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The Impact of COVID-19 Pandemic on Acne Patients and Their Management: An Observational Multicenter Study from Italy

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Abstract: Acne vulgaris was one of several diseases whose progression was significantly influenced psychologically by the rapid and protracted alteration of daily routines that occurred during the COVID-19 pandemic, especially for specific populations like adolescents. In order to assess their psychological impact and the relationship with the progression of acne vulgaris, this study aims to examine the quality of life, stress, anxiety, and depression of acne patients during the COVID-19 pandemic and their care. This observational, multicenter investigation was carried out in five dermatology clinics in Italy. Data were obtained via a remote telephone interview using questionnaires that were approved by a group of dermatologists and psychiatrists. Evaluations included demographic information, treatment status, disease progression, dietary habits, and employment activities. Some 178 acne vulgaris patients in various stages of systemic or topical medication were included in the study: 47 of 178 (26.4%) patients showed high scores on the HADS anxiety subscale, and 41 of 178 (23%) patients showed high scores on the HADS depression subscale. The Brief Resilience Scale (BRS) was used to measure resilience; 70 patients out of 178 (or 39.3%) showed low resilience (range: 1.00–2.99). In 32 out of 178 patients with PSS, high levels of stress were discovered (18%). Some 50 out of 178 patients experienced alterations in their way of life, including increased acne-related symptoms of relationship humiliation and constraints on everyday activities. Some 52 out of 178 patients (29.2%) said that they felt their condition had gotten worse over the study period. Our findings revealed a potential link between the exacerbation of acne and high levels of anxiety and depressive symptoms, as well as an elevated sense of stress and low or moderate levels of adaptability and resilience.

Keywords: acne; COVID-19

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1. Introduction

Following the SARS-CoV-2 epidemic outbreak in Italy in February 2020, a number of containment measures were put in place to stop the spread of this deadly virus due to the high infectivity of the virus, which was linked to significant morbidity and mortality, which increased public concern. From 9 March 2020 to 3 May 2020, these precautions

included home confinement; the lockdown of schools, workplaces, and commercial activity; the quarantine of suspected and active diseases; active surveillance; and the restriction of social gatherings. The rapid and extended alteration of several activities and regular daily routines, particularly for specific demographic groups like teens, had a significant psychological effect and had an effect on the trajectory of many people's lives and on the course of many diseases including acne vulgaris [1]. Psychological factors like shame and self-consciousness, social disengagement, melancholy, anxiety, and rage have an impact on acne. Numerous pieces of research on adolescents with acne have emphasized the significance of the social and psychological consequences of this condition [2]. Its placement on the face, in particular, has a considerable effect on how one perceives oneself and one's identity. This inevitably has ramifications for one's sexual identity [3]. These relationships between psychological health and acne help us understand how this dermopathy is frequently linked to emotional issues or serious psychiatric disorders, which are frequently more closely related to how the adolescent perceives their body than to the actual severity of the disease [4]. Acne sufferers may experience psychological illnesses that include altered body image, diminished self-esteem and confidence, humiliation, social isolation, sadness, rage, frustration, shame, avoidance, and problems forming social connections. According to reports, this skin ailment has a similar psychological impact on sufferers as long-term physical disorders like asthma, diabetes, or epilepsy do [5]. Dermatologists have also restricted in-person interactions with other chronic disease patients to telemedicine and teledermatology due to the pandemic, containment measures [6], and pressure on healthcare systems. This has allowed medical information to be transmitted to the dermatologist either through a live interactive consultation (video call) or through a store-and-forward system [7]. Patients with acne have been a prime example of how a skin condition has been impacted by the lockdown: the majority of them are teenagers, one of the demographics most impacted by the pandemic's effects; dermatological examinations were suspended or diverted to virtual communication; and patients had to deal with the disease differently and adjust to a set of habits and emotions that the pandemic was generating [8]. This study wants to measure the psychological impact of the COVID-19 pandemic lockdown on acne patients' quality of life, stress levels, and anxiety–depression symptoms. It does so by collecting specific psychiatric data and examining the correlation between those specific scales and the development of acne [9].

