

Evaluation of the relationship between lipid profiles and inflammatory parameters in patients with acne vulgaris

Gül Şahika Gökdemir¹ , Semahat Alp² , Cemal Nas³ , Hasret Ecevit⁴ 

¹ Mardin Artuklu University, Faculty of Medicine, Department of Physiology, Mardin, Türkiye

² Mardin Artuklu University, Faculty of Medicine, Department of Dermatology, Mardin, Türkiye

³ Gazi Yaşargil Training and Research Hospital, Department of Biochemistry, Diyarbakır, Türkiye

⁴ Mardin Artuklu University, Faculty of Medicine, Department of Medical Biology, Mardin, Türkiye

Received: 3 November 2024

Accepted: 23 December 2024

Published: 31 December 2024

Correspondence:

Dr. Gül Şahika GÖKDEMİR

Mardin Artuklu University, Faculty of Medicine, Department of Physiology, Mardin, Türkiye.

E-mail:

gulsahikagokdemir@artuklu.edu.tr



How to cite this article:

Gökdemir GŞ, Alp S, Nas C, Ecevit H. Evaluation of the relationship between lipid profiles and inflammatory parameters in patients with acne vulgaris. J Med Dent Invest 2024;5:e240384.
<https://doi.org/10.5577/jomdi.e240384>

Abstract

Aim: Acne vulgaris is a chronic inflammatory disease of the pilosebaceous unit, which typically begins in adolescence but can occur at any age throughout life. The role of lipid metabolism in sebum synthesis in sebaceous glands in the pathogenesis of acne vulgaris is still being studied. This study aims to investigate the relationship between lipid profiles and inflammatory markers in patients with acne vulgaris and those without acne vulgaris.

Methods: This study is designed as a retrospective study where the medical records of patients were reviewed. A total of 71 individuals, aged between 12 and 30, who applied to the Dermatology Clinic of Mardin Training and Research Hospital between January 1, 2022, and February 31, 2024, were included. Of these, 48 individuals were diagnosed with acne vulgaris and had not received any treatment, while 23 individuals were healthy controls with no history of chronic inflammatory systemic diseases or endocrine pathology. Demographic information (age, gender), lipid profile (cholesterol; CHO, triglycerides; TG, low-density lipoprotein; LDL, high-density lipoprotein; HDL), and inflammatory parameters (mean platelet volume; MPV, immature granulocyte; IG, platelet-large cell ratio; P-LCR, neutrophil-lymphocyte ratio; NLR, platelet-lymphocyte ratio; PLR, monocyte-lymphocyte ratio; MLR, and systemic immune-inflammation index; SII) were recorded. Appropriate statistical methods were used to evaluate the relationship between demographic characteristics, lipid profiles, and inflammatory parameters, depending on the type and distribution of the data. A p -value of <0.05 was considered statistically significant.

Results: No significant difference was observed in terms of demographic data between the patient groups. When lipid profiles and inflammatory parameters were compared between patients with acne vulgaris and the control group, TG levels were significantly higher in the patient group compared to the control group ($p = 0.039$). However, no statistically significant differences were found between the groups in terms of CHO, HDL, LDL, MPV, IG, P-LCR, NLR, PLR, MLR, and SII parameters ($p > 0.05$). According to Pearson correlation analysis, a positive correlation was found between P-LCR and CHO ($R: 0.399$, $p = 0.001$) and HDL ($R: 0.279$, $p = 0.022$), while a negative correlation was reported between P-LCR and LDL ($R: -0.317$, $p = 0.000$).

Conclusion: In our study, TG levels were found to be significantly higher in patients with acne vulgaris, and a correlation between P-LCR and lipid profile was reported. Our findings emphasize the necessity of considering the interaction between lipid profiles and inflammatory parameters in the treatment approach of patients with acne vulgaris.

