

Association Between Acne Vulgaris and Face Mask Usage in Turkish Young Adults During the COVID-19 Pandemic: A Prospective Survey Study

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Abstract

Aim: Throughout the coronavirus disease-2019 (COVID-19) pandemic, the widespread use of personal protective equipment, including facial masks, was associated with an increased incidence of facial dermatoses, notably acne and dermatitis. The objective of this cross-sectional study was to ascertain the prevalence and clinical manifestations of acne vulgaris in young adults aged 17-24 years and to compare these characteristics before and during the COVID-19 pandemic, as well as to elucidate the association between facial mask use and acne exacerbation.

Materials and Methods: This study was performed among 6,517 undergraduates studying at the university. A multiple-choice questionnaire was disseminated via email to all undergraduate students utilizing the electronic mailing addresses furnished by the university.

Results: 48.6% of the participants had acne vulgaris before the pandemic, and 18.8% had new-onset acne vulgaris during the pandemic. During the pandemic and before the pandemic, the frequency of acne was higher in females than males ($P < 0.001$, $P < 0.001$). The presence of papules-pustules, itching, pain, dryness, and flaking were more common in patients with newly developed acne in the pandemic ($P = 0.015$, $P < 0.001$, $P < 0.001$, $P = 0.001$, $P = 0.036$). The frequency of acne increased significantly in those who used masks, those who used masks every day, those who used masks for more than 4 hours during the day, those who used black masks, those who did not change their masks during the day, those who used facial cleansers every day, and those who used emollients ($P < 0.001$, $P = 0.001$, $P < 0.001$, $P = 0.001$, $P = 0.005$, $P < 0.001$, $P < 0.001$).

Conclusion: Wearing face masks results in the development of acne and causes considerable acne flare in acne patients before the pandemic. Mask-induced acne is a significant problem symptoms like itching, burning sensations, and dryness, which are more common than pre-pandemic acne.

Keywords: Acne vulgaris, masks, pandemics

INTRODUCTION

Acne vulgaris is a multifactorial chronic inflammatory disease with a complex pathogenesis, particularly in the pilosebaceous unit. Four key factors play vital roles in acne development: altered sebum production, altered keratinization of the pilosebaceous unit, *Cutibacterium acnes* (*C. acnes*) and inflammation.^{1,2}

The onset of acne is correlated with sebum production. The prevalence increases with age, and the incidence is highest in adolescents and lowest in pre-pubertal children. After young adulthood, the prevalence of acne decreases with increasing age.³

During the coronavirus disease-2019 (COVID-19) pandemic, the increased utilization of personal protective equipment, such as masks, was associated with a heightened prevalence of facial dermatoses.^{4,5} Prolonged use of surgical face masks has been linked to alterations in the epidermis, including decreased hydration levels, increased trans-epidermal water loss, altered pH, heightened erythema, and sebum production, all of which are associated with facial inflammatory

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dermatoses, particularly acne and irritant contact dermatitis.⁶ Maskne, or mask-related acne, is a dermatological condition associated with the COVID-19 pandemic, predominantly observed in healthcare workers but also prevalent in the general population. This type of acne is a type of mechanical acne that arises from persistent occlusion and friction caused by the continuous use of face masks.⁵

In our study, we aimed to determine the frequency and clinical features of acne in young adult patients aged 17-24 and compare these characteristics before and during the pandemic. In addition, we wanted to reveal the relationship between mask use and the development of acne.

MATERIALS AND METHODS

Study Design

This study was approved by the Karadeniz Technical University Faculty of Medicine Ethical Committee (approval number: 2024/80, date: 26.04.2024).

This cross-sectional analysis was conducted from September 2021 to May 2024 at Karadeniz Technical University Faculty of Medicine, which has a total of 25,000 actively enrolled undergraduates. A structured multiple-choice questionnaire was distributed electronically to the actively monitored e-mail addresses of all undergraduates, as furnished by the university. The questionnaire included a preamble detailing the study objectives and the responsible academic department. Prior to accessing the survey items, participants were presented with a consent form containing options to “agree to participate,” “decline participation,” or “ask for a reminder later.” Non-consenters, indicated by selecting “decline participation,” did not receive further correspondence. Conversely, individuals who chose the “ask for a reminder later” option were re-contacted. Incomplete responses were excluded from the analysis. The questionnaire incorporated visual aids to help identify acne vulgaris types and map the distribution of facial lesions. To validate the survey reliability, a control question was strategically embedded with varying answer choices. Inconsistency in responses to this repeated item resulted in the exclusion of the participant from the study dataset.

