JCTEI
JOURNAL OF CLINICAL TRIALS AND EXPERIMENTAL INVESTIGATIONS
Year: 2024 Volume: 3 Issue: 4

ORIGINAL ARTICLE

10.5281/zenodo.14550109

The relationship between social media addiction, inflammation, Dopamine, and awareness in adult patients with acne vulgaris

Mehmet Semih Celik[1], Mehmet Can Cepik[2]

1. Bismil State Hospital, Department of Dermatology, Diyarbakir, Turkey.
2. Firat University Hospital, Department of Psychiatry, Elazig, Turkey.

Correspondence
Mehmet Semih Celik, Bismil State Hospital, Department of Dermatology, TR21500, Diyarbakir, Turkey.
e-mail
drmsemihcelik@gmail.com

Received: 12 November 2024
Revised: 10 December 2024
Accepted: 12 December 2024
Published: 30 December 2024

Keywords
- Acne vulgaris
- Awareness
- Dopamine
- Inflammation

ORCID ID of the author(s):
MSC: 0000-0002-3378-0619
mcc: 0009-0002-4844-915X

Abstract

Objective: The aim of this study is to explore the relationship between social media addiction, inflammation, dopamine levels, and awareness in adult patients with acne vulgaris, considering psychological and physiological aspects.

Material and methods: A total of 98 participants were included in the study: 53 acne patients (23 male, 30 female) and 45 control group members (20 male, 25 female). Both the case and control groups consisted of non-smokers and individuals who were not addicted to alcohol or gambling. The patient group was divided into three subgroups (mild, moderate, and severe) based on the International Global Acne Grading System (IGA). All participants were administered the 6-item Bergen Social Media Addiction Scale (BSMAS), and according to the results, they were classified into four groups: mild, moderate, high, and very high addiction.

Results: The addiction level of the case group was observed as moderate with a score of 14.0±4.45, while the addiction level of the control group was observed as high with a score of 21.0±5.20. A significant difference was found between the two groups ($p<0.001$).

Conclusion: We attribute the lower level of addiction in acne patients compared to the healthy control group to a decrease in dopamine activation secondary to inflammation and to the state of awareness. However, it is clear that this issue requires further detailed research.

Cite as: Celik MS, Cepik MC. The relationship between social media addiction, inflammation, Dopamine, and awareness in adult patients with acne vulgaris. J Clin Trials Exp Investig. 2024;3(4):91-98.

Introduction

Acne (also known as Acne Vulgaris) is a chronic and persistent inflammatory skin condition affecting the pilosebaceous follicles, and it impacts individuals globally. More than 85% of adolescents are affected by acne, and the condition can persist into adulthood, particularly among women, who account for two-thirds of dermatology consultations for acne (1). Acne lesions are classified as either non-inflammatory (open/black and closed/white comedones) or inflammatory (papules, pustules, nodules, and cysts), which may lead to scarring and pigmentation on the skin, requiring long-term and consistent treatment. Typically, lesions are observed on the face, neck, upper back, and chest (1). Acne often involves the face, and since facial appearance plays a significant role in a person's body image perception, it is not surprising that individuals with facial acne may develop substantial psychosocial barriers. As part of the emotional impact, acne patients often experience increased levels of anxiety, anger, depression, and frustration (2).

In the cyber age, people interact not only face-to-face but also through social media platforms like Facebook and Instagram. Social media addiction has emerged as a global concern, with researchers worldwide conducting studies to evaluate the prevalence of this issue. However, reported rates of social media addiction vary significantly across the literature. Social media has become an almost ubiquitous aspect of daily life in the cyber age. As of July 2020, there were approximately four billion active social media users worldwide, with more than half of them being Facebook users (3). Social media allows people to make new friends and maintain communication with existing social network members without geographical or time restrictions (4).

The Bergen Facebook Addiction Scale (BFAS) is the most commonly used measure of social media addiction. It assesses six core components of behavioral addiction, referencing both diagnostic criteria and conceptual frameworks: salience, tolerance, mood modification, relapse, withdrawal, and conflict. Each of these components consists of three items, making a total of 18 items in the full version of BFAS. A shorter six-item version was created by selecting the item with the highest factor loading for each of the six components. With the emergence of more popular social media platforms (e.g., Instagram, Twitter), many individuals now have multiple social media accounts. Accordingly, BFAS was modified to expand its scope of inquiry beyond Facebook to include multiple social media platforms. Both the BFAS and the modified Bergen Social Media Addiction Scale (BSMAS) have demonstrated strong psychometric properties (5).

