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ORIGINAL PAPER

The relationship of quality of life and acne severity with chronotype and insomnia in patients with acne vulgaris

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Abstract

This study aimed to examine the relationship between acne severity and quality of life, insomnia, and chronotype. This study included 151 patients diagnosed with acne vulgaris, aged 18–30 years. A sociodemographic data form was completed by the clinician, and acne severity was evaluated using the Global Acne Grading System (GAGS). The Visual Analogue Scale (VAS), Acne Quality of Life Scale (AQLS), Hospital Anxiety Depression Scale (HADS), Insomnia Severity Index (ISI), and Morningness-Eveningness Questionnaire (MEQ) were completed by the participants. There was a significant difference between the MEQ scores of the participants who were divided into three groups according to the severity of global acne, as mild, moderate, and severe. In the post hoc analysis, the MEQ scores of the patients with mild acne were determined to be significantly higher than the scores of the patients with moderate and severe acne. A statistically significant negative correlation was observed between the GAGS scores and the MEQ scores. In addition, a statistically significant positive correlation was found between the participants' ISI scores and AQLS scores. Considering the variables related to chronotype and sleep in the treatment planning for patients with acne vulgaris may be appropriate within the scope of integrative treatment.

Keywords Acne · Chronotype · Insomnia · Quality of life

Introduction

Acne is a chronic inflammatory disease of the pilosebaceous unit. Acne vulgaris affects nearly the entire population of youth aged 15–17 years, with 15–20% of those affected having moderate to severe acne. Although perceived as a disease of adolescence, acne usually continues into adulthood [1]. One study showed that 64% of people aged from 20 to 29 and 43% of people aged from 30 to 39 suffer from acne [2].

Although the pathophysiology of acne is not yet fully understood, four factors are emphasized: abnormal follicular keratinization, excessive sebum production, *Cutibacterium acnes* (*C. acnes*) colonization, and inflammation [3]. In addition to these factors, acne vulgaris and stress have been reported to have a reciprocal relationship. Stress can trigger the secretion of the corticotropin-releasing hormone, which causes hyperplasia in the sebaceous glands via adrenal androgens [4]. In addition, psychopathologies, such as anxiety and depression, may occur following the occurrence of acne [5]. Acne also leads to a decrease in quality of life and life satisfaction [6].

Biological rhythm is one of the concepts that has been highlighted in recent years to explain both psychiatric disorders and general medical disorders associated with psychiatric disorders. Biological rhythms (chronotypes) are generally examined under three headings: morningness type, eveningness type, and intermediate type. These three rhythms are distinct from one another [7]. For example, individuals with the morningness type rhythm go to bed earlier and wake up earlier and their sleep hours vary less than the sleep hours of those with the eveningness type rhythm [8]. Additionally, individuals with the eveningness type have more difficulty in

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coping with stress and show more anxiety, depression, and somatic symptoms [9].

Sleep is one of the most important factors in maintaining health, affecting both psychological and physiological well-being [10]. Individuals with different chronotype preferences also have different sleep patterns. Eveningness types have shown more variability in their sleep patterns and durations than morningness types, and they experience higher levels of daytime sleepiness. The findings of a study that examined the chronotype differences of individuals with insomnia revealed that eveningness type individuals had the most irregular sleep–wake habits compared to morningness and intermediate types, and this situation is mostly associated with circadian irregularity [11].

Limited information is available on the potential impact of chronotype preferences on acute and chronic skin diseases [12]. In a study conducted in 2017 that included 186 patients with psoriasis, the relationship between sleep quality and chronotype preference differences and psoriasis severity was examined. According to the results, the severity of psoriasis was higher in patients with poor sleep quality, while there was no significant difference in terms of psoriasis severity between groups with a chronotype preference difference [13]. In another study that evaluated the role of chronotype preferences on the circadian pattern of chronic pruritus, while participants more prone to the morningness rhythm reported more severe pruritus symptoms later in the day, patients prone to the eveningness type reported more severe pruritus symptoms earlier in the day. These findings suggest that chronobiological factors affect the hours of the day during which skin symptoms intensify [12]. To our knowledge, our study is the first in the literature to examine the relationship between differences in chronotype preferences and insomnia and quality of life and acne severity in patients with acne vulgaris.

