

Correlation between Lipid Profile, Sebum Excretion Levels and Severity of Acne Vulgaris in Non-obese Patients

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Keywords: *acne vulgaris, lipid profile, sebum*

Abstract: Acne vulgaris is a common chronic skin disease involving blockage and inflammation of pilosebaceous units. Previous studies about lipid profile in acne patients showed variable results. Lipid profile was considered affecting sebum production. The aim of this study is to identify the correlation between lipid profile, sebum excretion levels and acne severity. This study also determines the correlation between lipid profile and sebum excretion levels. The study was conducted at Dr. Cipto Mangunkusumo General Hospital (RSCM) in Jakarta. This was a cross-sectional study with total of 30 non-obese AV patients. The subjects were divided into 3 groups based on the severity of AV. Total cholesterol, triglycerides, LDL, HDL serum and sebum excretion levels were measured. The results revealed significant correlation between sebum excretion levels and severity of acne vulgaris ($r = 0,6689$, $p = 0,0001$). There was no correlation between total cholesterol, LDL, triglycerides, HDL and acne severity. Lipid profile had no correlation with sebum excretion levels. The results of this study have proven that lipid profile does not affect the severity of acne and sebum excretion levels. While increased sebum secretion will increase acne severity.

1 INTRODUCTION

Acne vulgaris (AV) is a very common skin condition found worldwide, especially in teenagers and young adults. The development of AV is multifactorial, and a high-fat diet is considered by the public as an associated factor supporting AV occurrence. Several studies reported that AV is exacerbated by the consumption of foods with high glycemic index and dairy products. Consumption of foods with high levels of fat and high glycemic index can affect sebum production, thus fat is speculated to play a role in AV pathogenesis (Veith and Silverberg, 2011).

The correlation between lipid profile and sebum synthesis in sebaceous glands is continuously to be of interest. Sebum contains triglycerides (40-60%), wax esters (19-26%), squalene (11-15%), cholesterol, and cholesterol esters. The activity of sebaceous glands is influenced by circulating androgen in the blood. Sebaceous glands are also considered to express low density lipoprotein (LDL) receptors, which act in the uptake of circulating lipoprotein in the blood (Toruan et al., 2017). In other words, sebaceous glands are able to

autonomously synthesize lipids, express the androgen and lipogenesis enzymes receptors, which lead us to hypothesize about the relationship between lipid profile and sebum excretion.

Several studies reported the correlation between AV and lipid profile with variable results. Bakry et al (Bakry et al., 2014) in India investigated the relationship between total lipid levels with AV severity, and revealed significantly higher levels of total cholesterol and LDL in AV patients compared to non-AV group. El-Akawi et al (El-Akawi et al., 2007). reported different findings regarding lipid profile and AV, where they found low HDL levels and significantly increased triglycerides and LDL in AV patients compared to non-AV group. In Indonesia, Budiani (Budiani, 2013) studied lipid profile and AV severity, and found increased triglyceride levels and lower HDL levels in patients with severe AV compared to patients with mild AV. Currently, the role of lipid profile in AV is unclear. Several studies have shown a correlation between sebum levels on AV, but there is no data available on the relationship between lipid profile, sebum levels, and AV.

2 METHODS

This cross-sectional study was conducted in September 2017 at Dermatology and Venereology Outpatient Clinic, Dr. Cipto Mangunkusumo National General Hospital (RSCM). Subjects were consecutively sampled according to the inclusion and exclusion criteria, through interviews and physical examinations. The inclusion criteria were AV patients, male or female, aged 18-40 years, with normal or overweight body mass index (BMI). The exclusion criteria were active smokers, regular alcohol consumers, patients with diabetes mellitus and any symptoms of clinical hyperandrogenism, as well as patients under medications affecting blood lipid levels, oral corticosteroids within the last 1 month, oral retinoids within the last 4 months, and topical retinoids within the last 2 weeks.

The subjects were classified into three groups based on the Lehmann criteria: mild AV, moderate AV, and severe AV. During the subjects' first visit, informed consent was obtained and the AV lesions were documented. Before the next visit, the subjects were asked to fast for 9-12 hours before undergoing tests for blood lipid levels and the subjects were asked not to wash their face within 4 hours before

facial sebum levels measurement. Lipid profile test for total cholesterol, LDL, triglyceride, and HDL was performed in the Clinical Pathology Laboratory, RSCM. Sebum excretion measurement was performed in the Dermatology & Venereology Outpatient Clinic, using Sebumeter (Courage-Khazaka Electronic, Koln, Germany) on 5 areas of the face (forehead, nose, chin, left cheek and right cheek), with temperature of 22-24 °C and humidity of 40-50%. Afterwards, the mean facial sebum excretion (MFSE) was measured. The data were documented in the subjects' records. Subjects were informed of the lipid profile results through text message and the subjects were advised to consult an internist if dyslipidemia was present.

