

Effects of Coffee Consumption on Acne Vulgaris Severity in Atma Jaya Medical Students in Jakarta, Indonesia

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Abstract

Introduction: Acne vulgaris is a common multifactorial skin disease. With diet as one of the possible factors, the rising habit of coffee consumption may have its own effects on acne. In present time, there is a lack of study between coffee consumption and acne vulgaris as well as the relationship between the two topics. This study aimed to analyze the effects of coffee consumption on acne severity.

Methods: A cross-sectional study was conducted from September to December 2022 on 106 Atma Jaya medical students in Jakarta, Indonesia, who has acne and consumed coffee in the past month when the study was performed. The students were asked to fill a questionnaire about demographic and filtering questions along with questions about coffee consumption in the past month based on Diet History Questionnaire III (DHQ III). Acne lesion observations on the face, upper back, and chest were then performed on every individual to calculate acne severity based on Global Acne Grading System (GAGS).

Results: Students who only drank black coffee tend to have lower acne severity score (mean±SD: 19.69±5.68) than those who drank coffee mixtures beverages (mean±SD: 25.41±5.11) (p-value<0.001). There was a significant negative correlation between acne severity scores and amount of black coffee consumed (p-value=0.001). On the other hand, there was a significant positive correlation between acne severity scores and amount of coffee mixtures beverages consumed (p-value<0.001).

Conclusion: The results of this study show that the types and amount of coffee consumed had significant effects on acne vulgaris severity in medical students.

Keywords: acne vulgaris - black coffee - coffee mixtures

INTRODUCTION

Acne vulgaris is a common skin condition that happens when there is inflammatory disorder in the pilosebaceous unit, which is a unit that consists of the hair follicle, sebaceous gland,

and arrector pili muscle. Both inflammatory and noninflammatory lesions can be seen on the face, upper arms, chest, and the back.^{1,2} Four main pathogeneses of acne vulgaris are inflammation, an increase in the sebum production that is caused by androgen

stimulation, excessive colonization of *Cutibacterium acnes* (*C. acnes*), and increased hyperproliferation of follicular keratinocytes.³ According to the Global Burden of Disease study, acne is the eighth-most prevalent disease in the world, with the prevalence rate at 9.4%.⁴ Studies across the countries found that acne is most common among adolescents and young adults between age 11 years until 30 years. The highest prevalence of acne is found in the age of 16 years until early 20 years.⁵

Beside age as one of the factors that contribute to acne prevalence, history of severe acne in family, genetics, environmental factors, as well as diet are able to contribute to the appearance of acne.⁶ One of diet habits people adhere to is drinking coffee every day. Based on a report from United States Department of Agriculture (USDA), it is noted that there is an increasing trend of coffee demand in Indonesia from year to year.⁷ It is expected that there is an improved demand as much as 7% and increased coffee consumption following the alleviation of pandemic-related regulations. Globally, coffee is the third-most drink people consume after water and tea.^{8,9}

Amid previous studies about various factors in acne development, there is still a lack of studies which examine the effects of coffee consumption on acne vulgaris. Moreover, present reviews have shown different

outcomes which lead to a research gap regarding the effects of coffee consumption on health.¹⁰⁻¹² Henceforth, this study aimed to investigate the effects of coffee consumption, especially the types and amount of coffee consumed, toward acne vulgaris severity.

METHODS

Study Design

This cross-sectional study was conducted between September and December 2022 among medical students in Atma Jaya Catholic University of Indonesia, Jakarta. The study was performed in accordance with the Helsinki Declaration, with the approval of the Ethics Review Board of School of Medicine and Health Sciences of Atma Jaya Catholic University of Indonesia (Letter No. 09/10/KEP-FKIKUAJ/2022). Students were informed beforehand, and an informed consent form was signed individually before the study started.

Subject and Sampling method

We used proportional to size sampling to find out how many students were needed from each year, followed by simple random sampling to find the final sample. The inclusion criteria of this study are as follows: active preclinical students from the admission year 2020 until 2022, age between 17 until 21 years, had acne, and consumed coffee in the previous month before the cross-sectional study started. Among the students, we found 124 students

that matched the inclusion criteria. The initial students were screened with exclusion criteria which are as follows: did not want to participate further, had inflammatory skin diseases other than acne vulgaris (such as rosacea, seborrheic dermatitis, contact dermatitis, folliculitis), had a Body Mass Index (BMI) count that was outside of normal range (between 18.5 to 24.9), had a Perceived Stress Scale (PSS) result in the high stress category, and had acne treatment. After the screening, 18 students were excluded from the analysis.