Methods

Participants

This study included 151 patients diagnosed with acne vulgaris, aged 18–30 years, who applied to Afyonkarahisar Health Sciences University Medical Faculty Hospital Dermatology Polyclinic between May 11, 2020, and May 31, 2021, and agreed to participate in the study. Approval for the study was obtained from Afyonkarahisar Health Sciences University Faculty of Medicine Local Ethics Committee (Date: 05.05.2020, Decision No: 2020/184). The individuals involved in the study were informed about the purpose, content, and benefits of the study according to the Declaration of Helsinki, and their verbal and written consent was obtained. Exclusion criteria for the study included the following: being illiterate, having mental retardation, having previous history of receiving systemic treatment or current receiving any treatment for acne vulgaris, having a previous or current history of psychiatric illness or using medication for a psychiatric illness, being pregnant or lactating, working in shifts, using alcohol, and having a systemic disease (liver and/or kidney dysfunction, diabetes mellitus, atherosclerotic heart disease, thyroid dysfunction, anemia, metabolic disease, and so on).

Procedure

A sociodemographic data form was completed by the clinician, and acne severity was evaluated using the Global Acne Grading System (GAGS). The Visual Analogue Scale (VAS), Acne Quality of Life Scale (AQLS), Hospital Anxiety Depression Scale (HADS), Insomnia Severity Index (ISI), and Morningness-Eveningness Questionnaire (MEQ) were completed by the participants.

Scales

Sociodemographic data form

The researchers created a form for use in determining the sociodemographic characteristics of the participants. The form includes participant information on gender, age, height and weight, educational status, marital status, and income level. Body mass index (BMI) values were calculated using the formula BMI (kg/m^2) = body weight (kg) / height (m^2).

Global acne grading system (GAGS)

The GAGS, developed by Doshi et al. was designed to determine the severity of an individual's acne [14]. According to this system, the score of the most severe lesion (no lesion = 0, comedone = 1, papule = 2, pustule = 3, nodule = 4) detected from each of the six regions—namely, the face (forehead, left and right cheeks, nose, chin), chest, and upper back—is multiplied by a fixed factor determined for each region to determine the severity of the acne. The global acne scores of the patients ranged 0–44. According to the scores obtained, the acne levels of the patients were graded as 0 = no acne, 1–18 points = mild, 19–30 points = moderate, 31–38 points = severe, and 39 points or more = very severe.

Visual analogue scale (VAS)

The VAS is a scale created for patients to use to conduct personal evaluations of their own acne conditions [15]. According to this scale, patients are asked to rate acne lesions from 0 to 10. A score of 10 corresponds to the "worst" clinical

condition for the patient, while a 0 corresponds to the "best expected" clinical condition.

Acne quality of life scale (AQLS)

The AQLS was developed by Gupta et al. to evaluate the effect of acne on quality of life [16]. A Turkish validity and reliability study of the scale was performed by Demirçay et al. The Turkish version was found to be valid and reliable in measuring the effect of acne on quality of life in patients aged 14 years and older [17]. The scale comprises nine items with four-point Likert type response options ranging from "never" to "too much." On the scale in which negative items are scored, a score between 9 and 36 can be obtained; high scores reflect low quality of life.

Hospital anxiety depression scale (HADS)

Zigmond and Snaith developed the HADS self-report scale that measures anxiety and depression [18]. The validity and reliability of the Turkish version was evaluated by Aydemir et al. [19]. The scale contains 14 questions, 7 of which (the odd numbered items) measure anxiety and 7 of which (the even numbered items) measure depression. Responses are given using a four-point Likert format, scored from 0–3. By summing the subscale scores, 0–21 points are obtained from each of the depression and anxiety subscales.