3 RESULTS

From 69 new patients with AV visited outpatient clinic in September 2017, 30 subjects who met the inclusion and exclusion criteria were enrolled in this study. The subjects' characteristics are described in Table 1.

Table 1: Characteristics distribution of study subjects of correlation between lipid profile, sebum excretion levels and severity of acne vulgaris in non-obese patients study in RSCM, September 2017.

Characteristics	Mild AV		Moderate AV		Severe AV		TOTAL	
	n	%	n	%	n	%	N	%
Gender								
Men	2	20	2	20	2	20	6	23
Women	8	80	8	80	8	80	24	77
Education								
High school	5	50	7	70	8	80	20	66.7
Bachelor	5	50	3	30	2	20	10	33.3
Occupation								
Unemployed	5	50	7	70	6	60	18	60
Employee	5	50	3	30	4	40	12	40
Body mass index (BMI)								
Normal	10	100	8	80	8	80	26	86.7
Overweight	0	0	2	20	2	20	4	13.3

Notes: AV= Acne vulgaris, n = numbers of study subjects; N = total of study subjects.

Table 2: Correlation between lipid profile, sebum excretion levels and severity of acne vulgaris in non-obese patients study in RSCM, September 2017.

Variable	Severity of AV			r	p value
	Mild AV n=10	Moderate AV n=10	Severe AV n=10		
Total Cholesterols (mg/dl)	178.5 (SD 38)	188.6 (SD 3.7)	179.1 (SD 24.9)	-0.0519	0.785
LDL (mg/dl)	119.30 (SD 34.7)	128.60 (SD 35.6)	119,90 (SB 26.1)	-0.0401	0.833
Triglycerides (mg/dl)	68 (38-106)	66.9 (45-104)	82 (41-156)	0.1723	0.363
HDL (mg/dl)	50.5 (SD 10.5)	51.6 (SD 8.8)	49,1 (SB 9.2)	-0.0496	0.795
Sebum excretion ($\mu\text{g}/\text{cm}^2$)	89.64 (SD 31.1)	166.58 (SD45.4)	176 (SB 37.9)	0.6698	0.0001*

Notes; n = numbers of study subjects; mg/dl = miligram per deciliter; $\mu\text{g}/\text{cm}^2$ = microgram per centimeter square; SD = Standard deviation; *Spearman test; r= coefficient of correlation, statistically significant if $p < 0.05$

There was no significant correlation between lipid profile and severity of AV as shown in table 2. Nevertheless, we found a moderate positive correlation between sebum excretion levels and severity of AV (table 2). We also obtained the correlation between sebum excretion levels and lipid profile in this study. There were no statistically significant correlations between total cholesterol ($r = 0.1245$, $p = 0.51$), triglycerides ($r = 0.2468$, $p = 0.19$), LDL ($r = 0.1145$, $p = 0.55$), HDL ($r = -0.1391$, $p = 0.46$) and sebum excretion levels. However, there was no previous study regarding this subject.

4 DISCUSSION

No significant correlation between lipid profile and severity of AV was found in this study. A similar study by Budiani (Budiani, 2013) in 2013 reported significant positive correlation between triglyceride and severity of acne. Budiani (Budiani, 2013) also revealed negative correlation between HDL and severity of acne. Studies by El-Akawi et al (El-Akawi et al., 2007) in 2007 and Manzoor et al (Manzoor et al., 2016) in 2016 reported statistically significant increased of triglycerides and LDL in severe AV compared to mild and moderate AV, they also found significantly decreased of HDL as the

severity of AV increased. While Bakry et al (Bakry et al., 2014) in 2014 revealed that total cholesterols and LDL were significantly higher in severe AV compared to mild and moderate AV, while HDL were significantly lower in severe AV compared to mild and moderate AV. The latter studies showed different results compared to our studies, which might be caused by the high fat and high carbohydrate dietary habits in India and Jordania, where the studies were conducted. Variable results of studies about lipid profile and severity of AV might be due to other factors which affecting lipid profile, such as genetics, race, diet, and lifestyle (e.g exercise).

