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Insulin levels in teenagers with comedonal acne

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Abstract

Introduction: *Acne is considered a multifactorial skin disease secondary to an obstructive process of pilosebaceous units. Some studies suggest a relationship between insulin levels and the presence of acne, but this has not yet been demonstrated.* **Objective:** *To compare the levels of insulin in patients with and without comedonal acne.* **Material and Methods:** *From January to July 2012, we conducted a cross-sectional study in the Dr. Ladislao de la Pascua Dermatologic Center in Mexico City. We recruited men and women from 14 to 25 years old with and without comedonal acne. We measured the insulin levels in all patients with DXI 800 Beckman Coulter equipment in a blood sample.* **Results:** *Twenty patients with acne and 20 patients without acne were studied, with an average age of 17 (± 3) and 19 (± 4) years, respectively. Both groups were different in terms of gender. Body mass index was similar in both groups. We did not find a difference in insulin levels between groups (p = 0.818). The average level of insulin was 7.15 ± 4.7 uU/ml for the acne group and 7.85 ± 3.3 uU/ml for the control group.* **Conclusion:** *Insulin levels are similar in patients with and without comedonal acne. There is no direct relationship between hyperinsulinemia and acne.* (Gac Med Mex. 2015;151:410-4)

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Introduction

Acne is a chronic inflammatory dermatosis of multifactorial origin, secondary to pilosebaceous follicle obstruction. All adolescents between 15 and 17 years of age experience some degree of acne, but only 20% has it with moderate to serious intensity. Acne is one of the most common dermatoses in the general population and the main reason for medical consultation in dermatology[1].

The four factors involved in the pathogenesis of acne are: androgen-mediated increase in sebum production, follicle obstruction due to keratinocyte hyperproliferation, colonization by *Propionibacterium acnes* and inflammation[3]. Sebum production depends on androgen, estrogen, growth hormone, insulin, insulin-like growth factor-1 (IGF-1), corticotropic hormone, adrenocorticotropic hormone and melanocortin stimulation.

Insulin can cause circulating androgens (testosterone and dehydroepiandrosterone sulfate) and IGF-1 elevation by inhibiting hepatic production of globulin, which binds to them[3]. It also regulates sebocyte proliferation and pilous follicle keratinization[4-6].

In a previous study by Del Prete, et al., a difference was found between insulin levels in men with acne and patients without acne of the same gender[7]. However, Kaymak, et al. reported similar insulin levels in patients with acné compared with healthy controls[8]. Thus, it is important to know if there is a difference between insulin levels in patients with and without comedonal acne.

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Table 1. Baseline characteristics of both groups

Characteristics	Patients with acne n = 20 (100%)	Patients without acne n = 20 (100%)	Statistical test (p)
Age (X, SD)	17 ± 3	18 ± 4	17.8 (0.083)*
Sex n (%)			
Males	12 (60)	3 (15)	8.64 (0.004)†
Females	8 (40)	17 (85)	
Weight (md ± IQR)	59.5 ± 9.4	54 ± 7.5	118 (0.27)‡
Height (X, SD)	1.68 ± 0.10	1.62 ± 0.07	1.99 (0.05)*
BMI	22 ± 3	21 ± 3	1.23 (0.22)*

X: mean; md: median.
*Student's t-test.
†χ^2.
‡Mann-Whitney U-test.

Material and methods

From January to July 2012, a cross-sectional comparative study was conducted at the *Centro Dermatológico Dr. Ladislao de la Pascua* of the Distrito Federal (Mexico) Ministry of Health. The protocol was approved by the Ethics and Research Committee. Patients aged 18 years or older signed the informed consent; in the case of children under age, the document was signed by a parent or legal guardian and, in addition, approval of the patient to participate in the study requested.

Male and female patients of 14 to 25 years of age, diagnosed with moderate to severe comedonal acne with no dermatological treatment were recruited. Moderated to severe comedonal acne was considered in those patients with open and/or closed comedones on the face and/or trunk, with 20 to 100 lesions in moderate and more than 100 in severe cases. A control group of non-acne-diagnosed patients matched by age was recruited from the outpatient clinic.