Insomnia Severity Index (ISI)

The ISI can measure people's perception of insomnia and can be completed by the patients themselves. It includes seven items that assess difficulties in falling and staying asleep, satisfaction with sleep patterns, effects on daily life, disturbances caused by sleep problems, and the degree of stress and anxiety caused by sleep problems. Each item is scored between 0 and 4, and the total score varies between 0 and 28. A higher score indicates more serious sleep problems. The reliability and validity of the Turkish version of the index was confirmed by Boysan et al. [20].

Morningness-eveningness questionnaire (MEQ)

The MEQ consists of 19 items related to bedtimes and wake-up times, physical and mental performance preference times, and subjective alertness after getting out of bed and before going to bed. The MEQ score ranges from 16 to 86. Individuals scoring from 16 to 41 points are classified as eveningness type, those who score from 42 to 58 points are considered intermediate types, and morningness types score from 59 to 86 points. The psychometric properties of the Turkish version of the MEQ were tested by Agargun et al. [21].

Statistical analysis

The SPSS 20 package program was used in all analyses for this study. Descriptive statistics were reported as numbers and percentages for categorical data. Variables are shown as mean ± standard deviation.

The chi-square test was used between groups by providing the frequency distribution of the categorical data. Since the data were normally distributed, the one-way ANOVA test was applied to compare the three groups classified by acne severity level. A Pearson correlation test was used to examine the correlation between the clinical evaluation scales used in the study, and a partial correlation analysis was performed to determine whether the significant correlation between the MEQ and GAGS scores continued even when the BMI was controlled. While examining the differences in MEQ scores between the groups determined according to acne severity, an ANCOVA test was conducted to investigate the effect of gender. In the analyses, the significance value was accepted as $p < 0.05$ at the 95% confidence interval.

Results

The study was conducted with 151 acne vulgaris patients aged 18–30 years old, with a mean age of 21.53 ± 3.48. Females comprised 56.3% ($n = 85$) of the study sample, while 47.7% ($n = 66$) were male. The participants' sociodemographic characteristics are presented in Table 1.

The patients' mean global acne severity score was 23.03 ± 6.96. Acne was mild in 29.2% ($n = 44$) of the patients, moderate in 55.6% ($n = 84$), and severe in 15.2% ($n = 23$). The mean disease duration was 5.52 ± 3.24 years. The mean BMI of the patients was 23.02 ± 3.97. An assessment of the chronotypes of the participants uncovered that 16.6% ($n = 25$) were in the morningness type category, 62.2% ($n = 100$) were in the intermediate category, and 17.2% ($n = 26$) were in the eveningness type category. According to ISI scores, 46.4% ($n = 70$) had clinically insignificant insomnia, 39.1% ($n = 59$) were at the lower threshold of insomnia, 11.2% ($n = 17$) had moderate clinical insomnia, and 3.3% ($n = 5$) had severe clinical insomnia (see Table 2).

A comparison of the age, disease duration, and BMI values of the patients in the three groups, which were determined according to the global acne severity as mild, moderate, and severe, showed no significant differences between the groups. However, a significant gender difference was observed between the mild, moderate, and severe acne groups ($p = 0.017$, $x^2 = 8.106$) (see Table 3).