Keywords: Acne vulgaris, lipid metabolism, lipid profiles, inflammatory parameters

Introduction

Acne vulgaris is one of the most common skin diseases affecting individuals, particularly during late adolescence, worldwide (1). The prevalence of acne among adolescents can reach up to 85%, and it also has a significant prevalence among adults. Today, acne is not seen as a health issue limited to adolescence; its prevalence in adults is steadily increasing (2). Acne vulgaris is a multifactorial disease contributed by many factors, such as increased sebum production, follicular hyperkeratinization, inflammation, and the follicular colonization of *Cutibacterium acnes* (formerly *Propionibacterium acnes*) (3).

The role of changes in lipid metabolism in the development of acne has attracted increasing attention in recent years. Sebum, which is secreted by sebaceous glands abundant in the face and scalp, consists of complex lipid components such as triglycerides, fatty acids, wax esters, squalene, cholesterol esters, and cholesterol. Sebum plays a central role in acne pathogenesis, and increased sebum secretion and changes in its composition are among the fundamental mechanisms of the disease (4). Increasing evidence suggests that changes in lipid profiles are strongly associated with acne formation (5). Inflammation is another critical factor in acne pathogenesis. After follicular hyperkeratinization and comedo formation, the inflammatory process begins. A comedo expands due to the accumulation of keratin, sebum, and bacteria, causing the follicular wall to rupture. Keratin, sebum, and bacteria that reach the dermis trigger an inflammatory response (6). The mechanisms by which inflammation is triggered in acne are not yet fully understood, but it is known that the main cells involved in inflammation are macrophages, neutrophils, Langerhans cells, lymphocytes, keratinocytes, and sebocytes (4).

Lipid imbalance may trigger follicular hyperkeratinization and inflammation by increasing sebum production. A balanced lipid metabolism is thought to play a significant role in controlling acne formation (5). However, data supporting this relationship are still limited, and the relationship between acne and lipid profiles should be investigated in more detail in different populations. The limited studies in our country on this issue make it important to investigate the relationship between lipid profiles and inflammatory markers in acne patients. Although many factors play a role in the pathogenesis of acne vulgaris, inflammation, excessive sebum production, and follicular hyperkeratinization are among the most significant contributors. In recent years, there has been an increased search for new parameters to evaluate and manage inflammation in acne treatment. Understanding the relationship between lipid metabolism and inflammation could bring a new approach to treatment processes. Additionally, inflammatory markers such as the Systemic Immune-Inflammation Index (SII), neutrophil-lymphocyte ratio (NLR), platelet-lymphocyte

ratio (PLR), and monocyte-lymphocyte ratio (MLR) have been developed to measure the degree of inflammation more objectively. These inflammatory parameters are calculated using neutrophil, monocyte, platelet, and lymphocyte values in the hemogram and are indicators whose popularity is increasing these days (7, 8). NLR is generally considered an indicator and prognostic marker of subclinical inflammation and has recently emerged as a new research topic in SII dermatology (7, 8, 9). Studies increasingly focus on hemogram parameters such as MPV, NLR, PLR, PCT, and RDW as indicators of treatment efficacy in dermatology (7, 8).

However, there are limited studies on the use of these parameters in dermatology and acne vulgaris patients.

Examining the relationship between lipid profiles and inflammatory markers in acne vulgaris patients could contribute to a better understanding of the biological foundations of the disease, thus improving treatment approaches. Therefore, the aim of this study is to investigate the relationship between lipid profiles and inflammatory parameters in patients with acne vulgaris.

Materials and Methods

The study was approved by the Non-Interventional Clinical Research Ethics Committee of Mardin Artuklu University, with approval number 2024/3-29, dated 05.03.2024.

Our study is designed as a retrospective study, examining patients' medical records. A total of 71 individuals were included in the study, consisting of 48 individuals aged 12-30 who were diagnosed with acne vulgaris and had not yet received treatment, and 23 individuals with similar demographic characteristics who did not have acne vulgaris or any history of chronic inflammatory systemic diseases or endocrine pathology. Individuals under the age of 12, over the age of 30, those using medications or suffering from diseases that could affect inflammatory and lipid profile markers, or those with active infections, were not included in the study.