Patients with acne inflammatory lesions, insulin resistance-associated conditions, hyperandrogenism and on treatment with drugs that modify insulin metabolism were excluded in both groups. Patients on treatment with drugs associated with acne-like reactions such as corticosteroids, lithium, isoniazid, phenitoin, testosterone, halogens and vitamins of the B complex were also excluded.

All patients had their weight and height measured, standardized digital photographs were taken of the acne lesions and a blood sample was drawn after a 12-h fasting. A dermatologist classified acne severity in group 1, calculated the BMI and questioned the participants on familial history of acne. Levels of insulin were determined using a DXI 800 Beckman Coulter equipment in a certified external laboratory. All patients filled a food consumption questionnaire that quantified weekly rations. Foods were selected based on data of the Mexican diet published by the National Institute of Geography and Statistics and according to the questionnaire used by Adebamowo for his study on diet and acne[9-11].

A sample size of 20 patients per group was calculated in order to find a standard deviation (SD) of 5.6 µU/ml for insulin levels, with a power of 80% and an alpha value of 0.05. A consecutive cases non-probabilistic sampling was performed.

Data were analyzed using the SPSS program, v. 19. Descriptive statistics was used for study variables with means and SD. Qualitative variables were compared with the chi-square and Fisher's exact tests, and the Mann-Whitney U-test was used for quantitative variables.

Results

Twenty patients with acne and 20 without acne, with a mean age of 17 (SD 3 years) and 18 years (SD 4 years), respectively (p = 0.08), were recruited. In the acne group, 60% of the patients were males, whereas in the control group 85% were females (p = 0.004). Both groups were similar with regard to weight and height, as shown in table 1. Mean BMI was 22 and 21 kg/m^2 in the groups with and without acne, respectively (p = 0.22), which is classified as normal. However, 4 patients in the group with acne had BMI with values classified as overweight. In the group with acne, 75%

Table 2. Insulin levels in patients with and without acne

Insulin levels (µU/ml)	Patients with acne n = 20 (100%)	Patients without acne n = 20 (100%)
< 8.0	12 (60)	10 (50)
8-19.3	6 (30)	10 (50)
> 19.3	2 (10)	0 (0)
Average (median ± IQR)	7.15 ± 4.7	7.85 ± 3.3

χ^2 = 3.182; p = 0.203.

had moderate severity and 50% had face and trunk involvement with a mean evolution time of 3 years (SD 2 years).

Median levels of insulin were similar in both groups, with 7.15 µU/ml (interquartile range [IQR] 4.7) in patients with acne and 7.85 µU/ml (IQR 3.3) in the control group (p = 0.818). Considering that insulin mean level in individuals aged 16 to 19 years is 13.7 µU/ml, with a SD of 5.6 µU/ml, and that hyperinsulinemia is considered at values higher than 19.3 µU/ml, insulin levels were compared according to 3 categories, as shown in table 2[12]. No statistically significant differences were also found in both groups (p = 0.203), but 2 patients in the group with acne were observed to have hyperinsulinemia. The first patient, 18 years old and with BMI of 24.81 kg/m^2, had 28 µU/ml of insulin, and the second, aged 14 and with BMI of 25.7 kg/m^2, 50 µU/ml. A sex-stratified analysis was performed, since a significant differece was found between both groups with regard to this variable. No significant differences were found in insulin levels both in males (p = 0.505) and in females (p = 0.678). Finally, patients with first degree relatives with a history of acne were found to have 5-fold higher risk for having acne than those patients without a family history (confidence interval: 1.41-21.8).

With regard to food consumption frequency, only bread consumption was found to be higher in patients with acne, thus demonstrating a statisltically significant difference (p = 0.47) (Table 3). Ice cream was another food that was more frequently consumed in patients with acne, but no statistically significant difference was demonstrated. As for the other foods, consumption was similar in both groups.