Instruments

The questionnaire developed by the investigators was specifically designed to assess the prevalence of acne vulgaris prior to the onset of the COVID-19 pandemic, to compare the incidence during the pandemic period, and to evaluate the exacerbation rates of acne vulgaris. We evaluated the types (surgical mask, cloth mask, etc.), frequency, and duration of use of face masks on the development of acne vulgaris.

Facial area involvement in acne (T-zone, O-zone, U-zone), acne symptoms (comedone, papule, pustule), pain, itching, dryness, and scale scores were assessed.

In the participants of the study; usage of face mask, preference of face mask (medical mask, fabric mask, N95 mask), color of mask (white/green, black, colored), frequency of usage (everyday, < 7 days/week), time of usage during the day (< 4 hours, 4-8 hours, > 8 hours), change of mask during the day, and whether there is an increase in acne after COVID-19 infection or COVID-19 vaccine were questioned.

In addition, the frequency of use of facial cleaners and emollients under face masks was questioned.

Statistical analysis

Data analysis was conducted utilizing SPSS software version 23.0 (Armonk, NY: IBM Corp.). Quantitative results are presented as frequencies (n) and percentages (%) for categorical variables. The chi-square test was used to compare categorical variables and the prevalence of distinct acne treatment modalities. Bonferroni's adjustments were made to the *P* values account for multiple comparisons. Logistic regression analysis was employed to investigate the correlations between the incidence of acne vulgaris and exacerbations during the pandemic and demographic factors. The independent variables included gender, face mask usage, smoking status, alcohol consumption, type of mask used, duration of mask wearing per day, frequency of mask replacement, history of COVID-19 infection and vaccination status, and use of facial skincare products such as cleansers and moisturizers. The Hosmer-Lemeshow test was used to assess the goodness of fit for the logistic regression model. Multicollinearity diagnostics were performed to identify and exclude interdependent variables. A *P* value 0.05 was considered statistically significant.

RESULTS

Of the 25,000 undergraduates solicited, 6,517 (26%) completed the entire questionnaire. Among the respondents, 20.1% were enrolled in medical programs, whereas 79.9% were from other faculties, including engineering, science, economics and administrative sciences, and fine arts. The mean age of the participants was 21.17 years, with a standard deviation of ± 3.12 .

48.6% of the participants had acne vulgaris before the pandemic, and 18.8% had new-onset acne vulgaris during the pandemic. During the pandemic and before the pandemic, the frequency of acne was higher in women (69.6% and 61.5%) than males (69.6% and 30.1%). ($P < 0.001$, $P < 0.001$) Considering the facial location of acne lesions,

U-zone location was reported more frequently (51.7) and T-zone location (26.1%), and O-zone location (18.8%).

Comparison of the Clinical Features Between Patients with Pre-Pandemic and Newly Developed Acne During the Pandemic

The clinical features of patients with pre-pandemic and newly developed acne during the pandemic are summarized in Table 1.

Acne treatment intake was higher before the pandemic than during the pandemic ($P < 0.001$). When the facial location of acne lesions was evaluated, the most common U-zone, the second most common T-zone location, was found in those with acne before the pandemic, while the U-zone was the most common and the second most common O-zone location was found in those with new-onset acne during the pandemic period. The presence of papules-pustules, itching, pain, dryness, and flaking were more common in patients with newly developed acne in the pandemic ($P = 0.015$, $P < 0.001$, $P < 0.001$, $P = 0.001$, $P = 0.036$). In addition, flares were observed more frequently in lesions after COVID infection and after COVID vaccine ($P < 0.001$, $P < 0.001$).