2. Materials and Methods

An observational, multicenter, retrospective study of patients with acne vulgaris of all gravity scales treated with topical and systemic therapy at specialized acne clinics was conducted from 5 May 2020 to 31 May 2020, referring to the Italian lockdown from 9 March 2020 to 4 May 2020. The study's participating institutions included the University Federico II in Naples (Campania), the Centre Polo Pontino in Terracina (Lazio), the University of Ferrara in Emilia Romagna, and the AOU Emanuele F. San Bambino in Catania (Sicily). Data were gathered via a remote telephone interview using questionnaires that were approved by a group of dermatologists and psychiatrists. The Hospital Anxiety and Depression Scale (HADS) was used to measure anxiety and depression; the Perceived Stress Scale (PSS) was used to measure perceived stress levels; and the Brief Resilience Scale (BRS) was used to measure resilience and adaptation. Additionally, we assessed the quality of life for patients with skin diseases using the Dermatology Life Quality Index (DLQI). The patients were interviewed about their contacts with COVID-19-positive people or people suspected of having the infection, how much they thought their acne was getting worse (defined as an increase in the number or size of skin lesions), whether they were still receiving treatment or had stopped (defined as a break of at least 15 days), and whether they had stopped on their own volition or had been advised to do so by their treating dermatologist or general practitioner. No change in work activities, work stopped or lost, and home working modes were the three categories used to categorize work activity. Additionally, eating behaviors were looked into, particularly changes in

eating patterns such as increasing calorie intake, skipping meals more frequently, increasing off-meal consumption, and increasing consumption of junk food (e.g., sweets, cookies, snacks), cigarette consumption, and finally, increased alcohol consumption. The study was conducted following the principles of the Declaration of Helsinki.

Data were summarized using absolute and relative frequencies (%) or medians and interquartile ranges (IR) for qualitative and quantitative variables, respectively.

Differences regarding characteristics of patients who experienced a worsening in acne in respect to those who did not were tested by using a v2 test (or Fisher's exact test where appropriate) or the Mann–Whitney test.

Logistic regression analyses were carried out to assess whether anxiety, depression, stress, and resilience (evaluated by the relative scales and considered as both categorical and continuous variables) were associated with a worsening of acne.

In the multivariate analysis, the outcome was assessed while taking potential confounders into account, such as gender, drug suspension, work activity during the lockdown (no change in work activities, work suspension, or home working). Statistical significance was set at p-value < 0.05.

Analyses were performed using STATA 13.0 Software (StataCorp, College Station, TX, USA).

3. Results

A telephone interview was conducted with 178 acne vulgaris patients (average age: 20 years; 63 males and 115 females) (Table 1).

Table 1. Clinical and demographic characteristics of patients with acne vulgaris.

Characteristics of the Study Population (n = 178)		***n* (%) Median (Interquartile Range)**
Gender	Male	63 (35.39)
	Female	115 (64.61)
Age		20.00 (17.00–24.00)
Current isotretinoin treatment	No	123 (69.10)
	Yes	55 (30.90)
Current estroprogestinic treatment	No	135 (75.84)
	Yes	43 (24.16)
Current oral antibiotic treatment	No	145 (81.46)
	Yes	33 (18.54)
Topical acne treatment	No	33 (18.54)
	Yes	145 (81.46)
Treatment discontinuation	No	154 (86.52)
	Yes	24 (13.48)
Treatment discontinuation Yes: suggested by general practitioner	Suggested by general practitioner	4 (16.66)
	Suggested by dermatologist	4 (16.66)
	Fear of SARS-CoV-2 infection	7 (29.16)
	Inability to buy the drug	9 (37.5)
Dosage reduction	No	168 (94.38)