A study about risk factors of AV was conducted by Bataille et al (Bataille et al., 2002). in 2002. The study involved 400 twin subjects with AV and 2414 twin subjects without AV as the control group. They reported a significant relationship between family history and AV, while there were no significant differences in BMI, body height, birth weight, cholesterol levels, triglyceride levels, HDL levels, and blood glucose levels between the AV group and the control group. The study, whose sample population was larger than our study, revealed that the emergence of AV is affected by genetics, while lipid profile was not a risk factor for AV.

Our hypothesis of how an increase in lipid profile may lead to an increase in androgen

(DHEAS) and sebaceous glands activity needs further investigation. Chen et al (Chen et al., 2011) studied 318 subjects with polycystic ovary syndrome (PCOS) and reported DHEAS was related to AV occurrence in patients with PCOS, although contrarily, DHEAS had a weak negative correlation to cholesterol, LDL, and triglyceride levels. The mechanism of how an increase in DHEAS leads to decreasing lipid profile is unknown. Lipid profile is influenced by genetic factors and liver metabolism, while DHEA levels are influenced by its synthesis in the gonads and adrenal glands; thus high levels of cholesterol in the blood are not entirely converted into DHEAS.

Despite the lack of correlation between lipid levels and AV severity, the normal lipid profile in our study's subjects showed that AV patients aged 18-40 years have normal lipid profile. While severity of AV may be influenced by other internal factors, such as genetic factors (family history of AV) and hormonal factors.

Our study discovered a moderate positive correlation between sebum levels and AV severity. It was compatible with previous studies such as Janiczek-Dolphin et al.'s (Janiczek-Dolphin et al., 2010) meta-analysis study in 2010, which reviewed 6 studies on the relationship between sebum levels and AV. They found positive correlation between AV and sebum levels. Choi et al (Choi et al., 2013) conducted a study in Korea, their study investigate the correlation between sebum levels and the number of inflamed lesions in 914 AV patients. The study found a weak positive correlation between sebum levels and inflamed lesions in patients with AV.

Sebum production is affected by genetic, hormonal, and environmental factors. Walton et al (Walton, Wyatt and Cunliffe, 1988) investigated sebum excretion and its relationship with AV severity in 20 pairs of identical twins, and 20 pairs of fraternal twins. They reported the identical twins had the same level of sebum excretion but with different AV severity levels, while both variables differ in the fraternal twins. The study showed that sebum excretion was influenced by genetic factors, while environmental factors played a larger role in AV severity. Studies by Youn et al (Youn et al., 2005) in 2005 and Qiu et al (Qiu et al., 2011) in 2011 suggested facial sebum levels in summer is higher compared to winter. Both studies supported the theory of increasing sebum production rates is affected by warmer temperatures. Based on those previous studies, positive correlation between sebum excretion levels and severity of AV in our study

could be affected by genetic, hormonal, and environmental factors, such as the hot weather in Jakarta.

There was no previous study about the correlation between sebum levels and lipid profile in patients with AV. However, Bhattacharyya et al (Bhattacharyya, Connor and Spector, 1972) in 1972, measured sebum excretion and cholesterol composition in the sebum of five subjects with hypercholesterolemia and six subjects in the control group. They found no significant differences in cholesterol levels in the sebum of subjects with hypercholesterolemia and the control group, and concluded that the relationship between lipid and sebum levels can be studied further, especially in patients with AV.

As we found positive correlation between sebum excretion levels and severity of AV, the role of medications to reduce sebum excretion is essential in AV treatment. Retinoids are the main component of AV treatment, especially in managing excessive sebum production. However, oral and topical retinoids use are limited due to their side effects, which include teratogenicity, skin and mucose irritation and dryness. Cleansing is important to rid the dirt, cosmetics, germs, and reduce sebum lipids on skin surface. It also helps the application of topical medications. But currently, there are limited studies about cleanser substances and role of cleansing in AV patients. Therefore, more studies on medications or substances which can reduce sebum production in AV are also needed.

5 CONCLUSION

This study showed that the relationship between lipid profile and AV still varies. Nevertheless, this study also revealed that sebum levels are affected by severity of AV. There are many factors affecting the results of this study such as diets, genetics, hormones and weather. Factors may vary depending on the country where the study is conducted and consequently affect the result. Further studies are needed to observe the relationship between dietary patterns and profile lipid in AV patients.

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