A statistically significant difference was found between the MEQ scores of the participants, who were divided into three groups according to the severity of their acne ($p = 0.001$). In the post hoc analysis, the MEQ scores of the

Table 1 Sociodemographic characteristics of the participants

	Participants ($n=151$)
Age	21.53 ± 3.48
Gender: *n* (%)	
Female	85 (56.3)
Male	66 (43.7)
Marital status: *n* (%)	
Married	17 (11.3)
Single	134 (88.7)
Educational level: *n* (%)	
Secondary school	9 (6.0)
High school	37 (24.5)
University and higher	105 (69.5)
Employment status: *n* (%)	
Employed	34 (22.5)
Unemployed	117 (77.5)
Socioeconomic level: *n* (%)	
Low	26 (17.2)
Middle	95 (62.9)
High	30 (19.9)

Table 2 Mean GAGS scores, disease duration, BMI values, and distribution by MEQ, ISI, and GAGS scores of participants

	Participants ($n=151$)
GAGS score (Mean ± SD)	23.03 ± 6.96
Disease duration (year)	5.52 ± 3.24
BMI (Mean ± SD)	23.02 ± 3.97
MEQ chronotypes (%)	
Morningness type	25 (16.6)
Intermediate type	100 (66.2)
Eveningness type	26 (17.2)
ISI scores (%)	
No insomnia	70 (46.4)
Subthreshold	59 (39.1)
Moderate insomnia	17 (11.2)
Severe insomnia	5 (3.3)
GAGS scores (%)	
Mild	44 (29.2)
Moderate	84 (55.6)
Severe	23 (15.2)

GAGS Global Acne Grading System, *BMI* Body Mass Index, *MEQ* Morningness-Eveningness Questionnaire, *ISI* Insomnia Severity Index

patients with mild acne were determined to be significantly higher than the scores of the patients with moderate and severe acne, while no significant differences were uncovered between the MEQ scores of the two groups of patients—those with moderate and those with severe acne. While examining the differences in the MEQ scores of the three groups organized according to acne severity, an ANCOVA test was performed to investigate the effect of gender. No statistically significant differences were found in the ISI ($p=0.175$), AQLS ($p=0.216$), HADS-Anxiety ($p=0.058$), and HADS-Depression ($p=0.200$) scores of the three groups (those with mild, moderate, and severe acne) (see Table 4).

At the same time, a statistically significant negative correlation was observed between the GAGS scores and the MEQ scores, and a statistically significant positive correlation was found between the GAGS scores and BMI values of the participants ($r=-0.225$, $p=0.002$; $r=0.172$, $p=0.049$, respectively). A partial correlation analysis showed that the significant correlation between the MEQ scores and GAGS scores continued even when BMI values were controlled ($r=-0.301$, $p\leq0.001$). In addition, a statistically significant positive correlation was found between the participants' ISI scores and AQLS scores ($r=0.222$, $p=0.006$). When the correlation between the AQLS scores and GAGS scores (which evaluate acne severity objectively) and VAS scores (which evaluate acne severity subjectively) were evaluated, a statistically significant positive correlation was found between the AQLS scores and VAS scores ($r=0.372$, $p<0.001$), but there was no statistically significant correlation between the AQLS scores and GAGS scores. A statistically significant positive correlation was identified between the AQLS scores and the anxiety and depression subscale scores of the HADS ($r=0.425$, $p<0.001$; $r=0.412$, $p<0.001$, respectively). In addition, a statistically significant correlation was found between the participants' GAGS scores and BMI values ($r=0,0.172$, $p=0,0.049$) (see Table 5).

Discussion

In our study, we aimed to examine the relationship between acne severity and quality of life, insomnia, and chronotype. Study findings indicated that individuals with an eveningness type rhythm had more severe acne, and an increase in the severity of insomnia was associated with a decrease in the quality of life.