Table 1. *Cont.*

Characteristics of the Study Population (n = 178)		n (%) Median (Interquartile Range)
	Yes	10 (5.62)
SARS-CoV-2 infection	No	178 (100)
	Yes	0 (0)
Drug treatment restart during the lockdown	No	31 (83.78)
	Yes	6 (16.22)
Localization of acne	Face	106 (59.55)
	Trunk and face	62 (34.83)
	Only trunk	10 (5.62)
Acne self-evaluation severity	Stable	61 (34.27)
	Improved	65 (36.52)
	Worsening	52 (29.21)
Acne severity (self-evaluated)	Mild	25 (14.04)
	Moderate	106 (59.55)
	Severe	47 (26.40)
Work activity	Interrupted	18 (10.11)
	Home working	9 (5.05)
	No changes/not working	151 (84.83)
Eaten more	No	96 (53.93)
	Yes	82 (46.07)
More 'unhealthy' food consumption (e.g., sweets, cookies, snacks)	No	109 (61.24)
	Yes	69 (38.76)
Increased use of alcohol	No	162 (91.01)
	Yes	16 (8.99)

Only 1 of 178 (0.6%) patients in our sample of patients reported having contact with COVID-19-positive patients, necessitating a mandatory 14-day quarantine, and none of the patients who were enrolled in the trial were COVID-19 positive.

A significant percentage of the study population—actually, 52 out of 178 patients, or 29.2 percent—referred to disease deterioration that was unrelated to drug withdrawal. Of 178 patients, 106 (59.5%) had localized acne on the face, 10 (5.6%) had it on the trunk, and 62 (34.8) had it on both the face and the trunk.

Patients were asked to self-evaluate their acne during the phone call; 25 patients (14% reported mild acne, 106 patients (59.5%) reported moderate acne, and 47 patients (26.4%) reported severe acne. Some 33 out of 178 patients (18.54%) were receiving oral antibiotic therapy, 43 out of 178 patients (24.16%) were receiving estroprogestin therapy, 55 out of 178 patients (30.9%) were receiving isotretinoin therapy, and 145 out of 178 patients (81.46%) were also receiving topical therapy.

Some 24 of 178 subjects (13.5%) discontinued treatment; 8/24 (33.3%) did so after consulting their general practitioner or dermatologist; 9/24 (37.5%) patients did so because they were unable to obtain their medications due to the lockdown; and 7/24 (29.16%) patients did so on their own initiative out of concern that the medication might make

COVID infection more likely. Some 18/178 (10.1%) reported having their work interrupted or lost, while 9/178 (5%) reported working from home. During the lockdown, 151/178 (84.8%) patients reported no changes in their work activity or not working due to being students.

Some 49 of 178 (27.5%) patients had borderline scores on the HADS anxiety subscale, whereas 47 of 178 (26.4%) patients had abnormal values.

Some 37 out of 178 patients (20.8%) had borderline scores on the HADS depression subscale, whereas 41 out of 178 patients (23%) had abnormal values. On the BRS scale, 70 patients out of 178 (39.3%) showed low resilience (range: 1.00–2.99), while 32/178 (17.9%) demonstrated high levels of resilience. Some 32 patients out of 178 (or 18%) had high PSS stress levels, whereas 55% had normal PSS stress levels and 27% had low PSS stress levels (Figure 1). Concerns about SARS-CoV-2 infection or the perception that acne treatment may increase the risk of infection were reported as stressful events during the lockdown by 75/178 (42.13%) and 55/178 (30.9%) of patients, respectively. Other reported stressful events included a lack of social contacts by 98/178 (59%), a worsening of family relationships by 58/178 (32.6%), work-related worries due to lower work productivity or lower income by 72/178 (40.4%) and 75/178 (42.1%)