Discussion

The results of this study failed to demonstrate a direct association between high insulin levels or hyperinsulinemia and the presence of comedonal acne. And just as previously demonstrated by Kaymak's case-control study, insulin levels were similar in patients with and without acne, regardless of the number of inflammatory and non-inflammatory lesions. Of note, unlike previous studies, the insulin level to consider hyperinsulinemia was different, since data obtained by Aradillas in a sample of Mexican adolescents were considered. However, mean insulin level in our patients was significantly lower than that reported by Kaymak, 7.15 µU/ml versus 12.79 µU/ml in the group with acne, and 7.85 µU/ml versus 12.63 µU/ml in the control group. This could be due to Kaymak's patient sample, since most subjects were older females, 21.56 versus 17 years, with higher BMI, 25.18 versus 21 kg/m^2, and it included patients with inflammatory acne, unlike our patients, who only had non-inflammatory acne. However, a population-associated difference or a difference due to the non-random selection of our sample cannot be disregarded.

In the case of Del Prete's study, where male patiens with and without acne were included, 22 patients per group, a statistically significant difference in insulin levels and other parameters was found, including BMI, waist-hip ratio, glucose levels, HOMA-IR and glucose-tolerance curve, which guide on insulin resistance and its relationship with metabolic syndrome, even in those patients with BMI lower than 25 kg/m^2 [7].

These data support the fact that acne's etiology is multifactorial and its presence and/or severity is more related to insulin resistance and to IGF-1 and IGFBP-3 levels, as observed in previous studies[13]. In fact, insulin has been proposed to stimulate sebogenesis by increasing IGF-1 signalling and decreasing IGFBP-3 levels[14]. Although in our study no statistically significant differences were found in BMI between both groups, elevated levels are known to be associated with an increased risk of insulin resistance and that a high

Table 3. Average food consumption per week in patients with and without acne

Food	Patients with acne	Patients without acne	p*
Grains	3.05	1.95	0.118
Tortilla	9.80	10.45	0.787
Egg	2.30	2.20	0.853
Chicken	3.05	3.20	0.718
Pasta	2.95	1.85	0.073
Candies	5.15	2.90	0.136
Milk	8.65	5.15	0.123
Chocolate milk	1.30	0.65	0.198
Milk shake	1.50	1.30	0.664
Ice cream	1.45	0.60	0.075
Yoghurt	1.60	2.28	0.080
Cheese	2.65	3.10	0.640
Butter	0.50	0.15	0.075
Soft drinks	5.55	3.45	0.238
French fries	3.00	1.95	0.313
Pizza	0.50	0.25	0.108
Chocolate	2.15	1.85	0.633
Red meat	2.20	2.05	0.708
Fish	0.70	0.95	0.375
Vegetables	3.40	3.55	0.830
Fruit	5.15	7.05	0.306
Bread	6.05	3.25	0.047+

*Student's t-test.

glycemic index diet leads to weight gain that is disproportionate to height.

The limitations of this study include lack of information on other insulin-resistance-associated variables such as glucose, cholesterol and tryglycerides levels and waist circumference as components of the metabolic syndrome, as well as failure to explore if there is an association between insulin resistance and the presence and/or severity of acne in comparison with insulin levels, as well as not having used a validated instrument to measure the diet and calculating the exact glycemic index and measured its relationship with acne. However, a higher bread consumption frequency was observed in patients with acne. In contrast with Ademawobo's previous studies, higher consumption of low-fat milk was not documented in our patients with acne.

It is important pointing out that in our study, conversely to that by Kaymak, patients were not paired by age and sex for statistical analysis, and although a sex-stratified analysis was conducted later, we might infer that the control group was not representative of adolescents with acne based also on the fact that sampling was not random.

Finally, our study did not find statistically significant differences in insulin levels between patients with and without acne. However, we cannot rule out that insulin, and specifically insulin resistance, as well as IGF-1 and IGFBP-3 levels, participate as regulators of sebogenesis in acne.

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