


## The Relationship Between Diet and Body Mass Index with Events of Acne Vulgaris among Medical Students

Yeheskiel Holoaino Bunga<sup>1</sup>, Amanda Gracia Manuputty<sup>2</sup> , Elpira Asmin<sup>3</sup>,  
Santi Aprilian Lestaluhu<sup>4</sup>, Yudhie Djuhastidar Tando<sup>1</sup>

<sup>1</sup>Faculty of Medicine, Universitas Pattimura, Ambon – Indonesia

<sup>2</sup>Department of Dermatology and Venereology, Faculty of Medicine, Universitas Pattimura, Ambon – Indonesia

<sup>3</sup>Department of Public Health, Faculty of Medicine, Universitas Pattimura, Ambon – Indonesia

<sup>4</sup>Department of Nutrition, Politeknik Kesehatan Kemenkes Maluku, Ambon – Indonesia

### ABSTRACT

**Background:** Acne vulgaris is a chronic inflammatory disease of the pilosebaceous unit characterized by clinical features such as comedones, papules, pustules, and nodules that affect social and psychological functions. Foods containing carbohydrates with a high glycemic index can trigger acne vulgaris. Consumption of fatty foods, chocolate, milk, nuts, and cheese can stimulate the recurrence of acne vulgaris. Objective: This study aims to determine the relationship between dietary habits and body mass index (BMI) and the incidence of acne vulgaris among students of the Faculty of Medicine of Pattimura University. **Methods:** This research is an observational analytic study with a cross-sectional design. Samples were selected using a proportional stratified random sampling technique with a simple random sampling approach, totaling 89 respondents. Respondents were required to fill out the SQ-FFQ questionnaire and undergo height and weight measurements. **Result:** Out of 89 respondents, 81% frequently ( $\geq 2 \times$ /day) consumed carbohydrates 82% often ( $1 \times$ /day) consumed proteins and 71% often ( $1 \times$ /day) consumed reduced-fat. Regarding the quantity of intake, 55% of respondents consumed high carbohydrates per day, 69% consumed high proteins per day, and 24% consumed high fat intake per day. The prevalence of acne vulgaris was 66%,  $p$ -value  $< 0.05$ . **Conclusion:** There is a significant relationship between dietary habits based on carbohydrate, protein, and fat intake and the incidence of acne vulgaris. However, there is no significant relationship between BMI and the incidence of acne vulgaris among medical students at Pattimura University.

Keywords: Acne Vulgaris, Dietary Habits, Body Mass Index, Medical Students.

Correspondence: Amanda G. Manuputty, Faculty of Medicine, Universitas Pattimura, Ambon-Indonesia, email: [ag.manuputty@gmail.com](mailto:ag.manuputty@gmail.com), phone number: +628134228420.

| Article info |

Submitted: 06-02-2024 Accepted: 16-05-2024, Published: 31-07-2024

This is an open access article under the CC BY-NC-SA license <https://creativecommons.org/licenses/by-nc-sa/4.0/>

### BACKGROUND

Acne vulgaris is a chronic inflammatory disease of the pilosebaceous unit, which has a polymorphic clinical picture in the form of comedones, papules, pustules, and nodules.<sup>1</sup> The main lesions of acne vulgaris are comedones in the form of flat or slightly protruding papules with a slightly dilated central surface containing black keratin. The most common areas of predilection for acne vulgaris are the

face, shoulders, neck, chest, upper back, and upper arms, because the sebaceous glands are often active in these areas. Acne vulgaris can cause complications such as scarring or scarring.<sup>2</sup> This skin disease is not dangerous, but it can have a significant impact on sufferers by impairing social and psychological functions such as anxiety, low self-esteem, and depression.<sup>3</sup> Acne vulgaris sufferers may experience shame and a lack of trust about their looks and facial

scars, which can have an impact on their academic value and social environment.<sup>3</sup>