Comparison of Face Mask Usage Habits Between Patients with and Without New-Onset Acne During the Pandemic

Comparison of face mask usage habits between patients with and without new-onset acne and acne flares during the pandemic is shown in Table 2. It has been observed that the frequency of acne increases significantly in those who use

masks, those who use masks every day, those who use masks for more than 4 hours during the day, those who use black masks, those who do not change their masks during the day, those who use facial cleansers every day, and those who use emollients ($P < 0.001$, $P = 0.001$, $P < 0.001$, $P = 0.001$, $P = 0.005$, $P < 0.001$, $P < 0.001$).

Comparison of Face Mask Usage Habits Between Patients with and Without Acne Flares During the Pandemic

Acne flares were observed significantly more frequently during the pandemic period in women, those who wore masks, those who used masks every day, those who used daily emollients and cleaners, and those who did not receive the COVID vaccine ($P = 0.022$, $P = 0.029$, $P = 0.001$, $P < 0.001$, $P < 0.001$, $P = 0.006$, Table 2).

Logistic Regression Analysis of the Association Between Acne Vulgaris Frequency and Acne Flares During the Pandemic and Demographic Characteristics

When we evaluated acne flares during the pandemic period in logistic regression analysis; it has been shown that having a COVID infection increases 1.48 times, using a mask every day 1.39 times, and washing the face every day 1.48 times (Table 3).

When we evaluated the factors affecting new acne development during pandemic; it has been shown that the female gender increases 1.42-fold, the use of alcohol 1.29-fold, wearing

Table 1. Clinical features of acne patients before and during the pandemic

	Acne before the pandemic	Acne during a pandemic	P value
Gender			
Female	1802 (60.6)	850 (69.6)	<0.001
Male	1174 (39.4)	372 (30.4)	
Medical student	733 (25.1)	223 (18.5)	<0.001
Acne treatment	1356 (45.6)	382 (31.3)	<0.001
Acne type			
O-zone	501 (16.3)	296 (24.5)	<0.001
U-zone	853 (27.8)	653 (54.1)	
T-zone	1604 (52.2)	232 (19.2)	
Comedon	1187 (39.9)	463 (37.9)	0.229
Papules/pustul	998 (33.5)	458 (37.5)	0.015
Itching	1142 (38.4)	617 (50.5)	<0.001
Dryness	1294 (43.5)	718 (58.8)	<0.001
Burning and tenderness	672 (22.6)	335 (27.4)	0.001
Smoking	157 (5.3)	73 (6.0)	0.665
Alcohol	62 (2.1)	31 (2.6)	0.036
Flare after COVID-19 infection	312 (10.8)	206 (17.8)	<0.001
Flare after vaccination	335 (11.3)	272 (22.3)	<0.001

COVID-19: Coronavirus disease-2019

Table 2. Comparison of face mask usage habits between patients with and without new-onset acne and acne flares during the pandemic