We found a significant difference between the three groups determined according to global acne severity in terms of MEQ scores. Specifically, the MEQ scores for the groups with moderate and severe acne were lower than the scores for the group with mild acne. In addition, a significant negative correlation was found between MEQ scores and GAGS scores. These findings may suggest that people with moderate and severe acne tend to have an eveningness type rhythm preference. Although no studies that examine the relationship between chronotype preference and acne vulgaris are reported in the literature, the literature does include studies examining the relationship between chronotype preference

Table 3 Comparison of age, gender, disease duration and body mass indexes in three groups determined according to acne severity

Global acne severity					
	Mild ($n=44$)	Moderate ($n=84$)	Severe ($n=23$)	p	F/x^2
Age	22.54 ± 3.29	21.05 ± 3.11	21.34 ± 4.70	0.069*	2.72
Gender (%)					
Female	32 (72.7)	44 (52.3)	9 (39.1)	**0.017****	**8.106**
Male	12 (27.3)	40 (47.7)	14 (60.9)		
Disease duration (year)	4.65 ± 3.25	4.23 ± 3.15	5.35 ± 3.50	0.335*	1.10
BMI	22.09 ± 3.23	23.32 ± 4.0	23.75 ± 5.03	0.201*	1.623

Bold values denote statistical significance at the $p < 0.05$ level

BMI Body Mass Index

*One Way Anova was performed

**Chi-Square was performed

Table 4 Comparison of MEQ, ISI, AQLS, HADS-A, and HADS-D scores in three groups determined according to acne severity

Global acne severity						
	Mild ($n=44$)	Moderate ($n=84$)	Severe ($n=23$)	p	F	Post Hoc
MEQ scores	54.72 ± 6.69	48.91 ± 9.23	47.69 ± 10.06	**0.001**	**7.752**	**Mi > Mo = Se**
ISI scores	7.81 ± 4.79	9.65 ± 5.14	9.04 ± 6.37	0.175	1.766	
AQLS scores	13.88 ± 5.32	15.69 ± 5.91	14.73 ± 4.72	0.216	1.550	
HADS-A scores	7.29 ± 4.28	9.17 ± 4.46	8.04 ± 3.58	0.058	2.905	
HADS-D scores	5.29 ± 3.06	6.48 ± 3.81	6.0 ± 3.43	0.200	1.626	

Bold values denote statistical significance at the $p < 0.05$ level

One Way Anova was performed

MEQ Morningness-Eveningness Questionnaire, *ISI* Insomnia Severity Index, *AQLS* Acne Quality of Life Scale, *HADS-A* Hospital Anxiety Depression Scale- Anxiety Subscale, *HADS-D* Hospital Anxiety Depression Scale-Depression Subscale, Acne Severity, *Mi* Mild, *Mo* Moderate, *Se* Severe

Table 5 Pearson correlation coefficients

		1	2	3	4	5	6	7	8
1. GAGS	r	1.00							
	p								
2. VAS	r	**0.450**	1.00						
	p	**< 0.001**							
3. MEQ	r	**− 0.255**	− 0.068	1.00					
	p	**0.002**	0.409						
4. ISI	r	0.072	**0.165**	**− 0.408**	1.00				
	p	0.380	**0.043**	**< 0.001**					
5. AQLS	r	0.071	**0.372**	− 0.011	**0.222**	1.00			
	p	0.389	**< 0.001**	0.894	**0.006**				
6. HADS-A	r	0.073	0.150	**− 0.212**	**0.555**	**0.425**	1.00		
	p	0.372	0.066	**0.009**	**< 0.001**	**< 0.001**			
7. HADS-D	r	0.111	**0.214**	**− 0.208**	**0.527**	**0.412**	**0.596**	1.00	
	p	0.175	**0.008**	**0.011**	**< 0.001**	**< 0.001**	**< 0.001**		
8. BMI	r	**0.172**	0.117	0.075	− 0.006	0.127	0.061	0.042	1.00
	p	**0.049**	0.181	0.394	0.946	0.147	0.491	0.633	