Acne vulgaris can appear in children aged 9 years, but peaks in boys, especially at ages 17-18 years, and in women aged 16-17 years.<sup>4</sup> The *Global Burden of Disease* (GBD) study states that globally, acne vulgaris affects 85% of adults and young people aged 12-25 years.<sup>5</sup> A study conducted in Germany found that 64% of people 20-29 years and 43% aged 30-39 years suffered from acne vulgaris.<sup>6</sup> In Southeast Asia, the prevalence of acne vulgaris is 40-80% of cases. Meanwhile, according to cosmetic dermatology records in Indonesia, acne vulgaris sufferers continue to increase every year.<sup>7</sup> Acne vulgaris has a multifactorial cause, several factors are thought to contribute to the occurrence of acne vulgaris including hormones, age, hygiene, genetics, food and drugs. The pathogenesis of acne vulgaris itself is due to sebum hypersecretion, epidermal follicle hyperproliferation, an increased number of *Propionibacterium acnes*, and an increased inflammatory response.<sup>8</sup>

Food as one of the factors causing acne vulgaris is still a controversy. In general, foods glycemic index acne vulgaris. Consumption of fatty foods, chocolate, milk, nuts, and cheese can stimulate the recurrence of acne vulgaris.<sup>9</sup> One of the studies on diet and acne vulgaris conducted by Srikitta<sup>13</sup> states that carbohydrates with high glycemic levels and total fat can exacerbate acne vulgaris. The results showed that there was a significant relationship between carbohydrate intake ( $p=0.047$ ) and total fat ( $p=0.025$ ) and the incidence of acne vulgaris.<sup>10</sup> Another study conducted by Hasan<sup>11</sup> regarding the relationship between diet and the incidence of acne vulgaris in nursing college at the Faculty of Medicine of University of Sam Ratulangi Manado there was no correlation between diet and the incidence of acne vulgaris ( $p > 0.05$ ).<sup>11</sup>

Body Mass Index (BMI) is the method most often used to measure a person's weight level. According to the *World Health Organization* (WHO) there are several levels of body weight, namely *underweight*, normal weight, *overweight*, and obesity, which can be calculated by means of body weight (kg) divided by the square of height (m)<sup>2</sup>.<sup>12</sup> Overweight and obesity occur as a result of excessive accumulation of body fat which is usually accompanied by excess androgen hormones, so that may be related to the severity of acne vulgaris. Previous research conducted by Pranasari found that people who are *overweight* or obese have 2.423 times higher risk of acne vulgaris than people with *underweight* or normal weight.<sup>13</sup> This

is because of people. Those who are overweight and obese have relatively high androgen levels because they are related to *insulin-like growth factor-1* (IGF-1) levels, which can trigger sebum hypersecretion. Another study conducted by Aulia N. Fitriani et al.<sup>14</sup> Stated that there was no significant relationship between BMI and the incidence of acne vulgaris ( $p > 0.05$ ).<sup>14</sup>

The Faculty of Medicine of Pattimura University is one of the state universities in Ambon City, Maluku Province, which is located at Jl. Ir. M. Putuhena. Some students of the Faculty of Medicine of Pattimura University are overseas students who do not live with their families but live independently in boarding houses so the food consumed is often ready-to-eat or food. While on campus, students sometimes only eat makeshift food or what is only available in the canteen, such as *snacks*, sweet drinks, and fried foods which can trigger acne vulgaris.

Following this, researchers are interested in conducting a study on the relationships between eating, BMI, and the incidence of acne vulgaris among medical students.

## METHODS

This research is an observational analytic study with a *cross-sectional*. This research took place in 2023, from March 30 to at the Faculty of Medicine, of Pattimura University. The target population is pre-clinical students of the Faculty of Medicine of and the population is students from class of 2019-2022, who are still actively studying at the Faculty of Medicine of Pattimura University. In this study the sampling technique used a proportional technique stratified random sampling with the type of sampling using a simple random approach sampling. Researchers took samples by dividing the population into four strata of sample units based on the student batch (2019 - 2022). Furthermore, a number of students from each strata were randomly assigned to utilize the Microsoft Excel application. Every member of the population has a chance to be selected as the sample. The minimum sample size in this study was calculated using Slovin's formula, which is:

$$n = \frac{N}{1 + Ne^2}$$

Given:

N = Population size

n = Sample size

e = Margin of error (error tolerance)

Based on the formula above, we have:

Given: N = 777, e = 10%.

$$n = \frac{777}{1 + 777(10\%)^2}$$

$$n = \frac{777}{8,22}$$

n = 88.59 (rounded up to 89).