The aim of this study is to explore the relationship between social media addiction, inflammation, dopamine levels, and awareness in adult patients with acne vulgaris, considering psychological and physiological aspects.

Materials and methods

Ethical approval for this study was obtained from the Gazi Yaşargil Training and Research Hospital Ethics Committee. (11/10/2024 IRB no 216) This study was conducted in accordance with the principles of the Helsinki Declaration. It was carried out in compliance with the Good Clinical Practices (GCP) guidelines annexed to the circular no. 28617 of the Republic of Turkey. Informed consent was obtained from all participants for participation in the study. The study included 53 patients aged 18 and over (23 male, 30 female) who presented with acne vulgaris at the dermatology clinic. These patients were categorized into three groups—mild, moderate, and severe—based on the global

Table 1: Classification of severity of disease

Grade	Clinical Description
0	Clear skin with no inflammatory or noninflammatory lesions
1	Almost clear; rare noninflammatory lesions with more than one small inflammatory lesion
2	Mild severity; greater than grade 1; some noninflammatory lesions with no more than a few inflammatory lesions (papules/pustules only, no nodular lesions)
3	Moderate severity; greater than grade 2; up to many noninflammatory lesions and may have some inflammatory lesions, but no more than one small nodular lesion
4	Severe; greater than grade 3; up to many noninflammatory and inflammatory lesions, but no more than a few nodular lesions

Table 2: Social media addiction scale

	(1) very rarely	(2) rarely	(3) sometimes	(4) often	(5) very often
You spend a lot of time thinking about social media or planning how to use it.					
You feel an urge to use social media more and more.					
You use social media in order to forget about personal problems.					
You have tried to cut down on the use of social media without success.					
You become restless or troubled if you are prohibited from using social media.					
You use social media so much that it has had a negative impact on your job/studies.					

staging system (IGA) recommended by the FDA (Table 1). The control group consisted of 45 healthy individuals aged 18 and over (20 male, 25 female) who had no dermatological conditions. Both the patient and control groups were composed of individuals without smoking, alcohol, or gambling addiction. All participants completed the 6-item Bergen Social Media Addiction Scale (BSMAS). The questions on this scale were scored on a range from 1 (very rarely) to 5 (very often). The lowest possible score was 6, and the highest possible score was 30. Based on their scores, participants were classified into four groups: low addiction (6-11 points), moderate addiction (12-17 points), high addiction (18-23 points), and very high addiction (24-30 points) (Table 2).

Patients diagnosed with acne and those in the control group who agreed to participate in the study and signed informed consent were included. Patients under 18 years of age, those who did not sign informed consent, those who chose to withdraw from the study at any stage, and those who failed to provide detailed answers to the survey questions were excluded from the study.

Statistical analysis

Statistical analyses were performed using SPSS v27 and JAMOVI software. Descriptive statistics were presented as numbers and percentages for categorical variables, and as means, standard deviations, minimums, maximums, and medians for continuous variables. The Chi-Square Test was used to compare ratios within subgroups. The comparison of continuous variables between independent groups was conducted using either the Student's t-test or the Mann-Whitney U test, depending on the normality of the data distribution. The correlation between values and other data was evaluated using Pearson's Correlation Test. ROC analysis was performed to determine the predictive ability. A p-value of less than 0.05 was considered statistically significant.

Results

In this study, the mean age of the case group was 21.0±2.04, while the mean age of the control group was 20.9±2.37. There was no significant difference in terms of age between the two groups ($p>0.05$). Similarly, no significant difference was found between the groups regarding gender ($p>0.05$). The demographic data of the case and control groups are presented in Table 3.

Table 3: Demographic data of case and control groups

Group		Acne vulgaris n (%)	Control n (%)	P
Age (years)		21.0±2.04	20.9±2.37	p>0.05
Gender	Female	30 (57%)	25 (56%)	p>0.05
	Male	23 (43%)	20 (44%)	p>0.05

The addiction level in the case group was observed as moderate, with a score of 14.0±4.45, while the addiction level in the control group was observed as high, with a score of 21.0±5.20. A significant difference was found between the two groups ($p<0.001$).