Demographic data (age, gender), lipid profiles (cholesterol; CHO, triglycerides; TG, low-density lipoprotein; LDL, high-density lipoprotein; HDL), and inflammatory parameters (MPV, IG, P-LCR, NLR, PLR, MLR, and SII) were recorded from the hospital records of the included individuals. The NLR, PLR, MLR, and SII parameters were mathematically calculated from the lymphocyte, monocyte, and platelet counts obtained from hospital data.

Statistical analysis

Analyses were performed by using IBM SPSS 26.0 software (IBM Inc., Armonk, NY, USA).

The normal distribution of continuous data was analyzed using the Kolmogorov-Smirnov test. For data groups showing normal distribution, the Student's t-test

was used for analysis, the Kruskal-Wallis test was applied for multiple analyses of non-normally distributed data, and the Mann-Whitney U test was used for comparisons between two groups. Pearson correlation tests were performed to compare some data. A p-value of <0.05 was considered statistically significant for all comparisons.

Results

Table 1 shows the demographic data (age and gender), as well as the neutrophil, monocyte, lymphocyte, and IG levels in the groups. In our study, no significant differences were observed between the groups in terms of age and gender ($p > 0.05$). No statistically significant

differences were found in IG levels between the groups ($p > 0.05$).

The results of TG, CHO, HDL, LDL, MPV, P-LCR, NLR, PLR, MLR, and SII levels are shown in Table 2. TG levels were found to be significantly higher in acne vulgaris patients compared to the control group ($p = 0.039$).

In addition, there was no statistically significant difference between groups in terms of CHO, HDL, LDL, MPV, P-LCR, NLR, PLR, MLR, and SII parameters ($p > 0.05$). According to Pearson correlation analysis, a positive correlation was found between P-LCR and CHO ($R = 0.399$, $p = 0.001$) as well as HDL ($R = 0.279$, $p = 0.022$) levels, while a negative correlation was reported between P-LCR and LDL ($R = -0.317$, $p = 0.000$) (Fig. 1).

A graphical illustration of the study is shown in Figure 2.

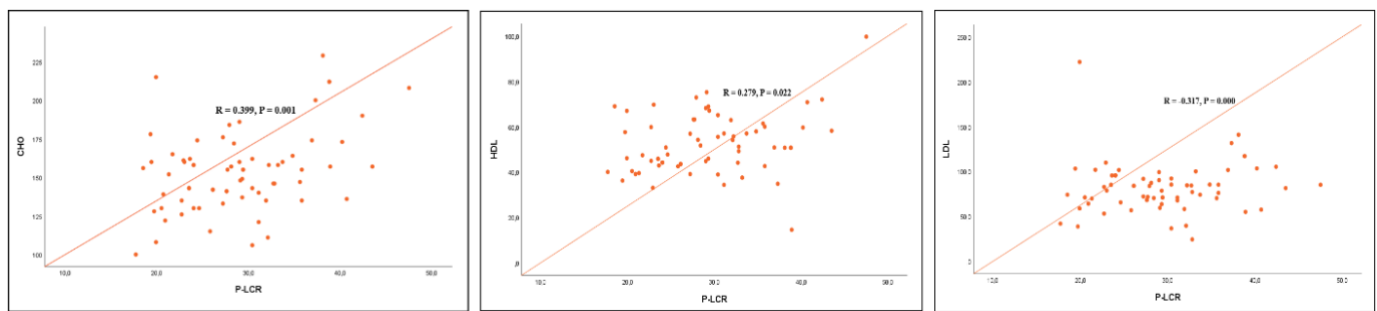


Figure 1. Correlation between Platelet-Large Cell Ratio (P-LCR) and Cholesterol (CHO), High-Density Lipoprotein (HDL), and Low-Density Lipoprotein (LDL) levels. R: Pearson correlation coefficient. Significant correlation, level of significance $p < 0.05$.