	Patients with new-onset acne	Patients without new-onset acne	P value	Patients with acne flare	Patients without acne flare	P value
Gender						
Female	850 (69.6)	2848 (53.8)	<0.001	1972 (66.5)	284 (61.1)	0.022
Male	372 (30.4)	2447 (46.2)		994 (33.5)	181 (38.9)	
Medical student	223 (18.5)	1067 (20.5)	0.119	699 (23.9)	108 (23.2)	0.741
Usage of the mask	1121 (91.7)	4637 (87.6)	<0.001	2712 (91.4)	439 (94.4)	0.029
Frequency of mask use						
< 7 days/week	526 (43.5)	2546 (48.7)	0.001	1320 (44.9)	246 (53.2)	0.001
7 days/week	684 (56.5)	2681 (51.3)		1619 (55.1)	216 (46.8)	
Time of daily mask use						
< 4 hours	547 (45.2)	2717 (51.9)	<0.001	1332 (45.3)	211 (45.4)	0.939
4-8 hours	528 (43.6)	2013 (38.4)		1256 (42.7)	196 (42.2)	
> 8 hours	135 (11.2)	510 (9.7)		351 (11.9)	58 (12.5)	
Mask type						
Medical mask	1108 (91.1)	4742 (90.6)	0.431	2702 (91.2)	430 (93.1)	0.414
Fabric mask	61 (5.0)	305 (5.8)		144 (4.9)	18 (3.9)	
N95 mask	49 (4.0)	188 (3.6)		116 (3.9)	14 (3.0)	
Colour of mask						
White/green	455 (37.5)	2042 (38.7)	0.001	1090 (36.9)	175 (37.6)	0.308
Black	744 (61.3)	3076 (58.3)		1785 (60.4)	283 (60.9)	
Colored	15 (1.2)	157 (3.0)		80 (2.7)	7 (1.5)	
Change in the mask	521 (42.7)	2017 (38.4)	0.005	1102 (37.4)	168 (36.1)	0.593
Confirmed COVID infection	467 (38.2)	1949 (36.8)	0.358	1137 (38.3)	172 (37.0)	0.579
COVID vaccine	1190 (97.7)	5114 (96.7)	0.077	2873 (97.0)	462 (99.4)	0.006
The type of vaccine						
Sinovac	140 (11.8)	635 (12.4)	0.531	337 (11.8)	51 (11.0)	0.656
Bionthec	1050 (88.2)	4475 (87.6)		2530 (88.2)	411 (89.0)	
Frequency of facial cleanser use						
< 7 days	495 (40.8)	2489 (48.1)	<0.001	1333 (45.3)	266 (57.2)	<0.001
7 days	717 (59.2)	2688 (51.9)		1609 (54.7)	199 (42.8)	
Usage of emollients	916 (75.0)	2890 (54.6)	<0.001	2058 (69.4)	284 (61.1)	<0.001

COVID: Coronavirus

Table 3. Logistic regression analysis of acne flare association according to demographic characteristics during the pandemic

Risk factor	OR (95% CI)	P value
Sex (female)	1,149 (0.921-1,433)	0.217
Not being a medical student	0.912 (0.715-1,165)	0.461
Smoker	1,187 (0.826-1,708)	0.354
Alcohol consumption	1,066 (0.741-1,532)	0.732
COVID vaccine	1,051 (0.855-1,292)	0.638
Confirmed COVID infection	1,487 (1,203-1,840)	0.012
Usage of the mask	0.656 (0.424-1,015)	0.058
Frequency of mask usage (7 days)	1,396 (1,127-1,729)	0.002
Time of daily mask usage (4-8 hours)	0.992 (0.789-1,246)	0.942
Time of daily mask use (> 8 hours)	0.899 (0.639-1,265)	0.541
Change in the mask	0.975 (0.788-1,206)	0.816
Frequency of facial cleanser usage (7 days)	1,487 (1,203-1,840)	<0.001
Usage of moisturizers	1,018 (0.824-1,257)	0.870

OR: Odds ratio, CI: Confidence interval, Omnibus test: $P < 0.001$, Nagelkerke's R-square: 2.9%, COVID: Coronavirus

the mask for 4-8 hours daily 1.26-fold, wearing the mask for more than 8 hours 1.29-fold, daily use of cleansers on the face 1.31-fold, and using moisturizers under the mask 1.72-fold (Table 4).

DISCUSSION

In our study, we observed that nearly one of two students had developed acne starting before the pandemic, and new acne developed in 18.8% of the participants during the pandemic period. In both periods, acne frequency was higher in females.

This observation aligns with the results reported by Altun and Topaloglu Demir⁷ and Techasatian et al.,⁸ who both identified females as having a higher propensity for the development of maskae, whereas Falodun et al.² did not show any sex predilection for maskne.

In the literature, Kiely et al.⁹ reported new-onset acne in 53% of 337 participants and acne lesion flares in 46.6% during the pandemic, whereas Villani et al.¹⁰ Reported rates of 76.3% and 23.7% in another study. In a study conducted by Tuncer Vural¹¹ it was observed that 40.5% of the participants experienced the onset of new acne, whereas 20.5% reported exacerbations of pre-existing acne. Contrary to the literature, new-onset acne was less common, but the incidence of acne flares was quite high at 86.4% in our study. Unlike our study, Kiely et al.⁹ conducted a study on healthcare professionals. However, in our study, no increase was found between medical students from other faculties regarding new-onset acne development and acne flares. We believe that this is due to the fact that all faculty students received online distance education during the pandemic period.

