HUBUNGAN PROFIL LIPID DAN POLA DIET DENGAN PRODUKSI SEBUM DAN KEPARAHAN ACNE

Correlations Between Lipid Profile and Diet with Sebum Production and Acne Severity

Rosmelia Rosmelia[1*], Nurmala Widya Absari[2], Ratna Amalia Fairuz[2], Ika Fidianingsih[3]

[1]Departemen Dermatologi dan Venereologi, Fakultas Kedokteran, Universitas Islam Indonesia, Yogyakarta, Indonesia
[2]Fakultas Kedokteran, Universitas Islam Indonesia, Yogyakarta, Indonesia
[3]Departemen Histologi dan Biologi, Fakultas Kedokteran, Universitas Islam Indonesia Yogyakarta, Indonesia
*Email: rosmelia@uii.ac.id

ABSTRAK

Acne vulgaris (AV) bersifat kronis dan kambuhan, dan mengenai mengenai hampir 85% orang dewasa muda. Memahami patogenesis AV dapat mencegah terjadinya acne. Hubungan antara profil lipid dan diet dengan AV masih kontroversial. Penelitian ini bertujuan untuk apakah ada perbedaan status profil lipid dan frekuensi diet dengan produksi sebum dan total lesi AV. Penelitian dilakukan dengan desain cross sectional dengan responden sebanyak 57 orang mahasiswa Universitas Islam Indonesia. Responden dilakukan pemeriksaan keparahan AV, produksi sebum, kadar profil lipid darah, dan wawancara menggunakan semi qualitative food frequency questionnaire yang sudah tervalidasi. Analisis statistik dilakukan untuk melihat hubungan dan korelasi antar variabel dengan tingkat kepercayaan 95%. Hasil uji korelasi tidak menemukan adanya hubungan yang signifikan (p>0,05) antara profil lipid dengan tingkat produksi sebum dan derajat keparahan acne, kecuali antara kadar trigliserida dan tingkat produksi sebum (p=0,017). Terdapat perbedaan bermakna lesi acne total antara responden dengan produksi sebum normal dan rendah (25,7±20,7 vs 15,7±12,2, p=0,032). Hasil uji korelasi Spearman antara pola diet dengan produksi sebum dan total lesi acne adalah p>0,05 kecuali konsumsi kacang tanah dan sereal terhadap total lesi acne berturut-turut (p=0,023; r=0,317 dan p=0,043; r=-0,285). Kesimpulan adalah kadar trigliserida yang lebih tinggi berkaitan dengan peningkatan produksi sebum, yang berkorelasi dengan jumlah lesi acne yang lebih tinggi. Terdapat korelasi yang lemah antara frekuensi konsumsi kacang tanah dan sereal dengan total lesi acne.

Kata kunci*: diet, lesi acne, produksi sebum, profil lipid*

ABSTRACT

Acne vulgaris (AV) is chronic and recurrent inflammation of pilosebaceous follicles. It affects almost 85% of young adults. Understanding the pathogenesis of AV can help in preventing acne. The relationship between lipid profile and diet with AV is still controversial. This study aims to determine whether there is a correlation in lipid profile status and diet frequency with sebum production and acne severity. The study was conducted using a cross-sectional design involving 57 students of the Islamic University of Indonesia as respondents. Respondents were assessed for AV severity, the number of acne lesions, sebum production, and blood lipid profile levels. Respondents were interviewed using a validated food frequency questionnaire. Statistical analysis was performed to examine the relationship and correlation between variables at a 95% confidence level. Sebum production between respondents with normal vs. high triglycerides was 237.2±102.7 vs. 343.6±74.3 (p=0.028). Total acne lesions in high vs low sebum production were 25.7±20.66 vs 15.7±12.2 (p=0.032). The results of the Spearman correlation test between diet and sebum production and total acne lesions

were p>0.05 except for peanut and cereal diets on total acne lesions, respectively (p=0.023; r=0.317 and p=0.043; r=-0.285). In conclusion, Higher triglyceride levels are associated with increased sebum production, which correlates with a higher number of acne lesions. A weak correlation exists between peanut and cereal diet frequency and total acne lesions.