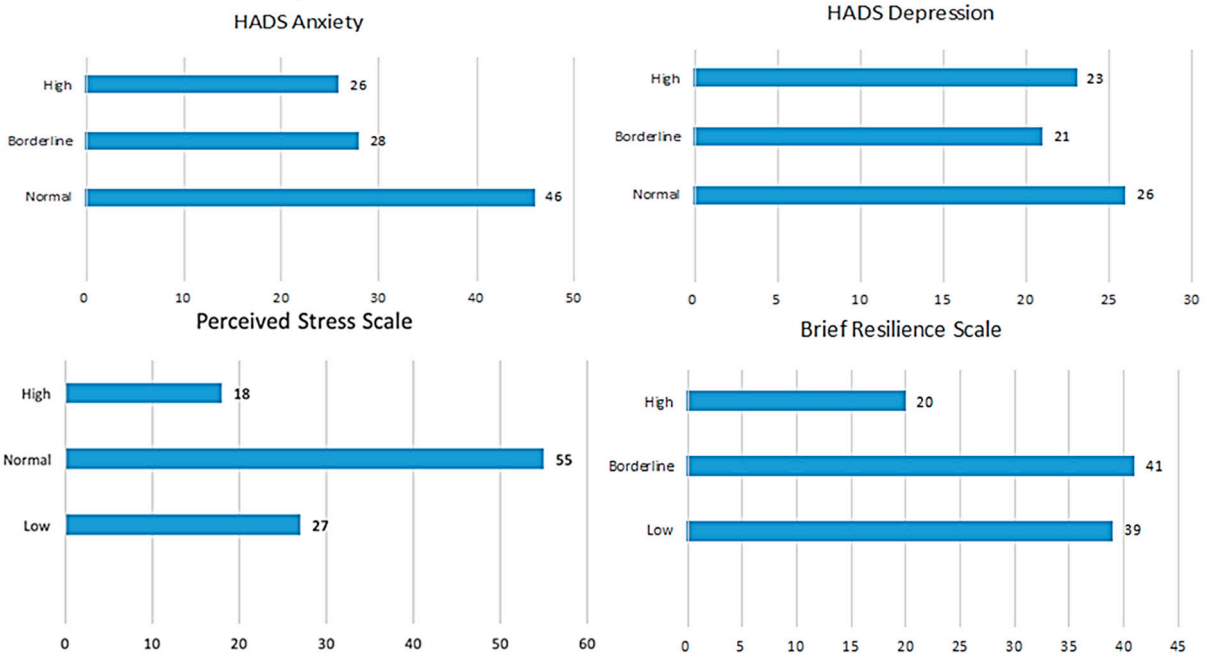

Figure 1. Graphic showing levels of anxiety in the studied population measured using the Hospital Anxiety and Depression Scale (HADS); graphic showing depression levels in the studied population measured using the Hospital Anxiety and Depression Scale (HADS); graphic showing levels of resilience in our study population measured using Brief Resilience Scale (BRS); graphic showing the perceived stress in the studied population measured using the Perceived Stress Scale (PSS).

Of the 178 patients, 82 (46%) also reported having evident dietary changes, including increased calorie intake, mealtime irregularities, eating between meals, and an increase in junk food and snacking in 69 of them (38.8%).

Following administration of the DLQI to assess the impact of skin disease on the quality of life of the patient, 35 patients (19.7%) reported that the disease had no impact on their quality of life, 80 patients (44.9%) reported that the disease had a limited impact with few effects, and 50 patients reported that the disease had elevated effects on their daily lives, including symptoms of embarrassment in relationships, limitations in daily activities due to acne, and avoidance of social situations (Figure 2).