Data Collection

All participants answered a demographic questionnaire along with filtering questions to rule out the exclusion criteria as well as coffee consumption in the previous month based on Diet History Questionnaire III (DHQ III). Coffee consumption questions were divided into black coffee consumption, which was coffee drink with nothing added such as sweetener and milk, and coffee mixtures beverages consumption, which was coffee drink with additives such as sweetener, milk, and sauces. Consequently, we examined the students' acne lesions on the face, upper back, and chest directly under the

supervision of a dermatovenereologist to determine each participant's acne severity score based on Global Acne Severity System (GAGS).

Statistical Analysis

Demographic characteristics and acne severity value were expressed as mean \pm standard deviation (SD) for continuous variables while types and amount of coffee consumed were expressed as frequency and percentage for categorical variables. Normality was analyzed by Kolmogorov-Smirnov test for sample amount above 50 and Shapiro-Wilk test for sample amount under or equals to 50. The Mann-Whitney U test was used to discover the difference between acne severity of the group who only consumed black coffee and acne severity of the group who consumed coffee mixtures beverages. The Spearman correlation test was used to determine whether the amount of coffee consumed is correlated to acne severity and to determine the direction of the correlation. All data were analyzed with IBM SPSS software version 23.0 (SPSS Inc., Chicago, IL, USA).

RESULTS

Participants of this study were dominated by females (69.8%) and 18 years old students (39.6%). The students mostly came from the admission year 2022 (44.3%). All participants fell into the normal BMI category, ranging from 18.5 until 24.9, with most students had their BMI value around 23.6 until 24.9 (36.8%). Participants' PSS value was calculated by their answers in the questionnaire, and students with moderate stress PSS category were the dominant group in this study (74.5%). Among the 106 students, 26 of them only drank black coffee in the previous month (24.5%), while the rest of the students drank coffee mixtures beverages (75.5%) [Table 1].

Students who drank black coffee only were grouped into 3 categories based on how many cups of black coffee they consumed in the previous month. For each cup of coffee, we generalized the amount of black coffee to 8 fluid ounces according to standard American measurement, from which DHQ III came from. Almost half of the students who drank only black coffee consumed 1 until 6 cups in a week

(46.2%) [Table 2]. Meanwhile, students who consumed coffee mixtures beverages were divided into 8 groups according to how many times they drank coffee mixtures beverages in the previous month. Of those students, the majority drank 2 until 3 times in the previous month (36.3%) [Table 3].

The participants' acne severity scores ranged from 8–37 with the highest frequency being 27 (11.3%). The mean of acne severity score of all participants was 24.01 ± 5.78 . Most participants had their acne severity in the moderate GAGS category (Table 4). Students who drank black coffee only had significantly lower scores on the acne severity of GAGS (mean \pm SD: 19.69 ± 5.68) compared to those who drank coffee mixtures beverages (mean \pm SD: 25.41 ± 5.11) (p-value<0.001) [Table 5]. There was a significant negative correlation between acne severity scores and amount of black coffee consumed (p-value=0.001, R=-0.601). On the other hand, there was a significant positive correlation between acne severity scores and amount of coffee mixtures beverages consumed (p-value<0.001, R=0.653).

Table 1. Demographic characteristics of students

Variables	n (%)
Gender	
Female	74 (69.8)
Male	32 (30.2)
Age (years)	
17	6 (5.7)
18	42 (39.6)
19	33 (31.1)
20	23 (21.7)
21	2 (1.9)
Admission year	
2020	26 (24.5)
2021	33 (31.1)
2022	47 (44.3)
BMI range	
18.5 – 19.59	26 (24.5)
19.6 – 20.59	8 (7.5)
20.6 – 21.59	10 (9.4)
21.6 – 22.59	11 (10.4)
22.6 – 23.59	12 (11.3)
23.6 – 24.9	39 (36.8)
PSS	
Low (0 – 13)	27 (25.5)
Moderate (14 – 26)	79 (74.5)
Types of coffee consumed	
Black coffee only	26 (24.5)
Coffee mixtures beverages	80 (75.5)

Note: BMI=Body Mass Index, PSS=Perceived Stress Scale

Table 2. Amount of black coffee consumed in the previous month

Amount of Black Coffee Consumed	Frequency (n)	Percentage (%)
small amount until 3 cups in the past month	7	26.9
1 until 6 cups per week	12	46.2
1 until 3 cups per day	7	26.9
Total	26	100

