1-Ir, and a positive correlation between FG and FI with adiponectin in the salivary glands. The AUCs for serum adipsin, salivary adipsin, and QUICKI were 0.992, 0.877, and 0.711, respectively, while the cut-off values were 3178, 344.5, and 0.325 when distinguishing between steady and exacerbation patients. FBG was shown to have a positive correlation with BMI in terms of serum parameters. There was no connection between BMI and FG in terms of salivary markers. Adipsin levels in the blood and salivary glands may both be utilised to distinguish acne vulgaris patients from healthy controls when predicting the development of acne vulgaris in such people.

Key words: Adipsin, Insulin Resistance, Acne Vulgaris.

1. Introduction

Adolescence is the most prevalent time period for acne vulgaris, however the severity of the condition varies across people. It is a chronic inflammatory skin condition with several etiological causes. Inflammation, aberrant keratinization, alterations in the microbial ecology, and an increase in sebum production are the major causes. Inflammation has been proposed as the first component, although the exact sequence of events is yet unknown. There is still much to learn about how the inflammatory response gets started and continues, but one thing we do know is that Propionibacterium acnes plays a key part in these processes [1].

Acne vulgaris prevalence among young people aged 12-25 years in France, the United Kingdom, and the United States is determined to be over 85%, according to the Global Burden of Disease (GBD). The disease's prevalence is almost same in different nations [2].

Adolescence's Cutibacterium acne (P.acnes) triggers Acne vulgaris by affecting the skin's pilosebaceous unit (PSU) and normal circulating dehydroepiandrosterone (DHEA) (DHEA). Inflammatory and non-inflammatory lesions may appear on the face, upper arms, torso, and back, making it a fairly prevalent skin condition [3]. Sebaceous gland activity, hyperseborrhoea, alterations in fatty acid composition, hormone microenvironment dysregulation, interaction with neuropeptides, follicular hyperkeratinization, induction of inflammation, and dysfunction of the innate and adaptive immune systems were all involved in the disease's pathophysiology, according to the study. Acne vulgaris severity is determined by a variety of factors, including the number of lesions present and the kind of photography used [4].

Acne may appear everywhere on the body, but the most common places are the face, chest, and upper back [5]. Despite the lack of consensus on a specific grading system for acne severity, a basic classification that divides severity into three categories, mild, moderate, and severe, still exists today. Acne severity grading standards should take into account skin conditions that are taken into account in the differential diagnosis of acne [6].

Having acne while you're a teen may have a lot of consequences. It's a source of physical and mental pain, as well as a source of embarrassment and lasting scars. It may also lead people to feel anxious and embarrassed, which may have a negative impact on their physical and social health. Acne may be triggered or worsened by a variety of circumstances. Many variables contribute to the development of a plethora of skin conditions, such

as heredity, the male sex, youth, stress, and smoking. Genetics and androgens seem to have a role in the production of abnormally high amounts of sebum that contribute to the development of acne lesions [7].

White bread, rice, and chocolate all have a high glycemic index (>70), which causes beta cells in the pancreas to produce insulin [8]. Akt signalling is activated both directly and indirectly by insulin, the hormone's receptor and IGF-1, the hormone it produces and the receptors it activates. Two ways IGF-1 affects the cells of the PSU: either by boosting enzymes involved in the stepwise DHT production process or by directly activating its receptor (IGF-IR) (9, 10, 11, 12).

Analyzing the BMI and fasting blood glucose levels of acne vulgaris patients was the goal of this study, which correlated them with disease severity.

2.Patients and Methods

This study included 60 patients (Patients Group) suffering from acne vulgaris in which they were divided into three groups (mild, moderate and severe acne vulgaris) each of 20 patients. In addition, 60 apparently healthy individuals were included as a control group. All subjects were recruited from the outpatient clinic of Dermatology, Andrology and Venereology Department of Benha University Hospitals during the period from July 2021 to February 2022.

Type of the study:

A prospective case-control study.

Inclusion criteria:

The study included patients with Different degrees of acne vulgaris according to Global Acne Grading system (GAGS) (′3).

Exclusion criteria:

- Patients treated by systemic antiacne therapy for at least 1 month or any topical therapy for at least 2 weeks prior to the study.
- Patients with infectious, inflammatory or autoimmune diseases.
- Diabetic patients.
- Pregnant and lactating females.
- Malignancy

Ethical consideration

An informed consent was obtained from all participants declaring fully understanding of the aims and methods of this study.

The study was approved by the local ethics committee on research involving human subjects of Benha Faculty of Medicine.