When the distribution of addiction levels by gender was examined, the addiction score was 16.0±5.32 for men and 17.0±5.38 for women, and no significant difference was found between the two groups ($p>0.05$). The data

regarding dependency levels based on case, control, and gender are presented in Table 4.

Table 4: Data on addiction levels according to case, control, and gender

Group	Addiction	
Case	14.0±4.45	p<0.001
Control	21.0±5.20	
Male	16.0±5.32	p>0.05
Female	17.0±5.38	

The relationship between addiction level and age was evaluated using Pearson's Correlation Test. A negative correlation was observed between age and addiction level, but this relationship was not found to be strong (Pearson's r=-0.163) (Figure 1).

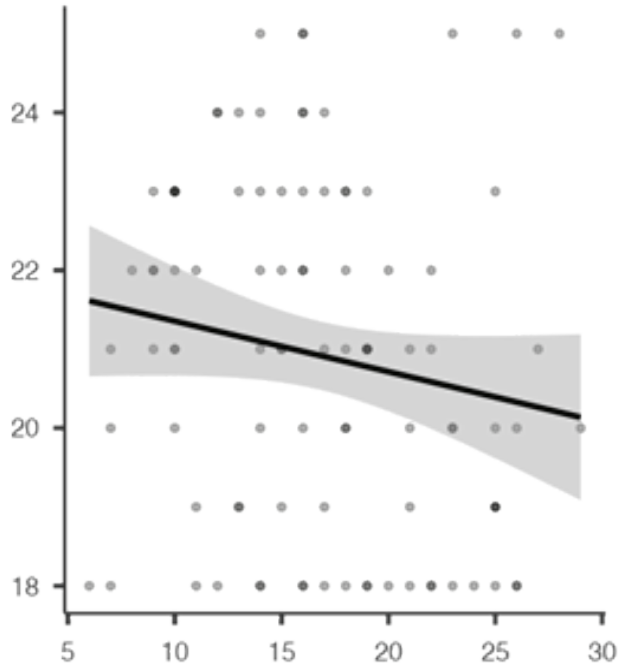

Figure 1: Relationship between Addiction Level and Age

The relationship between acne severity and addiction level was also evaluated using Pearson's Correlation Test. A positive correlation was observed between the severity of the disease and addiction level, but this relationship was not strong either (Pearson's r = 0.112) (Figure 2).

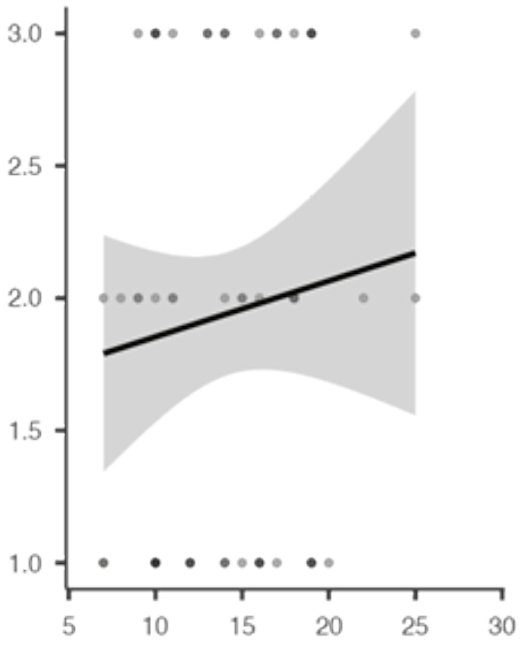

Figure 2: Relationship between Addiction Level and Acne Severity

Discussion

This study is one of the few that investigates the level of social media addiction in patients with acne. The social media addiction levels of the participants were assessed using the Bergen Social Media Addiction Scale (BSMAS). In our study, the average addiction level of the acne group was found to be 14, while it was 21 in the control group, indicating that acne patients were less addicted to social media compared to the control group.

We attribute this lower level of addiction to two main factors: the first being a reduction in dopamine activation in the brain, and the second being heightened awareness.

