Correlation between Sebum Level and Follicular Fluorescence in Acne Vulgaris Patients

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Abstract

BACKGROUND: The pathogenesis of acne vulgaris is multifactorial involving four important factors, including follicular epidermal hyperproliferation, increased sebum production, increased activity of *Cutibacterium acnes* and inflammation. Increased sebum levels can increase the production of porphyrins which appear as red-orange fluorescence on the faces of patients with acne vulgaris.

AIM: The objective of this study is to determine the correlation between sebum levels and follicular fluorescence in acne vulgaris patients.

SUBJECTS AND METHODS: This study was an observational analytic study with a cross-sectional data collection method involving 60 acne vulgaris patients based on inclusion and exclusion criteria. Basic data were recorded including age and gender. Sebum levels were measured using a Sebumeter® SM 815 (C & K, Courage-Khazaka, Cologne, Germany) and follicular fluorescence was examined using a Visiopor® PP34 camera (C & K, Courage-Khazaka, Cologne, Germany). The correlation between sebum levels and follicular fluorescence was analyzed using Spearman correlation. The result was significant if the $p < 0.05$.

RESULTS: Acne vulgaris was more common in women (76.7%) with a mean age of 22.52 years, the youngest was 18 years old, and the eldest was 36 years old. The results of this study showed a positive correlation with moderate strength between sebum levels and the spot counts ($r = 0.495$) and positive correlation with weak strength between sebum levels and the percentage of the area covered with follicular fluorescence spots ($r = 0.349$).

CONCLUSION: There is a correlation between sebum levels and follicular fluorescence in acne vulgaris patients.

Introduction

Acne vulgaris is a chronic inflammatory skin condition that is commonly found in pilosebaceous units characterized by polymorphic lesions in the form of comedones, papules, pustules, nodules, and cysts at predilection sites and can cause scar tissue and pigment changes [1], [2], [3], [4]. Epidemiological studies have shown that acne most often occurs in adolescents after puberty, most often affects adolescents aged 15−18 years and boys are more likely to have more severe acne. Acne vulgaris ranks 8th (9.4%) as the most common disease worldwide [1], [3], [5]. The pathogenesis of acne vulgaris is multifactorial, involving four important factors that are considered to play a role in the development of acne vulgaris lesions, namely epidermal follicular hyperproliferation, increased production of sebum, increased activity of *Cutibacterium acnes* (*C. acnes*), and inflammation [1], [6]. Other microbiomes that can cause acne vulgaris are *Staphylococcus epidermidis* and *Staphylococcus hominis* [7].

Sebum is a mixture of nonpolar lipids, most of which are synthesized de novo by the sebaceous glands [8], [9]. Sebum in human is closely associated with the occurrence of acne [10]. Increased sebum levels coupled with hyperkeratinization of follicles in pilosebaceous units will result in pore blockage that plays a role in acne lesion [11].

Porphyrins (protoporphyrin, coproporphyrin I, and especially coproporphyrin III) are endogenous metabolic products of *Propionibacteria*, which contribute to perifollicular inflammatory reactions and the fluorescence of porphyrins will appear red-orange and this fluorescence is useful for evaluating and assessing the development of acne vulgaris [12].

Several studies have found that red fluorescence is not only caused by C. acnes, but sebum also contributes to the formation of follicular fluorescence on the face [13], [14]. Therefore, this study aimed to examine the correlation of sebum levels with follicular fluorescence in acne vulgaris patients.

Methods

This study is an observational analytic study with a cross-sectional design involving 60 acne vulgaris patients with non-inflammatory lesions, age ≥ 18 years old, and signed an informed consent that came to the outpatient clinic of Dermatology and Venereology, Universitas Sumatera Utara Hospital, Medan, Indonesia. Patients who were pregnant or breastfeeding, receiving treatment for acne vulgaris, and had other dermatoses on the face were excluded.

Ethical permission is given by the Health Research Ethics Committee, Faculty of Medicine, Sumatera Utara University, and Universitas Sumatera Utara Hospital, Medan, Indonesia. History taking and clinical examination were conducted, sebum levels were measured by menggunakan Sebumeter$^®$ SM 815 (C & K, Courage-Khazaka, Köln, Germany), and follicular fluorescences were examined by Kamera Visiopor® PP34 (C & K, Courage-Khazaka, Köln, Germany).

The results were analyzed by descriptive analysis and Spearman correlation and the result is significant if the $p < 0.05$, then continued by assessing the strength of the correlation (r) between sebum levels and the number of spots and the percentage of the area covered by follicular fluorescence spots.

Results

In this study, the characteristics of acne vulgaris patients were higher in females (76.7%) compared to males (23.3%), and the mean age of the subjects was 22.52 years with the youngest age was 18 years old and the eldest was 36 years old (Table 1).

Table 1: Characteristics of acne vulgaris subjects

Characteristics	
Gender	
Male	14 (23.3%)
Female	46 (76.7%)
Age, years	
Average	22.52
Standard deviation	3.98
Median	22
Min–Max	18–36

The mean sebum level of this study was 89.49 ± 43.69 g/cm^2 (Table 2). Table 3 shows the follicular fluorescence in the study subjects and the number of spots in acne vulgaris patients was 24.32 ± 15.59 and the percentage of area covered by spots in acne vulgaris patients was 2.82% ± 2.34%. From the results of the Spearman correlation test, it was found that there was a positive correlation with moderate strength between sebum levels and the number of spots (r = 0,495, p < 0,001) also a positive correlation with weak strength

Table 2: Sebum levels in acne vulgaris subjects

Sebum level	μg/cm^2
Average	89.49
Standard deviation	43.69
Median	91.2
Min–Max	13.4–199.6

between sebum levels and the percentage of area covered by spots in acne vulgaris patients (r = 0,349, p = 0,006) (Table 4).