Each patient was subjected to the following:

I. Full history taking:

- Including personal history, family history, acne vulgaris history as well as history of other skin diseases or drug intake.

II. Clinical examination:

1. Complete general examination.
2. Complete cutaneous examination; to evaluate the clinical type and severity of acne, using GAGS.

Global Acne Grading System

Global Acne Grading System (GAGS) is a quantitative measure used to estimate the degree of severity of acne. The system was initially suggested and upgraded Amol Doshi and others in 1997. The score is actually the grand sum of six regional sub scores. Each is derived by multiplying the factors-2 for forehead, 2 for each check, 1 for nose, 1 for chin, 3 for both chest and back by the most heavily weighted lesion within each region (1 for ≥ one comedone, 2 for ≥ one papule,3 for ≥ one pustule, and 4 for ≥ one nodule). The regional factors were derived from consideration of surface area and distribution and density of pilosebaceous units (Table 1).

Table (1) Acne scores according to location and severity **[14].**

Location	Factor (F)	Severity (S)	Local score (F.S)	Acne severity	
Forehead	**2**	**0 Nil**		**Mild**	**1-18**
Right cheek	**2**	**1 Come done**		**Moderate**	**19-30**
Left cheek	**2**	**2 Papule**		**Severe**	**31-38**
Nose	**1**	**3 Pustule**		**Very severe**	**>39**
Chin	**1**	**4 Nodule**			
Chest&upper back	**3**				
		Total Score			

According to this table in the case of no acne the system will award the value of zero. Patients will be evaluated with respect to the value and location of the acne. In this context the following grades were recognized:

Mild: 1-18 Moderate: 19-30 Severe: 31-38 Very severe: 39 +

Laboratory investigations:

All participants were subjected to evaluation of serum and salivary insulin and adipsin levels using ELISA kits.

Estimation of serum and salivary levels of adipsin and insulin resistance using enzyme-linked immunosorbent assay (ELISA) technique.

Blood sampling:

Five ml of venous blood will be withdrawn from each participant and put in serum separating tube and left for 30 minute until clotting then will be centrifuged, the separating serum will be stored at -20 C till assay. The following figure shows images from different stages in the collection and analysis of such samples.

Salivary sampling:

Two to ten ml of saliva will be collected by un stimulated passive drool. Donor will tilt his head forward allowing saliva to pool on the floor of the mouth, and then pass the saliva through saliva collection aid into a polypropylene vial. After collection, particulates will be removed by centrifugation for 10 minutes at 2000-3000 rpm at 2-8 c for 10 minutes, and then will be stored at -20c till assay.

Methods

Sample collection

A total of 60 patients participated in this study. the sample were blood and saliva. The whole blood was separated by using gel tube then centrifuged for 230 RPM for 5 minutes then the serum was used for the ELIZA techniques to determine the level of adipsin and insulin level. The same participants were taken saliva by spotting 3 mL into sterile white tube for 3 mL then centrifuged for 5 minutes, after centrifugation, the supernatant was analyzed for adipsin and insulin. The sample were stored in -20 until the number of the participant were completed.

Insulin resistance and associated indices

The values of HOMA2-IR were obtained by the use of HOMA calculator version 2.2.3 as presented in the following figure.

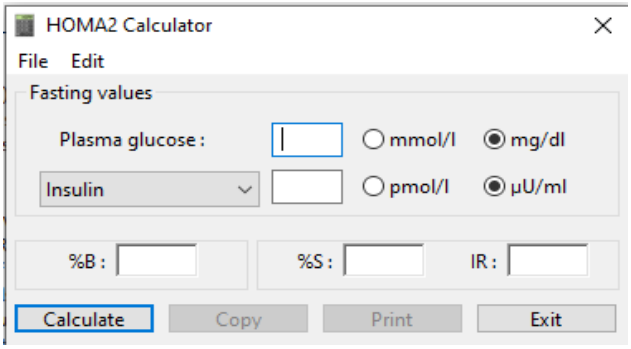


Fig. (1) HOMA calculator v 2.2.3.

Data analysis

All collected data were subjected to statistical analysis which was carried out by the well-known statistical software package IBM SPSS version 25. Descriptive and inferential statistics were made wherever it was necessary. Statistical models that was appropriate to handle some ideas about describing the relationships between parameters under study were implemented and results with proper interpretation.

3.Results

There was insignificant difference between patients and controls regarding age, sex and BMI (p=0.321, 0.568 and 0.012 respectively)

Table (1): Demographic Data of the studied groups.