According to the calculations, the minimal sample size for the entire study is 89 samples. The selection of respondents was based on inclusion criteria, namely active pre-clinical students from the 2019-2022 batches at the Faculty of Medicine, Pattimura University, and students who completed the questionnaire fully and underwent height and weight measurements. The exclusion criteria were students with a history of food allergies, students undergoing treatment for acne vulgaris, and students currently on a diet program.

The research instrument used a manual stepping scale with the brand "Onemed" to measure body weight and a microtoise to measure height. As for the Semiquantitative Food Frequency Questionnaire (SQ-FFQ) to assess eating patterns in periods certain time determined by the Ministry of Health of the Republic of Indonesia (Kemenkes RI), the food consumption survey method (SKP) for the SQ-FFQ group, as well as a food photo book, helped respondents complete the questionnaire.<sup>15</sup>

The data in this study are primary data obtained from interviews, filling out the dietary pattern questionnaire (SQ-FFQ), measuring weight and height directly using manual tread scales and *microtoise*, and observation by a dematovenereologist to assess the diagnosis of acne. Researchers obtained data by grouping the respondents who meet the inclusion and exclusion criteria into their respective categories. In the research process, the researcher was assisted by five colleagues and one dermatologist. The researcher has explained the interview technique for filling out the SQ-FFQ questionnaire. The collected data will be analyzed using the *Statistical Package for the Social Sciences* (SPSS). The analytical method used in this study univariate analysis on each variable, followed by ivariate analysis to see the relationship between the two variables that have been determined based on research results.

This research has received ethical approval from the Ethics Commission of the Faculty of Medicine, Pattimura University, Ambon (061/FK-KOM.ETIK/VIII/2023).

## RESULT

Characteristics of Respondents by Gender, Age, and class. Female respondents have a higher percentage (61.7%) compared to male respondents (38.3%). Based on age, respondents aged 18 years have the largest percentage (28%), followed by those aged 19 and 20 years (25% and 20.3%, respectively), while the fewest respondents were aged 23 years, with 1.1%. Based on cohort, the class of 2022 has the most respondents (31.5%), followed by the class of 2021 (25.8%), the class of 2020 (23.7%), and the class of 2019 (19%).

**Table 1.** Meal frequency distribution based on carbohydrate, protein, and fat intake

Food type	Meal frequency						Total	
	S*	%	O*	%	VO*	%	n	%
Carbohydrate	12	13	72	81	5	6	89	100
Protein	16	18	73	82	0	0	89	100
Fat	26	29	63	71	0	0	89	100

(\*S = Sometimes; \*O = Often; \*VS = Very often)

Respondents' eating frequency for each type of food was grouped into five categories: never consumed, rarely consumed (2x/month), sometimes consumed (1x-6x/week), often consumed (1x/day), and

very often consumed (>2x/day). Table1 shows that most of the respondents have dietary habit of frequently consuming high-carbohydrate foods (1x/day), which is as many as 72 respondents (81%),

protein 73 respondents (82%), and fat 63 respondents (71%).

Respondents' eating patterns based on the amount of food intake per day were grouped into intake foods with a high content of carbohydrates, proteins, and fats in the low, normal, and high categories high. Carbohydrate intake is said to be low if carbohydrates consumed are <368 g/day, normal if carbohydrates consumed 368–375 g/day, high if carbohydrates consumed > 375 g/day. Intake protein is said to be low