Keywords: acne lesions, diet, lipid profile, sebum production

INTRODUCTION

Acne vulgaris (AV) is a chronic, multifactorial skin disease characterized by inflammation of the pilosebaceous unit, including papules, comedones, pustules, nodules, and cysts, with a predilection mostly for the face, but can also involve the back, chest, and shoulders[1]. Based on Global Burden of Disease (GBD) data, approximately 85% of adolescents and young adults aged 12-25 have experienced acne. Research using GBD reports from 1990-2021 found an increase in incidence, prevalence, and disability-adjusted life years (DALYs) of 34%, 38%, and 37%, respectively[2]. During this period, by age group, the age-specific prevalence rate in adolescents and young adults increased the most, from 8,563 per 100,000 population in 1990 to 9,790 per 100,000 population in 2021.[3]Acne vulgaris is also a common skin condition in Indonesia. A study of 419 Indonesian women found an AV prevalence of 50% (20-30 years), 23% (31-40 years), 8.0% (41-50 years), and 2% (51-60 years)[4].

Acne vulgaris can cause discomfort and negatively impact self-confidence and quality of life. As many as 58% of adolescents with AV report feelings of stigmatization, a feeling of being looked down upon by others, and hindering interpersonal relationships[5]. In medical students with higher levels of stress, AV has many negative psychological and social impacts, including negative self-image, low self-confidence, shame, depression, anxiety, social withdrawal, and impaired social behavior.[6].

The primary goal of AV treatment, besides managing and addressing the lesion, is to prevent and minimize the frequency of recurrence. In this regard, understanding the pathogenesis of AV can be useful in preventing the disease.This[7].The pathogenesis of AV is the presence of inflammatory factors, excessive sebum production, colonization of Propionibacterium bacteria. *acnes,* hormonal imbalance, and lifestyle influences. The sebaceous glands are controlled primarily by hormonal stimulation. Thus, hormonal effects on sebum secretion are key to the pathogenesis acne[8]. Hormonal effects can be influenced by food. Although this is still relatively debatable due to environmental and habitual influences.[9] High-fat foods, milk, and cheese have been reported to increase sebum production.[10]. Consuming milk can stimulate sebocyte proliferation and increase the development of AV lesions. [11]One of the parameters of a high-fat diet is the lipid profile.

Recent lipid profile changes are associated with the occurrence of AV[12]. Lipid profiles, including cholesterol, triglycerides, high-density lipoprotein (HDL), and low-density lipoprotein (LDL), are associated with the risk of cardiovascular disease and unbalanced lipid metabolism. However, the relationship between lipid profiles and the incidence of AV remains controversial. A previous study by Sobhan (2020) found high cholesterol levels in patients with AV, especially in male patients. [12]. In another study conducted by Chunha (2015) it was shown that patients with grade II and III AV were more likely to experience changes in total cholesterol and low-density lipoprotein[13]. However, other studies have shown that moderate to severe AV does not show a decrease in HDL levels, and there is no relationship with other lipid profiles such as total cholesterol, LDL, and triglyceride levels[14].

This study aims to determine the differences in lipid profile categories and dietary patterns on sebum production and AV lesions. This study is expected to contribute to further understanding of AV pathogenesis and broaden insights into the role of lipid

profiles in developing more effective treatment strategies. Although previous studies have investigated the relationship between lipid profiles and AV, this study is unique in that it focuses on the UII student population. The sampling of acne patients among students of the Islamic University of Indonesia (UII) was chosen because this age group (18–25 years) is in an active hormonal phase that is physiologically susceptible to acne vulgaris. UII students also have a distinctive lifestyle, such as a diet high in simple carbohydrates, a habit of staying up late, and high levels of academic stress, all of which contribute to the appearance of acne. Furthermore, socio-religious characteristics such as hijab use, ablution routines, and preference for halal skincare products provide a unique dimension to dermatological studies. Yogyakarta's urban environment, exposed to pollution and high social media usage, also influences skincare habits and perceptions of appearance, making this population interesting for both clinical and sociocultural research.