Variables		Control N=60	Patients N=60	P
Age (years)	**Mean±SD**	21.27±4.037	22.10±5.071	0.321
Male	**N(%)**	23(53.50)	20(46.50)	
Female	**N(%)**	37(48.10)	40(51.90)	0.568
BMI (Kg/m^2)	**Mean±SD**	25.57±2.46	25.69±2.03	0.781

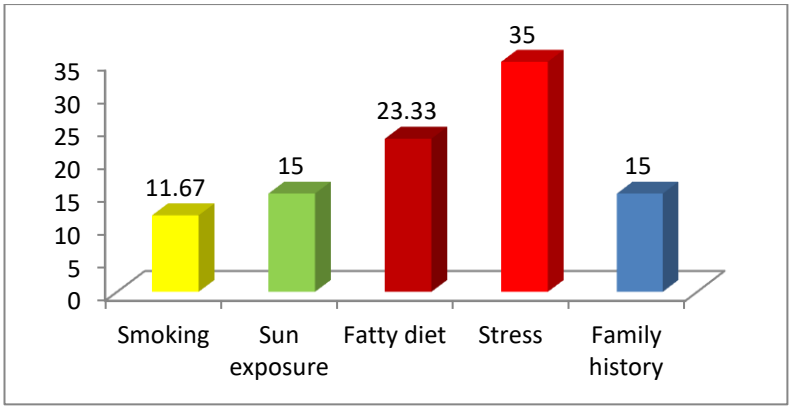
BMI: body mass index, P<0.05 is significant, SD: standard deviation

The mean acne duration was 1.04±0.84 years, the mean age of onset was 21.06±4.88 years, 32 patients (53.3%) had stationary course and 28 patients (46.7%) had remissions and exacerbations **(Table 2).**

Table (2) History findings of the studied cases.

Variables			Patients N=60
Duration (years)		**Mean±SD**	1.04±0.84
Age of onset (years)		**Mean±SD**	21.06±4.88
Course	**Stationary**	**N (%)**	32(53.3)
	Remission and exacerbation	**N (%)**	28(46.7)

Regarding the reported risk factors for acne development, seven patients (11.7%) were smokers. Relation to sun exposure was reported by 9 patients (15%), relation to diet was mentioned by 14 patients (23.33%) and relation to stress was reported in 21 patients (35%). Family history was positive in 9 patients (15%) (**Graph 1**).



Graph (1) The reported risk factors by the studied cases.

Face was affected in 93.3% of the cases, shoulders in 43.3%, chest in 50% and back in 41.7% of cases. Scars were present in 65%, and PIH(post inflamatory hyperpigmentation) in 75% of cases. The mean GAGS score was 23.21±9.13 **(Table 3).**

Table (3) Clinical findings in the studied cases.

Variables			Patients
Site of affection	**Face**	**N(%)**	**56(93.30)**
	Shoulders	**N(%)**	**26(43.30)**
	Chest	**N(%)**	**30(50.00)**
	Back	**N(%)**	**25(41.70)**
Scars		**N(%)**	**39(65.00)**
PIH		**N(%)**	**45(75.00)**
GAGS score	**All patients (N=60)**	**23.21±9.13**	
	Mild Acne (N=20)	**12.91±1.67**	
	Moderate (N=20)	**22.13±1.35**	
	Severe Acne (N=20)	**34.59±2.22**	

Serum and saliva parameters such as HOMA1-IR, HOMA2-IR, HOMA1-%B, HOMA1-%S, disposition index DI, and QUICKI were al calculated for both groups of participants in this research work. Results are listed in **Tables 4**.

With respect to serum parameters, means HOMA1-%B and HOMA1-%S were not significantly different in the two groups of patients and control as shown on **Table 4**. With respect to saliva parameters, means fasting insulin and adipsin were not statistically different according to the patients and control groups.

Table (4): Serum and salivary parameters among the study gruops.

Source	Test	Control (N=60)	Patients (N=60)	p-value
Serum	**FG**	83.22±7.04	89.72±8.36	<0.0001
	FI	10.16±1.75	12.57±3.98	<0.0001
	Adipsin	3610.48±281.36	3164.00±518.71	<0.0001
	HOMA2-IR	1.28±0.26	1.62±0.53	<0.0001
	HOMA1-IR	2.11±0.54	2.85±1.09	<0.0001
	HOMA1-%B	197.87±60.14	179.26±71.23	0.125
	HOMA1-%S	50.34±12.33	43.26±25.30	0.054
	DI	1.04±0.53	0.75±0.50	0.002
	QUICKI	0.34±0.01	0.33±0.02	0.003
Saliva	**FG**	5.26±1.24	9.78±0.83	<0.0001
	FI	1.40±0.48	1.51±0.18	0.106
	Adipsin	400.32±29.88	381.68±104.15	0.185
	IR	0.234±0.061	0.275±0.024	<0.0001
	HOMA1-IR	0.0186±0.0085	0.0365±0.0057	<0.0001
	HOMA1-%B	No data	No data	--
	HOMA1-%S	6634.67±3209.33	2808.75±446.56	<0.0001
	D1I	No data	No data	--
	QUICKI	1.29±0.39	0.86±0.051	<0.0001