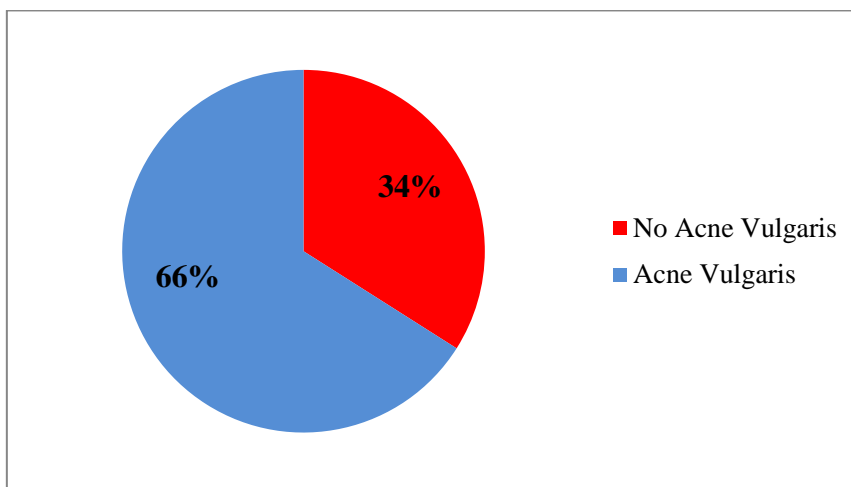
if the protein consumed is <62 g/day, normal if protein are consumed 62–66 g/day, and high if protein intake is >66 g/day. Fat intake is said to be low if the fat consumed <89 g/day, normal if the fat consumed is 89–91 g/day, and high if the fat consumed is >91 g/day. Most of the respondents had a diet that contained carbohydrate intake (55 respondents) and intake (61 respondents) per day were included in the highcategory, while fat intake was included in low category (50 respondents).

**Table 2.** Distribution of food intake based on carbohydrate, protein and fat consumption per day

Food type	Amount of food						Total	
	High	%	Normal	%	Low	%	n	%
Carbohydrate	55	62	20	22	14	16	89	100
Protein	61	69	14	16	14	16	89	100
Fat	21	24	18	20	50	56	89	100

Based on the results of the analysis, many respondents had a BMI in the normal range (37 respondents) and were also overweight (37 respondents), while the fewest had a BMI in the underweight range (15 respondents). The prevalence of

acne vulgaris among the 89 respondents, as depicted in Figure 1, shows that 66% of individuals experienced acne vulgaris, while 34% did not. The percentage of acne vulgaris is more common in females, at 58.2%, compared to 35% in males.



**Figure 1.** Prevalence of Acne Vulgaris.

**Table 3.** Relationship between diet based on total carbohydrate intake and the incidence of acne vulgaris

Dietary habits (Amount of carbohydrate)	Acne vulgaris		No acne vulgaris		Total		<i>p-value</i>
	n	%	n	%	n	%	
High	46	83,6	9	16,4	55	100	<0,001
Low to normal	8	23,5	26	76,5	34	100	
Total	54	60.7	35	39.3	89	100	

In Table 3 the analysis shows the relationship between dietary habits based on the amount of carbohydrate intake per day and the incidence of acne

vulgaris in students of the Faculty of Medicine of Pattimura University. The results using *chi square* obtained a *p value* <0.001. This *p-value* indicates a

significant relationship between dietary habits based on the interpretation of the amount of carbohydrate intake per day and the incidence of acne vulgaris. Respondents with acne vulgaris with the highest prevalence were found in the high carbohydrate intake

dietary group, namely 83.6%, while the highest percentage of respondents who did not experience acne vulgaris was found in the dietary habit group with low to normal carbohydrate intake, namely 76.5%.

**Table 4.** Relationship between diet based on total protein intake and the incidence of acne vulgaris

Dietary habits (amount of protein intake)	Acne vulgaris		No acne vulgaris		Total		<i>p-value</i>
	n	%	n	%	n	%	
High	41	75,9	13	24,1	54	100	0.001
Normal	7	33,3	14	66,7	21	100	
Low	6	42,9	8	57,1	14	100	
Total	54	60.7	35	39.3	89	100	

Table 4 shows the relationship between diet based on the total protein intake per day and the incidence of acne vulgaris in students of the Faculty of Medicine of Pattimura University. The results of the chi-square test obtained a value of  $p = 0.001$ . This p-value indicates a positive relationship, which means there is a significant relationship between diet based on the interpretation of the amount of protein intake per

day and the incidence of acne vulgaris. Respondents with highest prevalence of avne vulgaris were found in the group with a high protein intake, which was 75.9%. While the highest percentage of respondents who did not have acne vulgaris was found in the normal protein intake dietary habits dietary habits group, namely 66.7%.