METHODS

Research design

This study used a cross-sectional observational design. The study was conducted from August to December 2023. The research procedure was carried out after obtaining approval from the Ethics Committee of the Faculty of Medicine, Islamic University of Indonesia, Yogyakarta, Indonesia (Number: 10/Ka.Kom.Et/70/KE/VIII/2023). Participants were given informed consent regarding the study instructions, information that all data collected would be confidential, that participation was voluntary, and that their willingness to participate.

Participants

The inclusion criteria were male and female students of the Islamic University of Indonesia, aged 18-25, who were generally in good health. The first exclusion criterion was if participants had other illnesses or were taking medications that could affect the appearance of AV, such as hormones, corticosteroids, and isotretinoin. The second exclusion criterion was incomplete history, physical examination, and supporting examination data. A total of 67 students were willing to participate, but only 57 met the inclusion and exclusion criteria and ultimately became respondents in this study.

The sample size calculation for the 2-proportion difference test was performed via the website https://clincalc.com/stats/samplesize.aspx. The parameters used were incident anticipation.acne group 1: 73.7%, group 2: 26.3%, type I error (alpha) = 0.05, power 90%. The calculation results obtained sample size of groups 1 and 2 are 21 each, so the total is 42 people.

Variables and Instruments

Several variables were measured in the form of lesions on the respondents. Acne, sebum excretion rate, blood lipid profile, including total cholesterol, triglyceride, LDL, and HDL levels, and a food consumption questionnaire. The number of lesions was examined by a dermatologist and a venereologist. The sebum production rate was measured using a Sebumeter SM 815 (Courage-Khazaka, Germany) at three points (forehead, right cheek, and left cheek) in μg/cm2 units. The respondents' lipid profiles were examined from venous blood samples after a 10-hour fast by the Prima Diagnostika Clinical Laboratory, Yogyakarta. The examination and analysis methods used for the examination were: serum cholesterol levelscholesterol with the enzymatic colorimetric method CHOD-PAP, triglyceride levels with the enzymatic colorimetric method, HDL levels with the direct method, LDL levels with the direct method, and the Chol/HDL Ratio method: calculation. Respondents' food consumption data were obtained from interviews using questionnaires by research members who had carried out perception sharing.

Data Grouping

AV diagnosis is made by a doctor with severity criteria: acne is mild if a lesion is foundacne (blackheads, papules, nodules, cysts) total <30 with number of comedones <20, or inflammatory lesions <15, and no nodules/cysts;amoderate cne, if lesions are foundaTotal acne is 30-125 with 20-100 blackheads, or 15-50 inflammatory lesions, or <5 nodules/cysts; severe acne, if there are ≥125 total acne lesions with >100 blackheads, or >50 inflammatory lesions, or >5 nodules/cysts[15]. The average sebum production rate from 3 points was categorized as low (<80 ug/cm2), normal (80-160 ug/cm2), and high (>160 ug/cm2). Total cholesterol, triglyceride, LDL, and HDL levels were categorized into 2 categories: normal and dyslipidemia, with dyslipidemia limits of >200 mg/dL, >150 mg/dL, >130 mg/dL, and <40 mg/dL, respectively. Respondents were interviewed using a food frequency questionnaire to determine the frequency of consumption of boiled potatoes, cereals, cashews, almonds, peanuts, full-cream milk, powdered milk, cheese, yogurt, fried tempeh, fried fritters, chocolate, French fries, cooking oil, margarine/butter, and pizza. The semi-quantitative Food Frequency Questionnaire (FFQ) used has been previously validated in the Indonesian population (Aryawangsa et al., 2023). [10]. Data collection and analysis were carried out by the research team in consultation with nutritionists. The frequency of food consumption was categorized into 2 groups, namely never or rarely (1-3 times per month) and often (>1 time per week).

Statistical Analysis

Differences in sebum production between lipid profile groups were tested using the Independent t-test, while differences in the number of lesions between lipid profile groups were tested using the Mann-Whitney U test. The Chi-square test was used to see the relationship between sebum categories and acne. Spearman's correlation test was used to see the relationship between diet and the number of lesions. Acne and sebum production. Statistical tests used a 95% confidence level with a p-value <0.05, which is considered significant.