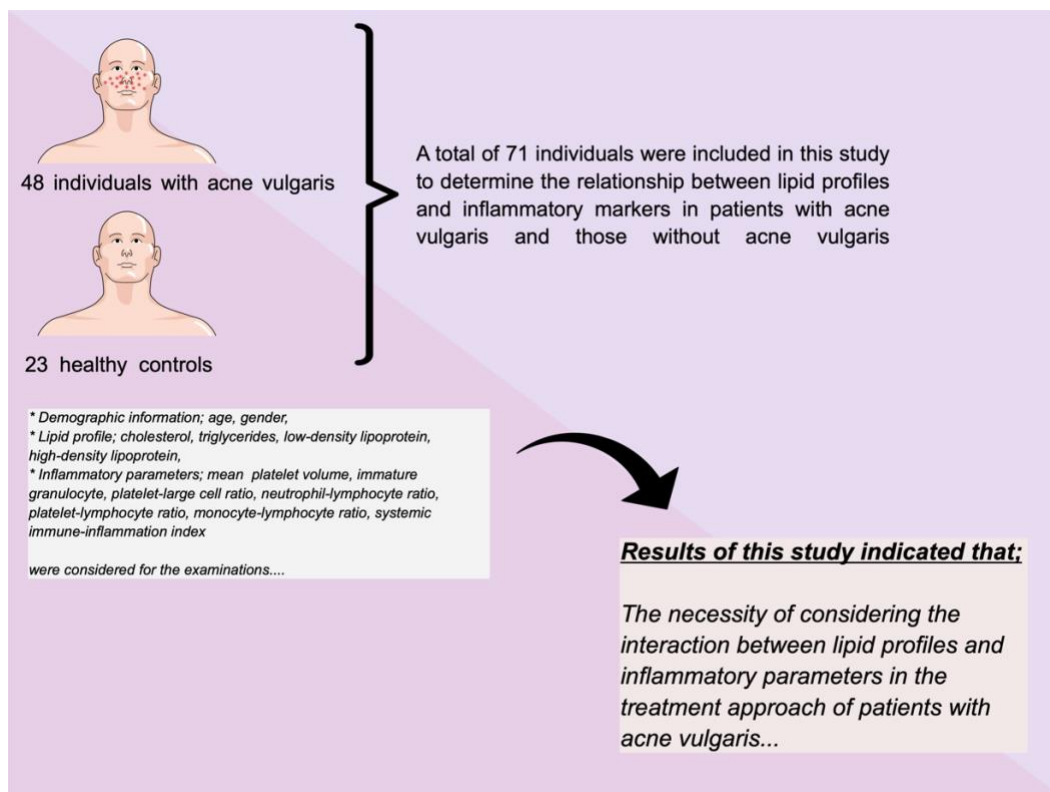


Figure 2. Graphical illustration of the study

Table 1. Demographic data (age and gender) and biochemical parameters (neutrophil, monocyte, lymphocyte, IG levels) comparison between control and acne vulgaris groups

Parameters	Control (Mean $\pm$ SD)	Acne Vulgaris (Mean $\pm$ SD)	<i>p</i>
Age (year)	20.09 $\pm$ 3.66	20.27 $\pm$ 5.25	<i>p</i> = 0.880
Gender	1.26 $\pm$ 0.449	1.23 $\pm$ 0.425	<i>p</i> = 0.773
Neutrophil (10 ³ /uL)	53.24 $\pm$ 11.02	52.60 $\pm$ 14.42	<i>p</i> = 0.897
Monocyte (10 ³ /uL)	53.24 $\pm$ 11.02	52.60 $\pm$ 14.42	<i>p</i> = 0.457
Lymphocyte (10 ³ /uL)	10.06 $\pm$ 2.30	10.55 $\pm$ 0.97	<i>p</i> = 0.169
IG (10 ³ /uL)	28.69 $\pm$ 6.67	29.56 $\pm$ 7.62	<i>p</i> = 0.174

IG: Immature granulocyte.