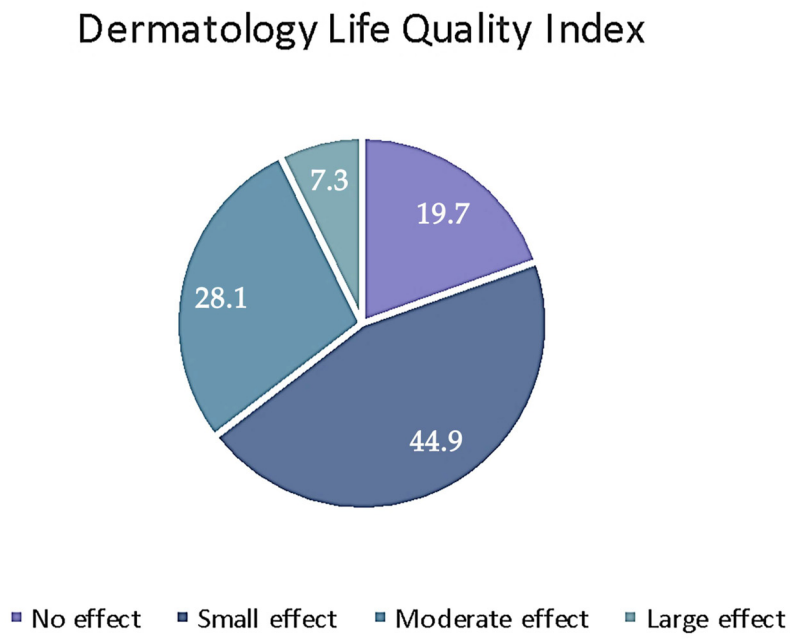

Figure 2. Graphic showing the impact of skin disease on the quality of life measured with DLQI.

To determine factors linked to acne worsening, a univariate analysis was conducted (Table 2).

Table 2. Univariate analysis showing correlations between demographic and clinical characteristics and worsening of the acne.

Characteristics of the Study Population (*n* = 178)		**No Worsening (*n* = 126) *n* (%) Median (IR)**	**Worsening (*n* = 52) N (%) Median (IR)**	***p*-Value**
Age		20.00 (17.00–25.00)	19.50 (16.50–23.50)	0.271
Gender	Female	83 (65.87)	32 (61.54)	0.582
	Male	43 (34.13)	20 (38.46)	
Comorbidities	No	82 (65.08)	43 (82.69)	0.019
	Yes	44 (34.92)	9 (17.31)	
Treatment discontinuation	No	109 (86.51)	45 (86.54)	0.996
	Yes	17 (13.49)	7 (13.46)	
Work activity	No change	110 (87.30)	42 (80.85)	0.282
	Work suspension	11 (8.73)	7 (13.46)	
	Home working	5 (3.97)	3 (5.77)	
Eat more between meals	No	78 (61.90)	18 (34.62)	0.001
	Yes	48 (38.10)	34 (65.38)	
Consuming “unhealthy” foods (junk food, sweets, cookies, snacks, fast food)	No	83 (65.87)	26 (50.00)	0.048
	Yes	43 (34.13)	26 (50.00)	

Table 2. *Cont.*

Characteristics of the Study Population (*n* = 178)		No Worsening (*n* = 126) *n* (%) Median (IR)	Worsening (*n* = 52) N (%) Median (IR)	*p*-Value
Use of alcohol	Not increased	119 (94.44)	43 (82.69)	0.013
	Increased	7 (5.56)	9 (17.31)	
Feeling stressed for:				
Reduced financial income or concern for the work–professional future	No	84 (66.67)	19 (36.54)	<0.001
	Yes	42 (33.33)	33 (63.46)	
Reduced work productivity and sense of inefficiency	No	89 (70.63)	17 (32.69)	<0.001
	Yes	37 (29.37)	35 (67.31)	
Reduced sporting activity	No	83 (65.87)	26 (50.00)	0.048
	Yes	43 (34.13)	26 (50.00)	
Impaired family relationships	No	101 (80.16)	19 (36.54)	<0.001
	Yes	25 (19.84)	33 (63.46)	
Lack of social and interpersonal relations	No	71 (56.35)	9 (17.31)	<0.001
	Yes	55 (43.65)	43 (82.69)	
Absence of sexual activity	No	106 (84.13)	25 (48.08)	<0.001
	Yes	20 (15.87)	27 (51.92)	
Fear of getting infected by SARS-CoV-19 or fear for my family	No	85 (67.46)	18 (34.62)	<0.001
	Yes	41 (32.54)	34 (65.38)	
Fear that acne therapy leads to an increased risk of infection	No	97 (76.98)	26 (50.00)	<0.001

An equally significant association was found between worsening of the disease and feeling stressed about reduced financial income or worries about future work–career, impaired family relationships during lockdown, and lack of sexual activity (p 0.001). Increased alcohol and unhealthy food consumption was different among those who reported worsening of the disease compared to those who did not (p 0.001). In the multivariable model, there was a significant correlation between anxiety (OR 1.45; 95% CI 1.16–2.67; p 14.007), depression (OR 1.64; 95% CI 1.03–2.66; p 14.033), and PSS (OR 0.48; 95% CI, 0.38–0.86; p 14.003) and the severity of acne vulgaris.