The pathogenesis of acne vulgaris is complex, involving interactions between hormonal, microbiological, and immunological factors. Nevertheless, the mechanisms underlying the causes of acne vulgaris remain unclear. Over the past decade, accumulating evidence has shown that acne vulgaris is a disease characterized by excessive inflammation in the pilosebaceous units and surrounding skin. This inflammation partly results from the interaction between Cutibacterium acnes (C. acnes) and skin cell components such as keratinocytes, sebocytes, and tissue macrophages. C. acnes is a Gram-positive anaerobic bacterium that secretes

inflammatory substances and plays a significant role in acne pathogenesis. It colonizes follicular channels and triggers an innate immune response, leading to the progression of so-called non-inflammatory comedones into inflammatory papules, pustules, or nodules (6).

In recent years, there has been a shift in understanding acne pathogenesis, with the current belief that it is primarily an inflammatory dermatitis. Studies have shown the presence of subclinical inflammation in the normal skin of acne patients even before the development of microcomedones (7). In a study by Jugeaou et al., an increase in pro-inflammatory cytokines such as TNF, IL-1, IL-8, and IL-12 was observed in individuals with inflammatory acne (8).

Selway et al. evaluated the role of Toll-like receptor 2 (TLR2) in acne pathogenesis and its importance in comedogenesis. Scientists found TLR2 expression in basal and infundibular keratinocytes and sebaceous glands, and they discovered that its activation triggered the release of IL-1α from primary human keratinocytes in vitro (9). Additionally, they found that C. acnes could induce mixed Th17/Th1 immune responses by stimulating the secretion of IL-17A and IFN-γ from specific CD4+ T cells in vitro. Moreover, Th17 and Th17/Th1 subpopulations specific to C. acnes have been found in the peripheral blood of acne patients. Kelhala et al. attempted to examine the inflammatory response in vivo in acne lesions, particularly the IL-23/Th17/IL-17A axis. IL-17 and IFN-γ exhibited synergy in promoting the production of pro-inflammatory cytokines in keratinocytes (10).

Dopamine (DA) is a critical neurotransmitter that plays a key role in maintaining and supporting a positive human mindset, including healthy mood and motivation, through its function in the reward/motivation system. On the other hand, neuropsychological studies, including neuroimaging research, have widely demonstrated the relationship between deficits in the reward system and addictions such as cocaine addiction, food addiction, and the problematic use of the Internet, which is considered one of the latest forms of behavioral addiction (11).

Studies have shown that cytokines released during the inflammatory response target subcortical structures, including the basal ganglia and dopamine function. Chronic exposure to inflammation and inflammatory cytokines can lead to lasting changes in the basal ganglia and dopamine function, which are reflected in symptoms like anhedonia, fatigue, and psychomotor slowing (12). In a study conducted on mice, it was shown that the activation of peripheral inflammation and the systemic release of inflammatory cytokines can have profound effects on the brain and behavior, with the remarkable finding that local tissue inflammation can activate distinct brain regions even in the absence of a systemic immune response (13).

In another study on rats, after intramuscular injection of IFN-alpha, researchers examined the concentrations of tetrahydrobiopterin (BH (4)) and monoamines in various regions of the brain. They found that BH (4) and dopamine levels were significantly reduced in the amygdala and raphe regions compared to controls (14). Additionally, in a study involving rhesus monkeys, eight rhesus monkeys were given IFN-alpha for four weeks, and the animals showed lower concentrations of the dopamine metabolite homovanillic acid (15).

In another study involving 14 patients with hepatitis C infection, the patients received interferon-alpha therapy for 4-6 weeks. The results showed significantly increased 18F-DOPA uptake and decreased 18F-DOPA conversion in the same ventral striatal regions, caudate, and putamen as determined by functional magnetic resonance imaging (16). Moreover, tetrahydrobiopterin (BH4) is required as a cofactor for the enzymes involved in the conversion of phenylalanine to tyrosine, which is necessary for dopamine synthesis. Studies suggest that the oxidative loss of BH4 in chronic inflammatory conditions may reduce catecholamine biosynthesis, which could be associated with impaired adrenergic neurotransmitter pathways in patients. Increased phenylalanine concentrations in cancer patients have been linked to markers and mediators of inflammation, such as IL-6, IL-2 receptor, and soluble TNF-alpha receptor-2, as well as peripheral blood markers of oxidative stress (17).