**Table 5.** Relationship between diet based on total fat intake and the incidence of acne vulgaris.

Dietary habits (amount of fat intake)	Acne vulgaris		No acne vulgaris		Total		<i>p-value</i>
	n	%	n	%	n	%	
High	18	85,7	3	14,3	21	100	0.019
Normal	8	44,4	10	55,6	18	100	
Low	28	56	22	44	50	100	
Total	54	60.7	35	39.3	89	100	

Table 5 illustrates the relationship between dietary habits ased on the total fat intake per day and the incidence of acne vulgaris in students of the Faculty of Medicine of Pattimura University. The results of the chi-square test  $p = 0.019$ . This p-value indicates a significant relationship between diet based on the interpretation of the amount of fat intake per day and

the incidence of acne vulgaris. Respondents with acne vulgaris with the highest prevalence were found in the dietary habits group with high at intake, which was 85.7%. While the highest percentage of respondents who did not have acne vulgaris was found in the normal fat intake dietary habits group, namely 55.6

**Table 6.** The relationship between BMI and the incidence of acne vulgaris.

BMI Category	Acne vulgaris		No acne vulgaris		total		<i>p-value</i>
	n	%	n	%	n	%	
Underweight	10	66.7	5	33.3	15	100	0.873
Normal	22	59.5	15	40.5	37	100	
Overweight	22	59.5	15	40.5	37	100	
total	54	60.7	35	39.3	89	100	

BMI : Body Mass Index

Table 6 describes the relationship between BMI and the incidence of acne vulgaris in medical students of Pattimura University. The results of the chi-square test obtained a value of  $p = 0.873$ , which

## DISCUSSION

Diet is a regulation of the amount and type of food in daily life to maintain health, prevent disease, help cure disease, and improve nutritional status.<sup>16</sup> A healthy diet is the habit of eating sufficient quantity, quality, and type of food to fulfill nutrients such as macronutrients and micronutrients.<sup>17</sup> Macronutrients are nutrients needed in large quantities by the body as a direct source of energy. Results of the study explained that most of the medical students diet high in carbohydrates, protein, and low in fat. This is in line with research conducted by Cholidah R et al<sup>18</sup> regarding diet in students of the Faculty of Medicine of Mataram University, West Nusa Tenggara, which showed there were 38 respondents (43.18%) with the right diet and 50 students (56.82%) with the wrong diet.<sup>18</sup>

There are 10 types of food sources of carbohydrates that are often consumed by medical students, namely white rice, bananas, potatoes, sweet bread, plain bread, noodles, vermicelli, watermelon and lontong. The types of food sources of protein most often consumed by them are chicken eggs, tofu, tempeh, meat, squid, peanuts, tuna, cakalang fish, meatball, and shrimp. Food sources of fat most often consumed, are chicken meat with skin, full cream milk, cooking oil, cheese, rendang, coconut milk, seasoning oil, fish oil, and pizza. High intakes of carbohydrates and protein are influenced by the availability of food in the city of Ambon, which includes a variety of carbohydrates such as rice, cassava, sweet potato, taro, bananas and sago, as a source of carbohydrates and protein sources such as fish, beans, tofu, tempeh, and eggs.<sup>10</sup>

This study found that most of the respondents had BMIs in the normal and overweight categories. This is in line with research conducted by Andriana J et al.<sup>16</sup> which stated that most students in the Faculty of Medicine have BMIs in the normal category, followed by respondents who have BMIs in the obese category.<sup>16</sup> Another study conducted by Astuti LW et al.<sup>19</sup> also mentioned that most students in the Faculty of Medicine have BMIs in the normal category. This is influenced by age. In adolescence, BMI tends to be dominated by the normal category at 61%, followed by thin at 53.1%, and fat at 3.9%.<sup>19</sup>