Bold values denote statistical significance at the $p < 0.05$ level

GAGS Global Acne Grading System, *VAS* Visual Analogue Scale, *MEQ* Morningness-Eveningness Questionnaire, *ISI* Insomnia Severity Index, *AQLS* Acne Quality of Life Scale, *HADS-A* Hospital Anxiety Depression Scale- Anxiety Subscale, *HADS-D* Hospital Anxiety Depression Scale- Depression Subscale, *BMI* Body Mass Index

and other chronic diseases. In a recent study involving 171 participants, the relationship between migraine attack frequency and chronotype preference was investigated. In this research, chronotype preference was evaluated using the MEQ. The results showed that low MEQ scores (indicating a propensity for eveningness type) were associated with an increased frequency of migraine attacks [22]. In another study examining the relationship between inflammatory bowel diseases and chronotype preferences, individuals with Crohn's disease were found to have a higher level of eveningness preference compared to the control group [23]. Another study that involved 100 participants examined the relationship between fibromyalgia severity and chronotype preferences. The findings indicated that MEQ scores and fibromyalgia severity were significantly and negatively correlated [24].

In the current study, a significant negative correlation was found between MEQ scores and ISI scores. In a different study conducted with 383 participants, individuals with an eveningness preference experienced insomnia more often than individuals with morningness and intermediate preferences [25]. When examining the sleep quality of nurses with different chronotypes, Yazdi et al. discovered that the poorest quality of sleep was experienced by nurses who have eveningness rhythm preferences [26]. In addition, a significant correlation between MEQ scores and GAGS scores was observed, but no significant correlation was identified between ISI scores and GAGS scores. This suggests that the effect of chronotype preference on acne severity may have arisen independently of insomnia.

While a correlation existed between AQLS scores and VAS scores in our study, no correlation was found between AQLS scores and GAGS scores. These findings are consistent with what has been reported in the literature. For instance, in a study that examined the relationship between acne severity and quality of life in 40 participants, no correlation was found between quality of life and GAGS scores, while subjective acne severity scores were correlated with quality of life [27]. Another study showed that quality of life scores were more strongly associated with patient-reported severity than clinician-determined severity, suggesting that patients' perceptions of their disease may be an important consideration in the evaluation and treatment of acne [28]. These findings show that the patient's perception of acne and quality of life may be directly related, regardless of the objective severity of the acne.

Our analysis also uncovered a significant positive correlation between ISI scores and AQLS scores. This finding is supported in the literature. In a study by Schrom et al. for example, a correlation was found between Dermatology Quality of Life Index and Pittsburg Sleep Quality Index scores. In the same study, the severity of insomnia was also correlated with the severity of acne, and the effect that insomnia had on quality of life may have occurred through the increase in acne severity [27]. However, we found no correlation between ISI scores and GAGS scores, which suggests that the relationship between AQLS scores and insomnia severity may be independent of acne severity. Considering the correlation between the HADS anxiety and depression subscale scores and the ISI scores, more studies are needed that examine the relationship between insomnia, mood, and quality of life.

The first limitation of this study is that it was a cross-sectional study, so a causal relationship could not be established. The lack of comparison with the control group was another limitation. In addition, psychopathology was not screened with a structured psychiatric interview and psychometric evaluation was done with self-report measurement tools.

In conclusion, our research revealed that, in patients diagnosed with acne vulgaris, disease severity was correlated with chronotype preferences, and quality of life was correlated with insomnia. With regard to insomnia, which is determined to be related to chronotype preferences and quality of life in our study, the American Academy of Sleep Medicine and Sleep Research Society reports that an adult should have at least 7 h of sleep [29]. Considering the variables related to chronotype, sleep, and mental state in the treatment planning for patients with acne vulgaris may be appropriate within the scope of integrative treatment. In this context, prospective studies with larger patient series will be beneficial in revealing the effect of these variables on treatment.

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Data availability The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Competing interests The authors declare no competing interests.

Conflict of interest The authors declare no competing interests.

Ethical approval Approval for the study was obtained from Afyonkarahisar Health Sciences University Faculty of Medicine Local Ethics Committee (Date: 05.05.2020, Decision No: 2020/184).

Consent The individuals involved in the study were informed about the purpose, content, and benefits of the study according to the Declaration of Helsinki, and their verbal and written consent was obtained.

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