Adipsin: Fasting Adipsin, DI: Disposition Index, FG: Fasting Glucose, FI: Fasting Insulin, HOMA1-IR: Homeostatic model assessment1 of insulin resistance, HOMA2-IR: Homeostatic model assessment2 for insulin resistance, HOMA1-%B: Homeostatic model assessment for β-cell function, HOMA1-%S: Homeostatic model assessment for insulin sensitivity, IR: Insulin resistance, QUICKI: Quantitative insulin sensitivity check index**.**

As regard to serum parameters, FBG, FSI and serum adipsin were found to be significantly correlated with most of the other serum parameters. The correlations is also affected by the readings of each variable in both groups of participants. FBG was found to be positively correlated with BMI **Table (5)**.

Table (5): Pearson correlations between the study variables and serum parameter

		BMI	**GAGs**	**FG**	**FI**	**Adipsin**	**HOMA2-IR**	**HOMA1-IR**	**HOMA1-%B**	**HOMA1-%S**	**DI**	**QUICKI**
BMI	**R**	1	0.29	0.244	0.21	-0.268	0.219	0.233	-0.209	-0.168	-0.256	-0.189
	p-value		0.024	0.007	0.021	0.003	0.016	0.01	0.022	0.067	0.005	0.038
GAGs	**R**	0.29	1	0.449	0.579	-0.444	0.577	0.583	0.011	-0.422	-0.338	-0.498
	p-value	0.024		0.001	1E-04	0.0001	0.0001	0.0001	0.934	0.001	0.008	0.0001
FG	**R**	0.244	0.449	1	0.822	-0.475	0.856	0.893	-0.578	-0.748	-0.871	-0.841
	p-value	0.007	0.001		0.000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
FI	**R**	0.21	-0.444	0.822	1	-0.553	0.998	0.987	-0.084	-0.892	-0.597	-0.95
	p-value	0.021	0.0001	0.000		0.0001	0.0001	0.0001	0.362	0.0001	0.0001	0.0001
Adipsin	**R**	-0.268	0.577	-0.475	-0.553	1	-0.555	-0.548	0.078	0.45	0.36	0.539
	p-value	0.003	0.0001	0.0001	0.0001		0.0001	0.0001	0.396	0.0001	0.0001	0.0001
HOMA2-IR	**R**	0.219	0.583	0.856	0.998	-0.555	1	0.994	-0.140	-0.892	-0.637	-0.955
	p-value	0.016	0.0001	0.0001	0.0001	0.0001		0.0001	0.128	0.0001	0.0001	0.0001
HOMA1-IR	**R**	0.233	0.011	0.893	0.987	-0.548	0.994	1	-0.205	-0.859	-0.667	0.937
	p-value	0.01	0.934	0.0001	0.0001	0.0001	0.0001		0.025	0.0001	0.0001	0.0001
HOMA1-%B	**R**	-0.209	-0.422	-0.578	-0.084	0.078	-0.140	-0.205	1	0.085	0.823	0.166
	p-value	0.022	0.001	0.0001	0.362	0.396	0.128	0.025		0.356	0.0001	0.071
HOMA1-%S	**R**	-0.168	-0.338	-0.748	-0.892	0.45	-0.892	-0.859	0.085	1	0.608	0.965
	p-value	0.067	0.008	0.0001	0.0001	0.0001	0.0001	0.0001	0.356		0.0001	0.0001
DI	**R**	-0.256	-0.498	-0.871	-0.597	0.36	-0.637	-0.667	0.823	0.608	1	0.672
	p-value	0.005	0.0001	0.001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001		0.0001

Table 6 shows the Pearson's correlations of GAGs, BMI and salivary parameters at 0.05 and 0.01 level of significance only. HOMA2-IR was not calculated due to small readings of fasting insulin which refused by the calculator. Instead an alternative formula for calculating salivary insulin resistance was applied to the data of this study. Salivary adipsin is only found to be negatively correlated with BMI.