The results of the study described that most (66%) of medical students of Pattimura University had acne vulgaris. This is in line with research conducted by Ayudianti P et al.<sup>19</sup> mentioned that the majority of new acne vulgaris patients visited the Dermatology and Dr. Soetomo are students. Acne vulgaris is influenced by several triggering factors, such as genetics, environment, age, diet, stress, cosmetics, and drugs. Pattimura University medical students who experience

showed that there was no significant relationship between BMI and the incidence of acne vulgaris. The highest acne vulgaris prevalence was found in respondents who were underweight, with 6.7%.

acne vulgaris mostly occur in the female.<sup>19</sup> This is in line with research conducted by Manasip CK et al.<sup>20</sup> showed that females experienced more acne vulgaris at the Faculty of Medicine of Sam Ratulangi University. This is because the androgen levels in women are relatively high and begin to decline at menopause. Androgen hormone originates from the mechanism of cholesterol conversion.<sup>20</sup> This study was also supported by another study conducted by Wibawa I Gede et al<sup>18</sup> which mentioned that women are more susceptible to acne vulgaris. It is said that factor which Hormonal and cosmetic factors play a role in the emergence of acne vulgaris in women. Usually, lesions due to in the form of closed comedones and papulopustules. Hormonal factors associated with the menstrual period are due to a sudden increase in hormones that result in increased activity of the sebaceous glands, resulting in the appearance of acne vulgaris.<sup>18</sup>

The study illustrated the relationship between diet and the incidence of acne vulgaris in several aspects including the relationship between carbohydrate intake, fat intake, and protein intake. The results of the study found that there was a significant relationship between the amount of carbohydrate intake and the incidence of acne vulgaris in students of the Faculty of Medicine of Pattimura University, with a value of  $p < 0.001$ . The results of this study are in line with previous research conducted by Huang et al.<sup>21</sup> which stated that the consumption of high-carbohydrate foods will significantly reduce the risk of obesity and increase the risk of moderate to severe acne vulgaris in adults with an increase by 1.6 to 2.5 times.<sup>21</sup> Foods with a high glycemic index are found in carbohydrates such as white rice, rice porridge, bananas, white whole wheat bread, whole wheat bread, cereals, boiled potatoes, sweet potatoes, chips, cookies, sago, and watermelon. Foods with a high glycemic index can cause acute hyperinsulinemia, which results in an increase in *insulin growth factor 1* (IGF-1). Increased IGF-1 can trigger androgen secretion and proliferation of sebaceous glands in large quantities, causing the formation of hyperkeratocytes, which is the initial pathogenesis of acne vulgaris.<sup>22</sup> This study revealed that there is a significant relationship between the amount of protein intake and the incidence of acne vulgaris in students of the Faculty of Medicine of Pattimura University with a value of  $p = 0.001$ .<sup>22</sup> This result is in line with previous research conducted by Akbar AR et al.<sup>22</sup> here is a significant relationship between the amount of protein intake and the incidence of acne vulgaris in students of the Faculty of Medicine of Baiturrahman University, Padang, Class of 2019-2020, with grades  $p=0,00$ .<sup>22</sup> Protein is an energy-producing macronutrient that does not act as an energy source but as a substitute for damaged tissue

and body cells. Protein is an important Food substance for the body, considering its function as fuel in the body and as a building and regulatory substance. However, if consumed in excess, it will trigger acne vulgaris. This is due to the fact that the *whey protein* content has triggering effect on acne vulgaris. Whey Protein can stimulate the subsequent increase in IGF1 and increase the growth and division of skin cells, sebum production, the efficacy of *tidak perlu italic* (LH), and estrogen production.<sup>22</sup> *Whey protein* is abundant in meat and milk and can activate excessive mTORC1, which can trigger increased *insulin/IGF-1 signaling* upregulation (IIS) and suppress *AMP-activated protein kinase* (AMPK) activity. mTORC1 plays a key role in the pathogenesis of acne vulgaris, such as increasing the proliferation of *acroinfundibular keratinocytes*, hyperplasia of the sebaceous glands and lipogenesis of the sebaceous glands.<sup>22</sup>