RESULT

Respondent characteristics

The majority of respondents were women between the ages of 18 and 23. Their lipid profiles were generally normal, except for higher-than-normal cholesterol levels. Participants generally had mild AV. Respondents generally had a small number of lesions, but normal sebum production (Table 1).

Table 1. Respondent Characteristics

Characteristics	Measure	Value
Gender		
Man	Frequency (%)	40 (70.2)
Woman		17 (29.8)
Age (years)	Mean ± SD	19.84 ± 1.18
BMI (kg/m2)		
Underweight		5 (8.8)
Normal	Frequency (%)	23 (40.4)
Overweight		12 (21.1)
Obesity I		10 (17.5)
Obesity II		7 (13.3)
Total cholesterol (mg/dL)	Frequency (%)	
Normal		33 (57.9)
Dyslipidemia		24 (42.1)
Triglycerides (mg/dL)	Frequency (%)	
Normal		52 (91.2)
Dyslipidemia		5 (8.8)
HDL (mg/dL)	Frequency (%)	
Normal		50 (87.7%)

Characteristics	Measure	Value
Dyslipidemia		7 (12.3)
LDL (mg/dL)	Frequency (%)	
Normal		33 (57.9)
Dyslipidemia		24 (42.1)
Total acne lesions	Mean ± SD	22.19 ± 18.64
Severity of acne	Frequency (%)	
Light		42 (73.7)
Medium-severe		15 (26.3)
Sebum production rate	Frequency (%)	
Low		29 (50.9)
Normal		28 (49.1)

The results of the correlation test (Table 2) show no significant relationship. There was a correlation between lipid profiles and acne severity and sebum production (p>0.05), except for a weak correlation between triglycerides and sebum production (r=0.316, p=0.017).).

Table 2. Relationship between Lipid Profile and Acne Severity and Sebum Production

	Severity of acne		p-value	Sebum production		p-value
	Mild n (%)	Moderate Severe n (%)		Low n (%)	Normal n (%)	
Cholesterol						
Normal	25 (75.8%)	8 (24.2%)	0.683	18 (54.5%)	15 (45.5%)	0.525
Dyslipidemia	17 (70.8%)	7 (29.2%)		11 (45.8%)	13 (54.2)	
Triglycerides						
Normal	39 (75.0%)	13 (25.0%)	0.476	29 (55.8%)	23 (44.2%)	0.017**
Dyslipidemia	3 (60.0%)	2 (40.0%)		0 (0%)	5 (100%)	
HDL						
Normal	33 (70.2)	14 (29.8%)	0.449	23 (49.8%)	24 (51.1%)	0.534
Dyslipidemia	9 (90.0%)	1(10%)		6 (60%)	4 (40%)	
LDL						
Normal	24 (72.7%)	9 (27.3%)	0.851	18 (54.5%)	15 (45.5%)	0.525
Dyslipidemia	18 (75%)	6 (25%)		11 (45.8%)	13 (54.2%)	

Description: *Spearman test; **r = 0.316

Table 3. Test of Differences in Lipid Profiles between Sebum Production Groups and Acne Severity

Lipid profile (mg/dL)	Sebum production		p-value
	Low Mean±SD	Normal Mean±SD	
Cholesterol	194.07 ± 30.04	210.61 ± 16.65	0.164*
Triglycerides	104.24 ± 16.65	111.29 ± 29.48	0.873**
HDL	48.0 ± 8.67	50.79 ± 12.08	0.320*
LDL	125.22 ± 29.05	137.56 ± 47.71	0.528**
	Severity of acne		p-value
	Mild Mean±SD	Moderete Severe Mean±SD	
Cholesterol	202.83±47.64	200.40±33.56	0.964**
Triglycerides	108.83±23.69	104.53±24.93	0.554*
HDL	48.33±10.55	52.27±10.07	0.215*
LDL	132.73±42.67	127.22±29.62	0.856**

Description: * Independent T test; ** Mann-Whitney test

The results of the difference test (Table 3) between groups with low and normal sebum production, and groups with mild and moderate-severe acne, did not show any significant differences. However, it was found that the group of respondents with normal