Table (6) Pearson's correlation between the study varaibles and salivary parameters

		BMI	**GAGs**	**FG**	**FI**	**Adipsin**	**IR**	**HOMA1-IR**	**HOMA1-%S**	**QUICKI**
BMI	r	1	0.29	0.108	-0.105	-0.363	-0.062	0.049	0.016	0.009
	p-value		0.024	0.239	0.254	0.0001	0.499	0.596	0.862	0.922
GAGs	r	0.29	1	0.449	0.403	-0.583	0.483	0.564	-0.532	-0.540
	p-value	0.024		0.0001	0.001	0.0001	0.0001	0.0001	0.0001	0.0001
FG	r	0.108	0.449	1	0.204	-0.219	0.482	0.868	-0.740	-0.704
	p-value	0.239	0.0001		0.025	0.016	0.0001	0.0001	0.0001	0.0001
FI	r	-0.105	0.403	-0.219	1	-0.101	0.956	0.638	-0.709	-0.701
	p-value	0.254	0.001	0.016		0.273	0.0001	0.0001	0.0001	0.0001
Adipsin	r	-0.363	-0.583	0.482	0.956	1	-0.156	-0.243	0.137	0.127
	p-value	0.0001	0.0001	0.0001	0.0001		0.088	0.007	0.137	0.168
IR	r	-0.062	0.483	0.868	0.638	-0.156	1	0.831	-0.856	-0.838
	p-value	0.499	0.0001	0.0001	0.0001	0.088		0.0001	0.0001	0.0001
HOMA1	r	0.049	0.564	-0.740	-0.709	-0.243	0.831	1	-0.877	-0.840
-IR	p-value	0.596	0.0001	0.0001	0.0001	0.007	0.0001		0.0001	0.0001
HOMA1	r	0.016	-0.532	-0.704	-0.701	0.137	-0.856	-0.877	1	0.994
-%S	p-value	0.862	0.0001	0.0001	0.0001	0.137	0.0001	0.0001		0.0001

4. Discussion

Acne vulgaris is most common throughout adolescence, however the severity of the disorder varies from person to person. Numerous factors contribute to the development of this chronic inflammatory skin disease. Major reasons include inflammation, abnormal keratinization, changes in the ecology of microorganisms and an increase in sebum production. The precise sequence of events is yet uncertain, however inflammation has been considered as the initial step. Despite the fact that much remains to be learned about the mechanisms of the inflammatory response, one thing is clear: Propionibacterium acnes is a significant player [1].

In France, the United Kingdom, and the United States, the Global Burden of Disease estimates that the prevalence of acne vulgaris among young individuals aged 12-25 years is above 85 percent (GBD). Worldwide, the illness is virtually universally prevalent [2].

Acne vulgaris is triggered by Cutibacterium acne (P.acnes) disrupting the skin's pilosebaceous unit (PSU) and normal circulating dehydroepiandrosterone (DHEA) levels in adolescents (DHEA). Skin lesions, both inflammatory and non-inflammatory, may form on the face, upper arms, back, and chest, making it a common ailment [3]. In the study, sebaceous gland activity, hyperseborrhea, changes in fatty acid composition, hormone microenvironment dysregulation, interaction with neuropeptides, follicular hyperkeratinization, induction of inflammation, and dysfunction of the innate and adaptive immune systems were all implicated in the disease's pathophysiology. There are several variables that contribute to the severity of acne vulgaris, including the amount of lesions and the kind of photography utilised [4].

On the face, chest, and upper back are three areas where acne seems to be most prevalent [5]. Acne severity may still be divided into three categories: mild, moderate, and severe, despite the lack of agreement on a formal grading system. Standards for rating the severity of acne should take into consideration skin diseases that are included in the differential diagnosis of acne [6].

Having acne as an adolescent may have a variety of negative effects. Physical and emotional agony, along with shame and lifelong scars, may be caused by it. Anxiety and embarrassment may have a bad effect on one's physical and social well-being. There are a multitude of factors that might cause or aggravate acne. Many factors, including inheritance, the male sex, youth, stress, and smoking, influence the development of a variety of skin diseases. An unusually high quantity of sebum production may be linked to genetics and androgens, which may in turn cause acne lesions [7].

Because of their high glycemic index (>70), white bread, rice, and chocolate all stimulate insulin production in the pancreas [8]. IGF-1 and IGF-1 receptors both directly and indirectly trigger Akt signalling, which in turn is activated by insulin. either by enhancing enzymes that are directly linked to DHT synthesis or by directly activating its receptor (IGF-IR), IGF-1 has a dual effect on the cells of the PSU [9, 10, 11, 12].

5. Conclusion

This study's purpose was to examine the relationship between patients' BMI and fasting blood glucose levels and the severity of their acne vulgaris.

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