Table 3. Amount of coffee mixtures beverages consumed in the previous month

Amount of Coffee Mixtures Beverages Consumed	Frequency (n)	Percentage (%)
1 time in the past month	8	10
2 – 3 times in the past month	29	36.3
1 time per week	9	11.3
2 times per week	8	10
3 – 4 times per week	20	25
5 – 6 times per week	1	1.2
1 time per day	4	5
2 or more times per day	1	1.2
Total	80	100

Table 4. Grade of acne severity according to Global Acne Grading System (GAGS)

Grade of acne severity (GAGS score)	Frequency (n)	Percentage (%)
Mild (1–18)	22	20.8
Moderate (19–30)	72	67.9
Severe (31–38)	12	11.3
Total	106	100

Table 5. Comparison of acne severity scores between groups

Group	n	Mean	SD	Median (Minimum-Maximum)	P
Black coffee only	26	19.69	5.68	18.00 (12.00–37.00)	<0.001
Coffee mixtures beverages	80	25.41	5.11	25.50 (8.00–36.00)	

Note: Independent samples *t*-test, Mann-Whitney U test. SD=Standard deviation.

DISCUSSION

As a multifactorial condition, diet plays a role in determining acne severity in many ways. Through this study, we found that both black coffee and coffee mixtures beverages and each amount consumed affected acne severity.

Coffee, as the main factor of this study, has had an increasing demand trend over the past years

globally. International Coffee Organization stated that in November 2022, world coffee exports reached 10.24 million bags, compared with 9.38 million bags in the previous year.¹³ The large amount of coffee demand can also be seen in the coffee consumption habit among the 106 students of this study, i.e. 73.1% students who only consumed black coffee had ≥

1–6 cups per week, meanwhile 53.8% students who consumed coffee mixtures beverages had ≥ 1 time per week. Our study also showed that more students drank coffee mixtures beverages than black coffee only. This high frequency of coffee mixtures beverages consumption confirms the result of National Coffee Association survey in the United States, which stated that cappuccino and latte were the two main choices of coffee mixtures beverages the survey's participants preferred, followed by the classic choice of black coffee.¹⁴

Most participants had their acne severity in the moderate GAGS category, followed by mild and severe categories, meanwhile there was no participant who got the very severe category. This result differs from a few studies that were conducted previously which had the highest frequencies of acne severity in the mild category.¹⁵⁻¹⁸ However, there is a similarity between them, namely the very severe category had the lowest frequency. Since acne is a multifactorial condition, there are numerous possible reasons as to why there are differences of results between this study and the other ones. Participants of this study came from medical students within the age of 17 years until 21 years, while some of the previous studies involved early teenager until adult participants. For instance, a study in Turkey examined acne in participants from age 13 years until 18 years (15.10 ± 1.53).¹⁵ A

systematic review of acne epidemiology in 2020 noted that both acne severity and acne prevalence are influenced by age.¹⁹ Acne prevalence increases with age, with the highest incidence in teenagers, and later decreases once reaching late teenage or young adult years. Acne starts in the early teenage years when sebum production starts, leading to the formation of comedones and followed by inflammatory lesions. During the teenage years, acne is found to be more severe among late teenagers rather than early teenagers or preteens.^{20,21} This is because sebum production is higher in older teenagers compared to younger ones. Another reason stated by Well D in 2013 is level of sex hormones affects the acne severity due to its secretion which tend to be highest in mid-teenage years.²²

Different elements including genetic factors, family history of acne, lifestyle, socioeconomics factors, cultural perceptions, until environmental factors such as seasons and air pollution level are also known to play its own important roles in the development and severity of acne.^{21,23,24} Namely, the nature of place where this study was conducted which is in a tropical country may differ the results provided by a study in Saudi Arabia, a country with 4 seasons.¹⁶ A difference in the access of proper healthcare between other countries and this study may also have its impact on the severity of acne.²⁰ Different design of studies,

such as the assessment and grading of acne severity, is also a factor to note in determining the results.

This study found that the types of coffee, between black coffee and coffee mixtures beverages, along with the amount of each type consumed, have significant effects to acne severity. The acne severity of students who consumed black coffee only tended to be lower compared to those who drank coffee mixtures beverages. Black coffee consumption had a negative correlation to acne severity, while coffee mixture consumption had positive correlation to acne severity.

Nuhu in a study about bioactive nutrients in coffee found that the compounds found in coffee have been associated with numerous beneficial effects on health.²⁵ The antioxidant, anti-inflammatory, and antimicrobe functions obtained from coffee nutrients like caffeine, chlorogenic acid, diterpenes, and trigonelline, may have affected the acne severity and acne occurrence. Polyphenols in coffee are able to decrease oxidative stress by trapping free radicals and they have been associated with its effects in reducing the risk of chronic inflammatory diseases development. Caffeine, which is the most well-known compound of coffee, plays a role in anti-inflammatory functions by increasing the release of anti-inflammatory cytokines and decreasing the release of proinflammatory ones.^{10,26,27} In short,

these functions the coffee nutrients possess may influence the acne severity by affecting the development of acne.