(higher) sebum production had more acne lesions than the lower group, although this difference was not significant (p=0.065, Mann-Whitney U test (Figure 1
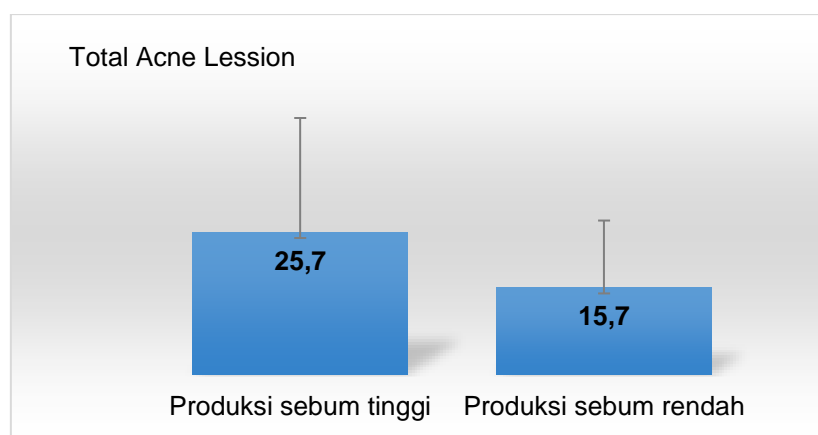

Figure 1. Difference in Total Acne Lesions between Sebum Production Categories

Respondents with normal (higher) sebum production had more acne lesions than respondents with low sebum production (p=0.032)

Table 4. Relationship between Dietary Patterns and Total Acne Lesions and Sebum Production

Types of food	Frequency of consumption		Total acne lesions*		Sebum production rate*	
	Seldom N (%)	Often N (%)	p-value	r value	p-value	r value
Boiled potatoes	51 (100%)	0	NA	NA	NA	NA
Cereals	48 (84.2%)	3(5.3%)	0.023	-0.317	0.636	-0.074
Cashew nut	15 (26.3%)	36 (63.2%)	0.775	-0.041	0.391	0.136
Almond	17 (29.8%)	34 (59.6%)	0.299	0.148	0.708	0.065
Peanuts	49 (86%)	2 (3.5%)	0.043	0.285	0.269	0.158
Full cream milk	22 (38.6%)	29 (50.9%)	0.327	0.140	0.377	0.109
Milk powder	47 (82.5%)	4 (7%)	0.446	-0.109	0.153	-0.216
Cheese	41 (71.9%)	10 (17.5%)	0.186	-0.188	0.175	-0.193
Yogurt	46 (80.7%)	5 (8.8%)	0.839	0.029	0.553	0.085
Fried tempe	9 (15.8%)	42 (73.7%)	0.510	-0.094	0.479	-0.101
Fried tempeh	14 (24.6%)	37 (64.9%)	0.779	0.040	0.311	0.145
Fritters	19 (33.3%)	31 (54.4%)	0.768	0.043	0.358	-0.133
Chocolate	18 (31.6%)	33 (57.9%)	0.253	-0.163	0.477	0.102
French fries	20 (35.1%)	31 (54.4%)	0.072	-0.254	0.662	0.063
Cooking oil	0	51 (100%)	NA	NA	NA	NA
Margarine	10 (17.5%)	41 (71.9%)	0.146	-0.206	0.963	0.007
Pizza	25 (43.9%)	26 (45.6%)	0.622	0.071	0.985	0.003

Description: * Spearman correlation test

Diet-related interview data were obtained from 51 respondents. All respondents rarely consumed boiled potatoes and frequently consumed cooking oil; therefore, these two dietary variables could not be analyzed. Spearman's correlation analysis showed a weak positive correlation between peanut consumption and the number of acne lesions (p = 0.023, r = 0.317). In contrast, cereal consumption showed a weak negative correlation with the number of acne lesions (p = 0.043, r = −0.285) (Table 4).