In our study, we found that new acne development was higher in those who used masks every day, those who wore masks for more than 4 hours a day, those who preferred black masks, and those who did not change their masks during the pandemic period.

In the existing literature that examined the variables of mask type, color, and usage duration, the results have been mixed. Yaqoob et al.¹² no significant correlation was observed between the incidence of acne and the daily use of face masks. Conversely, Tuncer Vural¹¹ reported that increasing the frequency of mask changes, a finding corroborated by our study, reduced the incidence of acne. Nonetheless, the relationship between acne development and the number of masks worn per day was not established in the study by Yaqoob et al.¹² We think that as the duration of mask use is prolonged and when the same mask is used during the day, the increased humidity and occlusion increase the clogging of the pores, and the irritation causes acne and increases flares. Our study is the first to evaluate the effect of mask color on acne, and we believe that the increased incidence of acne in black mask users may be due to the dyes in these masks.

Hua et al.⁶ assessed the dermatological impacts of surgical masks and N95 respirators, noting that these masks create microenvironmental changes in the skin, such as dehydration, increased sebum production, and elevated pH levels, which collectively foster conditions conducive to the proliferation of *C. acnes* and the activation of inflammatory lesions. The microbial contamination of masks and the anaerobic environment created by prolonged mask use can enhance bacterial virulence and promote the proliferation of opportunistic pathogens. This can lead to microbiome imbalance, increasing susceptibility to acne development.¹³⁻¹⁵

Table 4. Logistic regression analysis of association of acne vulgaris frequency during pandemic

Risk factor	OR (95% CI)	P value
Sex (female)	1,416 (1,220-1,643)	< 0.001
Not Being a medical student	1,239 (1,043-1,472)	0.015
Smoker	0.843 (0.672-1,059)	0.142
Alcohol consumption	1,293 (1,040-1,606)	0.021
Confirmed COVID infection	1,076 (0.533-1,133)	0.283
COVID vaccine	1,505 (0.993-2,282)	0.054
Usage of the mask	1,224 (0.958-1,563)	0.106
Frequency of mask usage (7 days)	1,052 (0.915-1,209)	0.477
Time of daily mask usage (4-8 hours)	1,258 (1,002-1,580)	0.048
Time of daily mask use (> 8 hours)	1,291 (1,115-1,494)	0.001
Change in the mask	1,017 (0.889-1,164)	0.802
Frequency of facial cleanser usage (7 days)	1,310 (1,143-1,502)	<0.001
Usage of moisturizers	1,719 (1,496-1,975)	<0.001

OR: Odds ratio, CI: Confidence interval, Omnibus test: $P < 0.001$, Nagelkerke's R-square: 5.6%, COVID: Coronavirus

However, the literature presents divergent results concerning the link between mask type and acne development. Techasatian et al.⁸ observed that approximately half of the participants experienced adverse skin reactions to face masks, with acne constituting 40% of these responses. Studies by Chaiyabutr et al.¹⁶ and Techasatian et al.⁸ indicated a higher prevalence of acne with surgical masks compared to cloth masks.^{19,22,24} In contrast, Yaqoob et al.¹² and Foo et al.¹⁷ identified a positive correlation between the use of N95 masks and acne development, whereas Choi et al.¹⁸ Reported that cotton face masks intensified acne flares. Roy et al.¹⁹ found that surgical masks increased the risk of acne by 2.40 times and N95 masks by 3 times. Han et al.²⁰ suggested that cloth masks were more likely to cause acne than surgical and FFP2/KN95 masks, potentially due to prolonged use without proper washing and the accumulation of sweat and environmental dirt. In contrast to these findings, our study did not reveal a significant difference in the onset of new acne or the exacerbation of existing acne across different mask types during the pandemic. Supporting our results, İnan Doğan and Kaya²¹ and Tuncer Vural¹¹ reported no association between mask type and acne. We hypothesized that the minimal use of N95 and fabric masks in our cohort may have limited our ability to discern a clear relationship between acne development and flares. Daye et al.²² and Choi et al.¹⁸ both concluded that extended mask-wearing durations are associated with increased acne flares. Similarly, Techasatian et al.⁸ demonstrated that the risk of adverse skin reactions, including acne, escalates with mask wearing periods of 4-8 hours per day and further increases beyond 8 hours of use per day. These findings are in concordance with our study, in which regression analysis revealed that wearing a face mask for more than 4-8 hours, and again beyond 8 hours augmented the risk of acne development by factors of 1.29 and 1.25, respectively. Mask-related acne has been observed to manifest predominantly on the chin, particularly within the “O”-zone of the face, presenting primarily as mild papular eruptions that are often accompanied by comedones and seborrhea. Kiely et al.⁹ reported that among individuals who developed Maskne following the onset of the COVID-19 pandemic, most (85.5%) experienced papulopustular eruptions, 46% experienced comedonal breakouts, and 22.5% suffered from nodulocystic lesions. Notably, a small fraction (12.8%) of these individuals sought medical advice for their acne. In our study, we found that papules/pustules develop more frequently in those with acne during the pandemic compared with those with acne before the pandemic; we did not detect any difference in the rate of comedones. In addition, the U- and O-zone localization of acne lesions increased significantly in those with new-onset acne during the pandemic. We believe that the increase in the O- percent and U-zone locations of new-onset acne during the pandemic is due to the areas where the mask is placed on the face.