Table 2. Comparison of biochemical and inflammatory markers between control and acne groups

Parameters	Control (Mean $\pm$ SD)	Acne vulgaris (Mean $\pm$ SD)	<i>p</i>
TG (mg/dL)	88.83 $\pm$ 41.88	141.05 $\pm$ 153.45	<i>p</i> = 0.039
CHO (mg/dL)	149.13 $\pm$ 23.59	156.00 $\pm$ 27.35	<i>p</i> = 0.283
HDL (mg/dL)	53.24 $\pm$ 11.02	52.60 $\pm$ 14.42	<i>p</i> = 0.840
LDL (mg/dL)	53.24 $\pm$ 11.02	52.60 $\pm$ 14.42	<i>p</i> = 0.410
MPV (fL)	10.06 $\pm$ 2.30	10.55 $\pm$ 0.97	<i>p</i> = 0.336
P-LCR (%)	28.69 $\pm$ 6.67	29.56 $\pm$ 7.62	<i>p</i> = 0.625
NLR	1.91 $\pm$ 0.73	2.13 $\pm$ 0.84	<i>p</i> = 0.274
PLR	119.83 $\pm$ 36.79	124.98 $\pm$ 28.42	<i>p</i> = 0.558
MLR	0.228 $\pm$ 0.076	0.260 $\pm$ 0.089	<i>p</i> = 0.130
SII	548.35 $\pm$ 225.70	612.26 $\pm$ 323.73	<i>p</i> = 0.339

TG: Triglycerides, CHO: Cholesterol, HDL: High-density lipoprotein, LDL: Low-density lipoprotein, MPV: Mean platelet volume, P-LCR: Platelet-large cell ratio, NLR: Neutrophil-lymphocyte ratio, PLR: Platelet-lymphocyte ratio, MLR: Monocyte-lymphocyte ratio and SII: Systemic immune-inflammation index.

Discussion

Acne vulgaris is a chronic inflammatory disease characterized by relapses and flare-ups. It affects approximately 650 million people worldwide and is considered the most common skin condition, ranking as the seventh most prevalent health issue (10). In the pathogenesis of acne, inflammation, and lipid metabolism play a significant role. This study analyzes the relationship between lipid profile and inflammatory markers in patients with acne vulgaris.

In our study, there was no significant difference between the acne vulgaris group and the control group in terms of age and gender. According to our literature review, there are studies showing no significant differences in the prevalence of acne based on gender

(11), while other studies report a higher prevalence in women (12). This difference may be due to lifestyle, hormonal differences, and variations in skincare routines. Collier et al. noted that acne prevalence was significantly higher in adult women compared to men (13), while a meta-analysis conducted in China found a higher prevalence in men, suggesting that differences in lifestyle and androgen levels may be the cause (14). These findings indicate that gender-based factors can influence the prevalence of acne based on regional and demographic factors.

There are limited studies on the relationship between acne and lipid profiles such as TG, CHO, HDL, and LDL. Most studies in the literature have focused on the effects of drugs used in the treatment of acne on lipid profiles (15). In this study, however, we evaluated untreated acne patients. The relationship between acne

and lipid profiles in the literature presents conflicting results. El-Akawi et al. reported significantly lower HDL levels and higher TG and LDL levels in patients with severe acne (15). Similarly, a study conducted in China observed higher total cholesterol and LDL levels in patients with severe acne compared to healthy controls. These findings suggest that lipid profile abnormalities may play a role in the pathogenesis of acne, but the degree and nature of these changes may vary. Despite studies reporting lipid profile changes in acne patients, other studies have found no significant differences. For example, Ekiz et al. found no relationship between acne and TG, TC, LDL, or thyroid function (16). Cunha et al. did not observe significant differences in lipid profiles across different acne severity groups in a population in Brazil, indicating that lipid profile changes are not always related to acne severity (17). Additionally, a cross-sectional study conducted in Indonesia also found no significant correlation between lipid profiles and acne (18). These inconsistencies may arise from differences in study methodologies and acne grading systems. In our study, it was observed that TG levels were significantly higher in the acne vulgaris group compared to the control group. However, no significant difference was reported between the groups in terms of CHO, HDL, and LDL levels.