DISCUSSION

In this study, the majority of participants were female with an average age of 19.8 years. Data from the 2021 Global Burden of Disease Study shows that women are more likely to experience acne vulgaris (AV), with the 14-19 age group being the most affected.[1]The study also showed that nearly half of the respondents had cholesterol levels above normal limits. This aligns with the shift in dietary patterns in developing countries toward a Western lifestyle, with a diet high in saturated fat, sugar, and processed foods, and low in fiber[16]. This trend is thought to contribute to the increasing prevalence of AV among adolescents. The average total cholesterol levels of respondents were found to be above normal or higher. This is one of the reasons why the increasing number of adolescents experiencing AV is due to increased consumption of a Western diet[1].

The results of this study indicate that the majority of respondents (73.7%) experienced mild AV, but 26.3% had moderate to severe severity. This is consistent with global data showing that approximately 20% of the population has moderate to severe AV[17]. Analysis of this study's data found no differences in sebum production levels and acne severity between groups with normal lipid profiles and those with dyslipidemia. This is consistent with the results of research by Khairina (2018), which showed no association between lipid profiles (total cholesterol, triglycerides, LDL, or HDL) and AV[18]. However, other studies have found a relationship between the severity of AV and total cholesterol, LDL, and HDL[19]. This is because AV is also influenced by many other factors, such as genetics, hormonal influences, such as androgens, insulin-like growth factor (IGF1), testosterone, and cortisol[20]. In this study, respondents with high triglycerides were associated with higher sebum production. This is similar to the results of a study in East Java that showed a significant association between elevated triglyceride levels and the incidence of AV.[21]. This is likely due to the stimulation of the sebaceous glands to produce sebum, which subsequently plays a role in the formation of comedones in the pathogenesis of acne. Elevated triglyceride levels also trigger the activation of the enzyme 5-delta desaturase, which increases arachidonic acid production, ultimately producing leukotrienes and prostaglandins (PGE2), which are inflammatory mediators. PGE2 formation can also trigger the release of histamine by mast cells and the formation of bradykinin. This mechanism likely plays a role in the inflammation of AV lesions[22]. This finding is further supported by data showing that respondents with higher sebum production (although still within normal limits) also exhibited a greater number of acne lesions.

The results of this study indicate that adolescents who consume cereals more frequently tend to have fewer acne lesions. This finding is consistent with a previous study conducted in Malaysia involving 1,117 acne cases and 723 controls, which reported that frequent consumption of common breakfast foods, including butter, probiotic drinks, cereals, and milk, was associated with a reduced risk of developing acne vulgaris and a lower severity of acne scarring[23]. The influence of a nut diet is still controversial; research on students in Padang who experienced AV consumed nuts more often than those who did not experience AV[22]. However, on the other hand, in teenagers in Surabaya who consumed peanuts, it did not cause AV[24]. The results of a systematic review indicate that foods with a high glycemic index, high glycemic load, and excessive carbohydrate intake have pro-inflammatory and acnegenic effects[25]. Studies with other types of food, such as milk (full-fat/whole, low-fat, low-fat/skim), dairy products (cream, ice cream, yogurt, cheese), or chocolate (cocoa, dark/milk chocolate), have shown inconsistent results. Research on the relationship between food types and acne alone is insufficient to provide sufficient information, as different food preparation methods result in different nutritional content[26]. The impact of diet on AV formation is also likely to depend on gender and ethnicity[27]. Although fat generally increases the

risk of developing diseases, including AV, this depends on the type of fat consumed. Promising dietary intakes to support AV therapy include omega-3 fatty acids and γ-linoleic acid, probiotics, fruits, and vegetables[28].

Limitations of this study include the limited coverage of respondents from one university and the dietary questionnaire's lack of detailed food preparation methods. However, these findings provide important insight into the tendency of college students to have high cholesterol levels, which institutions should address to promote a healthy lifestyle. The relationship between triglycerides and sebum production also underscores the need for dietary control in the management of AV.

CONCLUSION

This study found that most respondents were women with mild acne. Elevated triglyceride levels were associated with increased sebum production, and higher sebum production was correlated with a greater number of acne lesions. A weak correlation was observed between higher legume consumption and lower cereal intake, with an increased total number of acne lesions. Further studies are recommended to include a larger sample size and to consider the influence of food processing methods in dietary assessment instruments.

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