Szepietowski et al.²³ reported that approximately 20% of young individuals wearing face masks experienced episodes of itch, corroborating the findings of Zuo et al.,²⁴ who documented a 14.9% incidence of itch attributed to face mask use. In a study by Tuncer Vural¹¹ showed that 35.5% of participants with new-onset acne experienced itching, 20.5% had dryness, and 19.5% had burning and tenderness. In our study, these symptoms were examined in more detail (rates were 50.5%, 58.8%, 27.4%, respectively), and we showed that the incidence of these symptoms was significantly higher than that of acne before the pandemic.

Factors associated with increased rates of maskne included female sex, younger age, history of acne, family history of acne, working in a “hot and sweaty” environment, use of emollients under the masks, and use of face shields and goggles.⁸ In our study, acne patients with COVID-19 who used a mask every day and washing their face every day were found to have an increased risk of acne flares. Further analysis revealed that female gender, use of alcohol-based products, prolonged mask wearing for periods of 4-8 hours and over 8 hours daily, daily application of facial cleansers, and regular use of emollients beneath the mask were associated with increased rates of new acne development during the pandemic. We believe that the acne flare caused by the use of facial cleanser may also be due to the use of an inappropriate cleanser. Our study was also a cross-sectional study, and the properties of the cleanser were not examined. These limitations may have made it difficult to assess the relationship between cleanser use and acne. This should be confirmed by studies that examined the properties of cleansers. In addition, we think that regular use of a moisturizer under the mask leads to acne development by increasing occlusion and humidity.

Study limitations

The primary limitation of this study was its reliance on self-reported data on acne occurrence. Furthermore, the participants were not subjected to prospective follow-up evaluations, which could have provided more objective and consistent assessments of acne development.

CONCLUSION

The results of this study indicate that the use of face masks is associated with the onset of acne and significantly exacerbates acne flares in individuals with a pre-pandemic history of acne. The phenomenon of mask-induced acne is a notable dermatological issue, with symptoms such as itching, burning sensations, and dryness being more prevalent than acne cases prior to the pandemic. Strategies to mitigate such conditions include minimizing the duration of mask use. However, the

application of emollients underneath masks could potentially contribute to the development of acne. Additionally, data suggest that women are at an increased risk of developing acne during the pandemic compared with their male counterparts.

Ethics

Ethics Committee Approval: This study was approved by the Karadeniz Technical University Faculty of Medicine Ethical Committee (approval number: 2024/80, date: 26.04.2024).

Informed Consent: It was obtained.

Authorship Contributions

Concept: D.A.A., L.B.S., Design: D.A.A., L.B.S., İ.E.A., Supervision: D.A.A., L.B.S., İ.E.A., Data Collection or Processing: D.A.A., L.B.S., Analysis or Interpretation: D.A.A., L.B.S., İ.E.A., Literature Search: D.A.A., L.B.S., İ.E.A., Writing: D.A.A., L.B.S., Critical Review: D.A.A., L.B.S.

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