Acne severity and stress levels have been linked, especially when there are problems with family relationships and a lack of social and interpersonal connections.

Among the patients whose conditions worsened, those who were exposed to or perceived a deteriorating home environment and felt stressed by the decline in and impossibility of having regular interpersonal and social contacts ran the risk of testing abnormal on the HADS. They were 4.6 times more likely to experience anxiety compared to those

who were not exposed to these factors. Similarly, when all other factors are held constant, the same characteristics predict a 16.03 times higher probability of presenting depressed symptoms with a high level on the HADS depression.

Finally, the multivariate analysis revealed that there was a 4.53-fold increased risk of developing pathological eating behaviors among patients whose condition worsened, with deterioration of family relationships and stress from missing social relationships, and who were found to have high levels of PSS, with changes in eating habits, dysregulation of daily main meals, increased consumption of food between meals, increased calorie intake, increased consumption of junk food, and dyscontrol over appetite.

In neither model was treatment stopping significantly linked to a worsening of acne.

4. Discussion

Patients with chronic skin problems were denied access to usual outpatient dermatology visits during the blockade, as there was a sharp decline in hospital admissions for conditions other than COVID-19 during the pandemic. Visits were made only in urgent situations [10]. Teledermatology services were an effective technique to reduce the effects of the inability to make in-person visits. Our results show that patients with chronic conditions, such as acne vulgaris, were severely affected by this exceptional circumstance [11,12].

One of the major consequences was lower adherence to treatment, which may have been caused by panic over the outbreak and difficulties in accessing regular medical care and prescription refills. In fact, 29.2% of our patients voluntarily chose to stop treatment for fear of an increased risk of SARS-CoV-2 infection associated with the medications they were taking. Some 16.6 percent of patients who discontinued their medications did so after consulting their primary care physician, who had expressed concern about the pandemic-related use of antibiotic, estroprogestin, or isotretinoin therapy.

This occurred despite the advice of the Italian Society of Dermatology—SIDeMaST [13]. However, among the study population, a significant percentage of patients (29.2%) reported worsening of the disease, which was not related to either discontinuation of the medication or discontinuation of therapy (only 13.5% of patients had discontinued treatment, and this finding was not significantly associated with worsening in the univariate statistical analysis). In addition, mask-related mechanical or irritant stimuli were not the cause of exacerbation because our patients were confined at home for the duration of the study and did not wear personal protective equipment (it was not mask-acne) [14].

Patients who continued treatment also experienced a worsening of the disease [15], as evidenced by the correlation found between changes in HADS, BRS, and PSS and worsening acne, confirming the well-known relationship between psychological distress and skin immune response [16,17]. This seems to be mainly due to the psychological distress experienced by the patients during isolation and resulting from the situation itself. Indeed, acne worsening was strongly correlated with high levels of anxiety and depressive symptoms, with increased perception of stress and low-to-moderate adaptive and resilience skills. Among the worsened patients, those who were exposed to a deteriorated family environment and felt stressed by the reduction and inability to have daily interpersonal and social relationships had an 11.6-fold higher risk of presenting with HADS pathological anxiety than those who were not exposed to these factors, with a 4.6-fold higher risk of increased alcohol consumption; the same factors led to a 16.03-fold higher risk of presenting with depressive symptoms with high levels of HADS depression, all other variables being equal. Finally, multivariate analysis showed that patients with deteriorating family relationships and stress due to lack of social relationships, and who were found to have high levels of PSS, had a 4.53-fold increased risk of developing pathological eating behaviors, with change in eating habits, dysregulation of daily main meals, increased consumption of food outside meals, increased caloric intake, increased consumption of junk food, and dyscontrol over food. This was 53 times greater than developing pathological eating behaviors, with change in eating habits, dysregulation of daily main meals, increased consumption of food outside meals, increased caloric intake, increased consumption of

junk food, and dyscontrol over food with increased consumption outside meals reported as snacking (NAS Eating Behavior Disorder in which patients eat outside of main meals as a result of fluctuating emotions during the day, such as boredom, loneliness, anxiety, anger, and not being able to resist the sight of food, with egodystonic thoughts if they should taste it) [18].