Contradictorily, the increase of acne severity in students who drank coffee mixtures beverages has the possibility of being influenced by the additives found in the beverages. A meta-analysis study showed that regular intake of milk is associated with higher acne severity.²⁸ Amino acid found in milk has the ability to increase IGF-1 (hepatic insulin like growth factor-1) synthesis. IGF-1 is known to stimulate multiple factors in the development of acne, like the proliferation of keratinocyte and sebum production.^{17,28,29} However, the same previously mentioned meta-analysis also found that the amount of milk consumption that was associated with higher odds ratio for acne is the intake of 1 glass of milk or more per day, meanwhile 2 until 6 glass per week consumption had no associations.²⁸ Hence, it remains unclear whether milk in the coffee mixtures beverages consumed by the students was sufficient to influence acne.

Another additive commonly found in coffee mixtures beverages is sweetener. Sugar and sauces with different flavors are among this group. High sugar intake is associated with high glycemic index dietary habit. Several studies have found the association between high glycemic index (GI) diet and/or high glycemic load (GL) diet and acne. Food with a

high GI and/or GL has been shown to worsen acne.^{17,30} It works by increasing the signaling pathway of IGF-1 which leads to enhanced androgenic stimulation and sebum production.¹⁷

The strength of this study is that acne severity is compared between medical students who drank black coffee only and students who drank coffee mixtures beverages. To our knowledge, this study is the first study to confirm that coffee consumption, based on the types consumed, has various significant effects on acne severity. In addition, the amount of coffee consumed also plays a role in affecting the acne severity. However, this study did not cover and control respondents' daily habits, such as diet and personal hygiene. Acne severity can be affected by personal habits of each respondent along with the habit of coffee consumption. Additionally, this study did not control the types and quality of coffee consumed, hence the possibility of differences in components that can affect acne severity. After the outcomes of this study, the next things to be discovered are which components and how much of it that are contained in the coffee beverages consumed are able to give significant effects, either negatively or positively, toward acne severity.

CONCLUSION

In conclusion, this study confirms the effects of coffee consumption on acne severity. There are differences in acne severity scores between group of students who consumed black coffee only and group of students who consumed coffee mixtures beverages, as well as difference of effects the amount of black coffee consumption and coffee mixtures beverages consumption have on acne severity. Further studies are needed to investigate which components and its amount of coffee drinks consumed that can give significant effects on acne vulgaris severity.

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CONFLICT OF INTEREST

Nil.

REFERENCES

1. Sutaria AH, Masood S, Saleh HM, Schlessinger J. Acne vulgaris. In: StatPearls [Internet] 2020 [cited 2020 Jun 24]. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/29083670>.
2. Martel JL, Miao JH, Badri T. Anatomy, hair follicle. In: StatPearls [Internet] 2020 [cited 2020 Jun 24]. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/29261946>.
3. Masterson KN. Acne basics. *J Dermatol Nurses Assoc*. 2018;10(2008):S2–10.
4. Karimkhani C, Dellavalle RP, Coffeng LE, Flohr C, Hay RJ, Langan SM, et al. Global skin disease morbidity and mortality an update from the global burden of disease study 2013. *JAMA Dermatol*. 2017;153(5):406–12.
5. Tan JKL, Bhate K. A global perspective on the epidemiology of acne. *Br J Dermatol*. 2015;172(S1):3–12.
6. Tan AU, Schlosser BJ, Paller AS. A review of diagnosis and treatment of acne in adult female patients. *Int J Womens Dermatol*. 2018;4(2):56–71.
7. Rahmanulloh A. Indonesia coffee annual report. United States Department of Agriculture [Internet] 2022 [cited 2022 Dec 6]. Available from: https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Coffee%20Annual_Jakarta_Indonesia_ID2022-0014.pdf.
8. Dybkowska E, Sadowska A, Rakowska R, Dębowska M, Świdorski F, Świąder K. Assessing polyphenols content and antioxidant activity in coffee beans according to origin and the degree of roasting. *Rocz Panstw Zakl Hig*. 2017;68(4):347–53.
9. Kanwar J, Taskeen M, Mohammad I, Huo C, Chan TH, Dou QP. Recent advances on tea polyphenols. *Front Biosci*. 2012;4 E(1):111–31.
10. Yorulmaz A. Coffee and skin: what do we know about it? *Turkiye Klinikleri J Dermatol*. 2019;29(1):31–5.
11. Zari S, Alrahmani D. The association between stress and acne among female medical students in Jeddah, Saudi Arabia. *Clin Cosmet Investig Dermatol*. 2017;10:503–6.
12. Mousavi A, Saedisomeolia A, Yekaninejad M, Ildarabadi A, Meshkani M, Vahid-Dastjerdi M. Effect of green coffee supplementation on androgens level in women with polycystic ovary syndrome: a randomized clinical trial. *Obes Med*. 2020;20:100298.
13. ICO. Coffee market report, December 2022. London: International Coffee Organization [Internet] 2022 [cited 2023 Jan 16]. Available from:

- <http://www.ico.org/documents/cy2022-23/cmr-1222-e.pdf>.
14. ICO. National coffee data trends 2022: media highlights. London: International Coffee Organization [Internet] 2022 [cited 2022 Dec 14]. Available from: https://www.ncausa.org/Portals/56/PDFs/Communication/20220315_media_highlights.pdf?ver=Xz7bwWmt8eAtyGxkFp30bg%3d%3d.
 15. Koku Aksu AE, Metintas S, Saracoglu ZN, Gurel G, Sabuncu I, Arikan I, et al. Acne: prevalence and relationship with dietary habits in Eskisehir, Turkey. *J Eur Acad Dermatol Venereol*. 2012;26(12):1503–9.
 16. Abo El-Fetoh NM, Alenezi NG, Alshamari NG, Alenezi OG. Epidemiology of acne vulgaris in adolescent male students in Arar, Kingdom of Saudi Arabia. *J Egypt Public Health Assoc*. 2016;91(3):144–9.
 17. Roengritthidet K, Kamanamool N, Udompataikul M, Rojhirunsakool S, Khunkhet S. Association between diet and acne severity: a cross-sectional study in Thai adolescents and adults. *Acta Derm Venereol*. 2021;101:adv00611.
 18. Muthupalaniappen L, Tan HC, Puah JWD, Apipi M, Sohaimi AE, Mahat NF, et al. Acne prevalence, severity and risk factors among medical students in Malaysia. *Clin Ter*. 2014;165(4):187–92.
 19. Hwee A, Heng S. Systematic review of the epidemiology of acne vulgaris. *Nature*. 2020;10(5754):1–29.
 20. Lynn DD, Umari T, Dunnick CA, Dellavalle RP. The epidemiology of acne vulgaris in late adolescence. *Adolesc Health Med Ther*. 2016;7:13–25.
 21. Bhate K, Williams HC. Epidemiology of acne vulgaris. *Br J Dermatol*. 2012;168(3):474–85.
 22. Well D, Levine SR. Acne vulgaris: a review of causes and treatment options. *J Dermatol Nurses Assoc*. 2014;6(6):302–9.
 23. el Haddad C, Gerbaka NE, Hallit S, Tabet C. Association between exposure to ambient air pollution and occurrence of inflammatory acne in the adult population. *BMC Public Health*. 2021;21(1):1–14.
 24. Krutmann J, Moyal D, Liu W, Kandahari S, Lee GS, Nopadon N, et al. Pollution and acne: is there a link? *Clin Cosmet Investig Dermatol*. 2017;10:199–204.
 25. Nuhu AA. Bioactive micronutrients in coffee: recent analytical approaches for characterization and quantification. *ISRN Nutr*. 2014;2014:1–13.
 26. Bouarab-Chibane L, Forquet V, Lantéri P, Clément Y, Léonard-Akkari L, Oulahal N, et al. Antibacterial properties of polyphenols: characterization and QSAR (quantitative structure–activity

- relationship) models. *Front Microbiol.* 2019;10:829.
27. Yahfoufi N, Alsadi N, Jambi M, Matar C. The immunomodulatory and anti-inflammatory role of polyphenols. *Nutrients.* 2018;10(11):1618.
28. Juhl CR, Bergholdt HKM, Miller IM, Jemec GBE, Kanters JK, Ellervik C. Dairy intake and acne vulgaris: a systematic review and meta-analysis of 78,529 children, adolescents, and young adults. *Nutrients.* 2018;10(8):1049.
29. Meixiong J, Ricco C, Vasavda C, Ho BK. Diet and acne: a systematic review. *JAAD Int.* 2022;7:95–112.
30. Ismail NH, Manaf ZA, Azizan NZ. High glycemic load diet, milk and ice cream consumption are related to acne vulgaris in Malaysian young adults: a case control study. *BMC Dermatol.* 2012;12:13.