It is known that all acne lesions, including early-stage lesions, develop with an inflammatory process. In early-stage lesions, the density of perivascular lymphoid cells is prominent, while in later stages, polymorphonuclear cells dominate (19). Most studies in the literature have focused on the effects of drugs used in acne treatment on inflammatory markers (20). In our study, we evaluated untreated acne patients. It has been reported that in moderate-to-severe acne patients, inflammatory markers such as neutrophil count and NLR are significantly higher compared to healthy individuals (21). In recent years, studies have focused on inflammation parameters such as MPV, NLR, PLR, PCT, and RDW as indicators of anti-inflammatory activity in acne treatment. Despite conflicting results, many studies have confirmed a significant reduction in these inflammatory markers following systemic isotretinoin treatment (7). In our study, no significant differences were observed between the groups in terms of MPV, IG, P-LCR, NLR, PLR, MLR, and SII levels.

In particular, our study found a positive correlation between P-LCR and CHO and HDL, and a negative correlation between P-LCR and LDL. These correlations suggest that lipid metabolism interacts with inflammation in acne patients and reflects the inflammatory processes.

Limitations

The most significant limitation of our study is the small sample size. Additionally, factors such as individuals' dietary habits, physical activity levels, and genetic predisposition were not considered. Our current study

should be supported by further research with a larger sample size, where lifestyle factors, particularly dietary habits and physical activity levels, are taken into account. Future studies should also include individuals from different geographical regions and ethnic backgrounds. In this way, the role of lipid metabolism and inflammation in acne pathogenesis and its impact on treatment can be evaluated in more detail.

Conclusion

Certain relationships between lipid profiles and inflammatory parameters have been observed in patients with acne vulgaris. In particular, the correlation between P-LCR and lipid profile suggests that inflammation interacts with lipid metabolism, and this interaction may contribute to the pathogenesis of the disease. However, these findings need to be confirmed with larger and longer-term studies. Further research is needed to investigate the impact and clinical significance of the relationship between lipid metabolism and inflammation on treatment processes.

Disclosures

Ethical Approval: Ethics committee approval was received for this study from the Non-Interventional Clinical Research Ethics Committee of Mardin Artuklu University, in accordance the World Medical Association Declaration of Helsinki, with the approval number: 2024/3-29.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - G.Ş.G.; Design - G.Ş.G., S.A.; Supervision - S.A., C.N.; Materials - G.Ş.G., S.A.; Data collection &/or processing - C.N., H.E.; Analysis and/or interpretation - S.A.; Literature search - G.Ş.G.; Writing - G.Ş.G.; Critical review - G.Ş.G.

Conflict of Interest: There is no any conflict of interest.

Funding: There is no any funding.