This study also showed that there was a relationship between fat consumption and the incidence of acne vulgaris ( $p=0.019$ ). This results is in line with a study conducted by Wasono HA et al.<sup>23</sup>, which showed that there was a significant relationship between fat consumption and the incidence of acne vulgaris ( $p=0.00$ ).<sup>23</sup> Consumption of high-fat milk, especially skim milk, can increase IGF-1 in plasma. This affect androgen secretion in the ovary and can activate 5 alpha which converts testosterone to dihydrotestosterone, thus stimulating sebum production and causing hyperkeratinization of the pilosebaceous unit.<sup>23</sup> the Palmitic acid, a saturated fatty acid, is most

commonly found in the human body and is available in foods such as palm oil, meat and dairy products, as well as butter can also be synthesized endogenously from fatty acids, carbohydrates, and amino acids. Palmitic acid can cause acne vulgaris. This is due to the activating effect of *leucotrine-B4*, which causes an inflammatory Response that may affect acne vulgaris.<sup>24</sup>

This study found the highest prevalence of acne vulgaris in the *underweight* category, with 66.7%. the *chi square* test analysis found that there was no significant relationship between BMI and the incidence of acne vulgaris in medical students  $p = 0.873$  This is because this study did not classify acne based on severity and did not control for other factors that can influence the appearance of acne vulgaris, such as genetics, cosmetic usage and, face cleaning habit. The results of this study are supported by previous research conducted by Raditdra<sup>25</sup>, which states there is no relationship between BMI and the incidence of acne vulgaris in USU Medical Faculty students aged 19-23 years with a value of  $p = 0.336$ . In the research, Raditdra stated that BMI only had an effect on degree of severity of acne vulgaris, but does not trigger the occurrence of acne vulgaris.<sup>25</sup>

Based on the study's findings, it can be concluded that the consumption of carbohydrates, protein and fat has a significant relationship with the incidence of acne vulgaris, while body mass index does not have a significant relationship with the incidence of acne vulgaris among students of the Faculty of Medicine of Pattimura University.

## REFERENCES

1. Teresa A. Akne vulgaris dewasa: etiologi, patogenesis, tatalaksana terkini. *J Kedokt* 2020; 8(1): 952–64.
2. Sibero HT, Putra IWA, Anggraini DI. Tatalaksana terkini acne vulgaris. *J Kesehat Unila* 2019; 3(2): 313–20.
3. Tyasari IA, Pertiwi SB, Wibowo D. Karakteristik usia dan dampaknya terhadap kualitas hidup siswa dengan akne vulgaris. *Menara J Heal Sci* 2022; 1(3): 263–72.
4. Sibero HT, Sirajudin A, Anggraini DI. Prevalensi dan gambaran epidemiologi akne vulgaris di provinsi Lampung. *J Kedokt Unila* 2019; 3(2): 309–12.
5. Lynn D, Umari T, Dellavalle R, Dunnick C. The epidemiology of acne vulgaris in late adolescence. *Adolesc Health Med Ther* 2018; 1(7): 13–25.
6. Heng AHS, Chew FT. Systematic review of the epidemiology of acne vulgaris. *Sci Rep* 2020; 10(1): 1–29.
7. Shauma M, Panongsih R, Sani N, Wasono H. Hubungan Kebersihan Wajah terhadap Kejadian Akne Vulgaris pada siswa kelas X SMK Negeri Tanjungsari Lampung Selatan Tahun 2020. *J Med Malahayati* 2020; 4(April): 82–6.
8. Sulung NKS, Garna H, Budiarti I. Faktor risiko kejadian akne vulgaris pada remaja putri SMKN 10 Cilawu di Kabupaten Garut. *Bandung Conf Ser Med Sci* 2023; 3(1): 1–6.
9. Tan ST, Firmnsyah Y. New drug formulations for acne vulgaris - pathogenesis based treatment of acne vulgaris. *J Med Hutama* 2021; 02(04): 1021–6.
10. Akbar ade rosyida, Mona L, Tanjung S. Hubungan pola makan dengan kejadian akne vulgaris pada mahasiswa fakultas kedokteran Universitas Baiturrahmah Padang angkatan 2019-2020. *J Kedokt Nanggroe Med* 2022; 5(2): 1–10.
11. Hasan S, Kepel B, Rompas S. Hubungan pola makan dengan kejadian acne vulgaris pada mahasiswa semester V (lima) di Program Studi Ilmu Keperawatan Fakultas Kedokteran Universitas Sam Ratulangi Manado. *J Keperawatan UNSRAT* 2017; 3(1): 107156.
12. Gosa IPMW, Indonesiani SH, Ningrum RK. Hubungan antara Indeks Massa Tubuh dengan derajat akne vulgaris pada mahasiswa Fakultas Kedokteran dan Ilmu Kesehatan Universitas Warmadewa. *Aesculapius Med J* 2023; 3(1): 19–24.
13. Rasyid M fauzan abdillah. Pengaruh asupan