Parkinson's disease (PD) is a progressively debilitating neurodegenerative disorder. It is characterized by motor symptoms such as tremors, rigidity, bradykinesia, and gait imbalance, as well as non-motor symptoms like executive dysfunction, sleep disturbances, and depression. Pathologically, PD is defined by the selective degeneration of dopamine-producing neurons in the substantia nigra pars compacta and

the simultaneous accumulation of α-synuclein-rich neuronal inclusions known as Lewy bodies, which spread predictively or progressively across multiple brain regions. Recent studies suggest that α-synuclein is a damage-associated molecular pattern (DAMP) capable of regulating inflammatory cytokine production in microglia. The specific contribution of different α-synuclein conformations to TLR (Toll-like receptor) activation is currently unclear, but it has been shown that α-synuclein can at least activate the TLR2 receptor in microglia and promote the production of inflammatory cytokines (18).

It has also been demonstrated that TLR2 may play a role in the pathophysiology of acne patients. In this study, it was also shown that TLR2 triggers inflammation in patients with Parkinson's disease and may contribute to the decrease in dopamine levels. Dopamine is known to be the key molecule involved in addiction. Furthermore, inflammatory processes play a role in the reduction of dopamine activation. In acne, inflammatory processes are also present. Previous studies have shown that peripheral inflammation can cross into the brain and reduce dopamine activation. In acne, peripheral inflammation exists, and inflammatory molecules from this condition could also pass into the brain, reducing dopamine activation and potentially lowering addiction levels.

In our study, a slight increase in addiction levels was observed with an increase in acne severity, but this was not statistically significant. We attribute this to the insufficient number of subjects in our study, given the high prevalence of acne in the general population.

Social media use (SMU) is a significant part of many people's daily lives. The conscious reduction of SMU time and an increase in physical activity are recognized as protective factors that promote positive mental health and awareness, thereby reducing the risk of addictive tendencies. Studies have shown that individuals with high levels of mindfulness are more likely to employ functional coping strategies in stressful and unexpected situations, and they are less likely to engage in dysfunctional or self-destructive behaviors (19).

In another study, it was observed that traditional yoga practices, which direct attention to health while accepting the spiritual aspects of one's nature, were successful in treating addiction through increased mindfulness (20). Similarly, two studies by Eşkisu et al. and Sun et al. also found that mindfulness was effective in reducing social media addiction (21, 22).

Although the concept of mindfulness has not yet been fully clarified, it can be defined as observing moment-to-moment thoughts, emotions, and bodily sensations without judgment. In acne patients, since attention is often focused on the body, this situation can be considered a form of mindfulness. Bodily sensations may create awareness, which in turn could reduce addiction levels. Recent studies have also observed that mindfulness has been successful in reducing social media addiction.

The study's limitations include a relatively small sample size, potential biases in self-reported survey responses, lack of longitudinal data to assess causality, and exclusion of participants with other addictions or underlying medical conditions, which may limit generalizability.

Conclusions

We attribute the lower level of addiction in acne patients compared to the healthy control group to a decrease in dopamine activation secondary to inflammation and to the state of awareness. However, it is clear that this issue requires further detailed research.

Conflict of interest: The authors report no conflict of interest.

Funding source: No funding was required.

Ethical approval: Ethical approval for this study was obtained from the Gazi Yaşargil Training and Research Hospital Ethics Committee. (11/10/2024 IRB no 216) This study was conducted in accordance with the principles of the Helsinki Declaration. It was carried out in compliance with the Good Clinical Practices (GCP) guidelines annexed to the circular no. 28617 of the Republic of Turkey. Informed consent was obtained from all participants for participation in the study.

Informed consent: Written informed consent was obtained from all individual participants and/or their gaurdians.

Acknowledgments: None

Peer-review: Externally. Evaluated by independent

reviewers working in at least two different institutions appointed by the field editor.

Data availability: All data supporting the findings of this study are included in the article. Further inquiries can be directed to the corresponding author.

Contributions

Research concept and design: MSC, MCC

Data analysis and interpretation: MSC, MCC

Collection and/or assembly of data: MSC, MCC

Writing the article: MSC

Critical revision of the article: MSC, MCC

Final approval of the article: MSC, MCC

All authors read and approved the final version of the manuscript.

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