References

1. Aydemir EH. Acne vulgaris. *Turk Pediatri Ars.* 2014;49(1):13-6. <https://doi.org/10.5152/tpa.2014.1943>
2. Smith EV, Grindlay DJC, Williams HC. What's new in acne? An analysis of systematic reviews published in 2009-2010. *Clin Exp Dermatol.* 2011;36:119-23. <https://doi.org/10.1111/j.1365-2230.2010.03921.x>
3. Nandy P, Shrivastava T. Exploring the Multifaceted Impact of Acne on Quality of Life and Well-Being. *Cureus.* 2024 Jan 22;16(1):e52727. <https://doi.org/10.7759/cureus.52727>
4. Özlü E, Baykan A, Ertaş R. Akne Vulgaris Etiyopatogenezi Genel Bakış. *J DU Health Sci Inst* 2018; 8(1): 44-51
5. Sobhan M, Seif Rabiei MA, Amerifar M. Correlation Between Lipid Profile and Acne Vulgaris. *Clin Cosmet Investig Dermatol.* 2020;21;13:67-71. <https://doi.org/10.2147/CCID.S230617>
6. Huang L, Yang S, Yu X, Fang F, Zhu L, Wang L, Zhang X, Yang C, Qian Q, Zhu T. Association of different cell types and inflammation in early acne vulgaris. *Front Immunol.* 2024; 31;15:1275269. <https://doi.org/10.3389/fimmu.2024.1275269>
7. Turan Ç, Metin N. A Novel Inflammatory Marker in the Follow-up of Moderate-to-Severe Acne Vulgaris Administered Isotretinoin: Systemic Immune-Inflammation Index (SII). *Current Health Sciences Journal* 2022;48(1)
8. Talay MN, Orhan Ö. The effect of neutrophil/lymphocyte ratio and mean platelet volume on the use of antivenom in snake bites and scorpion stings. *Phoenix Med J.* 2023;5(3):196-200. <https://doi.org/10.38175/phnx.1320445>
9. Bıçak EA, Orhan Ö, Turanlı EE, Bıçak M, Kılıç Y. The effect of cardiopulmonary bypass on hemogram parameters in patients operated for tetralogy of Fallot. *Med Pharm J.* 2023;2(3):149-157. <https://doi.org/10.55940/medphar202353>
10. Szepietowska M, Stefaniak AA, Krajewski PK, Matusiak L. Females May Have Less Severe Acne, but They Suffer More: A Prospective Cross-Sectional Study on Psychosocial Consequences in 104 Consecutive Polish Acne Patients. *J Clin Med.* 2023;19;13(1):4. <https://doi.org/10.3390/jcm13010004>
11. Bagatin E, Timpano DL, Guadanhim LR, Nogueira VM, Terzian LR, Steiner D, Florez M. Acne vulgaris: prevalence and clinical forms in adolescents from São Paulo, Brazil. *An Bras Dermatol.* 2014;89(3):428-35. <https://doi.org/10.1590/abd1806-4841.20142100>
12. Yang YC, Tu HP, Hong CH, Chang WC, Fu HC, Ho JC, Chang WP, Chuang HY, Lee CH. Female gender and acne disease are jointly and independently associated with the risk of major depression and suicide: a national population-based study. *Biomed Res Int.* 2014;2014:504279. <https://doi.org/10.1155/2014/504279>
13. Collier CN, Harper JC, Cafardi JA, et al. The prevalence of acne in adults 20 years and older. *J Am Acad Dermatol.* 2008;58:56-59. <https://doi.org/10.1016/j.jaad.2007.06.045>
14. Li D, Chen Q, Liu Y, Tang W, Li S. The prevalence of acne in Mainland China: a systematic review and meta-analysis. *Br Med J Open.* 2017;7:e015354. <https://doi.org/10.1136/bmjopen-2016-015354>
15. El-Akawi Z, Abdel-Latif N, Abdul-Razzak K, Al-Aboosi M. The relationship between blood lipids profile and acne. *J Health Sci.* 2007;53(5):596-599. <https://doi.org/10.1248/jhs.53.596>
16. Ekiz O, Balta I, Unlu E, Bulbul Sen B, Rifaioğlu EN, Dogramaci AC. Assessment of thyroid function and lipid profile in patients with postadolescent acne in a mediterranean population from Turkey. *Int J Dermatol.* 2015;54:1376-1381. <https://doi.org/10.1111/ijd.12547>
17. Cunha MG, Batista AL, Macedo MS, Machado Filho CD, Fonseca FL. Study of lipid profile in adult women with acne. *Clin Cosmet Investig Dermatol.* 2015;8:449-454. <https://doi.org/10.2147/CCID.S83248>
18. Nasution K, Putra I, Jusuf N. No association between lipid profiles and acne vulgaris. *Mol Cell Biomed Sci.* 2018;2(2):70-72. <https://doi.org/10.21705/mcbs.v2i2.33>
19. Tanghetti EA. The role of inflammation in the pathology of acne. *J Clin Aesthet Dermatol.* 2013, 6(9):27-35.
20. Esen M. Effect of isotretinoin treatment on inflammatory and hematological parameters in patients with acne vulgaris. *Cutan Ocul Toxicol.* 2024;43(1):27-32. <https://doi.org/10.1080/15569527.2023.2268166>
21. Turkmen D, Altunisik N, Sener S. Investigation of monocyte HDL ratio as an indicator of inflammation and complete blood count parameters in patients with acne vulgaris. *Int J Clin Pract.* 2020;74(12):e13639. <https://doi.org/10.1111/ijcp.13639>