- kalsium terhadap indeks masa tubuh (IMT). *J Med Utama* 2021; 2(4): 1095–1095.
14. Fitriani AN, Achmad S, Hikmawati D. Hubungan indeks massa tubuh dengan derajat keparahan akne vulgaris mahasiswa FK Unisba. *Semin Penelit Sivitas Akdemika Unisba* 2018; 3(2): 632–9.
  15. Cholidah R, Widiastuti IAE, Nurbaiti L, Priyambodo S. Gambaran pola makan, kecukupan gizi, dan status gizi mahasiswa Fakultas Kedokteran Universitas Mataram, Nusa Tenggara Barat. *Intisari Sains Medis* 2020; 11(2): 416–20.
  16. Andriana J, Nunu N. Hubungan tingkat stres dengan Indeks Massa Tubuh pada mahasiswa Fakultas Kedokteran Universitas Kristen Indonesia. *J Kedokt Univ Palangka Raya* 2021; 9(2): 1351–61.
  17. Ayudianti P, Indramaya DM. Studi retrospektif: faktor pencetus akne vulgaris. *Dep Med fungsional Kesehat kulit dan kelamin* 2018; 26(1): 41–7.
  18. Arya IG, Winaya KK. Karakteristik penderita akne vulgaris di rumah sakit umum Indera Denpasar periode 2014-2015. *J Med udayana* 2019; 8(11): 1–4.
  19. Astuti LW, Yuliana N, Utami S. Gambaran Indeks Massa Tubuh (IMT) mahasiswa DIII Keperawatan Fakultas Kesehatan Universitas Samawa. *J Kesehat Samawa* 2021; 1(1): 24–9.
  20. Manarisip CK, Kepel BJ, Rompas S. Hubungan stres dengan kejadian acne vulgaris pada mahasiswa semester v (lima) Prodi Ilmu Keperawatan Fakultas Kedokteran Universitas Sam Ratulangi. *ejournal Keperawatan (e-Kep)* 2018; 3(1): 1–27.
  21. Zhang X, Huang X, Xiao Y, Jing D, Huang Y, Chen L, et al. Daily intake of soft drinks is associated with symptoms of anxiety and depression in Chinese adolescents. *Public Health Nutr* 2019; 22(14): 2553–60.
  22. Akbar AR, Mona L, Tanjung S. Hubungan pola makan dengan kejadian akne vulgaris pada mahasiswa Fakultas Kedokteran Universitas Baiturrahmah padang angkatan 2019-2020. *J Kedokt Nanggroe Med* 2022; 5(2): 1–10.
  23. Giovanni A, Anggoro Wasono H, Sani N, Nando Panonsih R. Hubungan diet tinggi lemak dengan kejadian akne vulgaris pada siswa SMKN Tanjungsari Lampung. *Arter J Ilmu Kesehat* 2020; 1(4): 313–8.
  24. Kucharska A, Szmurło A, Sinska B. Significance of diet in treated and untreated acne vulgaris. *Postep Dermatologii i Alergol* 2018; 33(2): 81–6.
  25. Raditra GZH, Sari MI. The correlation between Body Mass Index and acne vulgaris. *Sumatera Med J* 2020; 3(1): 13–22.