Table 3: Follicular fluorescence in acne vulgaris subjects

	Spot counts	Percentage of the area covered by spots, %
Average	24.32	2.82
Standard deviation	15.59	2.34
Median	22.3	2.08
Min–Max	0.8–76.2	0.02–9.32

Discussion

Acne vulgaris can affect all ages and ethnic groups, most often occurs in adolescents after puberty and can heal in adulthood [3], [5]. In a study of 2000 healthy men and women aged 18−70 years, it was found that at the age of 16 years, acne was more occurs mostly in men and after the age of 23 years occurs more in women [15]. This study is also in accordance with the study by El-Hamd *et al*. in Egypt, which also showed that acne vulgaris was more common in women (60%) than men (40%) [16]. Acne that occurs in women can be persistent although it is not yet fully understood, possibly caused by several factors, such as the use of cosmetics, drugs, hormonal disorders, stress, sleep patterns, and awareness to seek treatment [15], [17], [18].

Table 4: Correlation between sebum level and follicular fluorescence in acne vulgaris patients

Follicular fluorescence	Sebum level	
	p	r
Spot counts	<0.001	0,495
Percentage of area covered by spots	0.006	0.349

This study found that the mean age of acne vulgaris patients was 22.52 years which was in the young adult age category, in accordance with the study conducted by Choi *et al*. in their research that the average age of acne vulgaris patients was 23 years [19]. In Medan, Marpaung *et al*. found that the most common age group for acne vulgaris was inflammatory and non-inflammatory lesions in the age range of 18 – 23 years (51.6% and 77.4%) [20]. Dewi *et al*. also found that most cases of acne vulgaris occurred in the age range of 18−25 years (84.5%) [21].

Increased sebum production is one of the key factors that play a role in the pathogenesis of acne vulgaris. Increased sebum levels coupled with follicular hyperkeratinization in the pilosebaceous units will result in pore blockage, which plays a role in the formation of acne lesions [1], [11]. The average sebum level of

the subjects in this study was 89.49 ± 43.69 μg/cm^2. Gencebay *et al*. found the average sebum level in acne vulgaris patients was 75.8 μg/cm^2 [22]. Okoro *et al*. reported the average sebum level in acne vulgaris patients in the T + U zone 80.4 μg/cm^2, T-zone 93.67 μg/cm^2, and zone U 59 μg/cm^2 [13]. A study conducted by Tamba showed that there was a relationship between skin type and acne vulgaris, where oily skin was 5 times more likely to have acne vulgaris. This study also found that acne vulgaris can occur in patients with dry skin although the number is less than acne vulgaris patients with oily skin [23].

Fluorescence indicates the presence of porphyrins produced by *C. acnes*. This substance is illuminated by ultraviolet light with a wavelength between 320 and 400 nm and produces a red-orange fluorescence. This fluorescence can be seen if there are at least 1,000 *C. acnes* colonies in the follicle. Fluorescence in the past was used to evaluate the effects of various therapies [11], [21], [24]. From Table 3, it was found that the spot counts in acne vulgaris patients were 24.32 ± 15.59 and the percentage of the area covered by spots in acne vulgaris patients was 2.82% ± 2.34%. Follicular fluorescence is currently also associated with increased sebum levels [25]. Choi *et al*. found that the fluorescence proportion in the T-zone was 5.68% ± 5.92%, the U zone was 5.17% ± 6.16%, and the entire face was 5.52% ± 5.76% [26]. Putra *et al*. found that the number of UVRF spots was 39.98 ± 11.45 with a percentage of the area covered by spots 4.39% ± 1.72%. There was no correlation between UVRF and the type of acne lesion [27]. The results of each study may vary due to different research groups and areas [28].

Our study showed that there was a positive correlation with moderate strength between sebum levels and the number of spots (r = 0,495, p < 0,001) also positive correlation with weak strength between sebum levels and the percentage of area covered by spots in acne vulgaris patients (r = 0,349, p = 0,006). Previous research conducted by Okoro *et al*. showed a positive correlation between acne lesions and red follicular fluorescence in the U-zone but not in the T-zone [13]. The study of Leite *et al*. showed a strong positive correlation between sebaceous gland activity and porphyrins and had a correlation with sebum levels [29]. Youn *et al*. conducted a correlation study between mean facial sebum levels and fluorescence and no correlation was found, then this study was continued by grouping subjects into high and low sebum levels and found significant fluorescent differences in the two groups. This study concluded that facial red fluorescence was more related to the level of sebum excreted than the presence of *C. acnes* and this was previously confirmed by culture results [14].

Conclusion

There is a correlation between sebum levels and follicular fluorescence in acne vulgaris patients.

Acknowledgments

Author Contribution

All authors have contributed to this research process, including preparation, data gathering, analysis, drafting, and approval to publish this manuscript.

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