Numerous mechanisms have been put forward as to how stress might exacerbate acne vulgaris. Some researchers think that times of emotional stress cause higher levels of glucocorticoids and adrenal androgens to be released, two hormones known to exacerbate acne and perhaps cause sebaceous hyperplasia. Additionally, it has been discovered that corticotropin-releasing hormone, the body's stress response coordinator, promotes sebaceous lipogenesis and sebocyte conversion of androgen precursors to testosterone. According to several studies, stress-related releases of neuroactive chemicals from the epidermis might trigger inflammatory skin conditions. Recently, it was shown that substance P, a neuropeptide released by stressed peripheral neurons, stimulates the growth of sebaceous glands and increases lipid synthesis in sebaceous cells [19]. Finally, psychological stress, such as test stress, can cause wound healing to be up to 40%, which could be a factor in slowing the repair of acne lesions. On the other hand, despite reports that work-related worries are another source of stress in our society, no link has been discovered between work activities during the isolation time and increasing acne.

The risk of developing pathological eating behaviors was 4.53 times higher in cases with high PSS levels, including changes in eating habits, dysregulation of daily main meals, increased non-meal consumption, increased caloric intake, increased consumption of junk food, and increased off-meal consumption that was reported as snacking. Given the influence on the clinical course of acne seen in this study, which is also consistent with the recent literature, the high level of statistical significance with a relatively small sample size suggests that this association is real, even though more subjects are required to validate these data [20,21].

Although a definitive link between diet and acne has not yet been established, current research has made it possible to pinpoint specific dietary components and habits that may have an impact on acne severity [22]. There is consensus, however, that excessive consumption of dairy products and meals with a high glycemic index is associated with elevated levels of insulin-like growth factor 1 (IGF1) and decreased levels of insulin-like growth factor binding protein-3 (IGFBP-3) [23]. In particular, IGF-1 increases the production of androgens in the adrenal and gonadal glands; encourages the expression of 5—reductase, which increases the conversion of testosterone to DHT; depletes FoxO1, a crucial negative regulator of androgen receptor transactivation; and promotes basal keratinocyte proliferation [24].

On the other hand, eating foods like fish, fruit, and vegetables on a daily basis that are low in lipids and trans-fatty acids and high in glycemic index has been linked to a lower incidence of acne [25]. Based on these factors, the continuation of medication as well as changes to the patients' routines, such as diet changes by favoring nutritious foods and keeping up regular physical exercise, even if indoors, may be advised to control hyperinsulinism. Additionally, there may be a substantial correlation between the exacerbation of acne and high levels of anxiety and depressive symptoms, as well as a higher feeling of stress and low or moderate levels of adaptive and resilient capacities [26]. Patients whose conditions were getting worse had an 11.6-fold higher risk of being classified as "pathological" on the HADS anxiety scale, a 4.6-fold higher risk of drinking more alcohol, and a 16.03-fold higher risk of exhibiting depressive symptoms when they were exposed to a deteriorating family environment and felt stressed by the loss of regular interpersonal and social relationships [27,28]. Finally, the multivariate analysis revealed that patients who were experiencing stress did so from a lack of social connections and worsening family relationships. Stressful conditions are known to cause an increase in the hormones CRH, ACTH, MSH, cortisol, and catecholamines, which are meant to put the body in an alert state [29]. However, these hormones have the ability to promote adrenal DHEAS

and cortisol production at the peripheral level, with hair follicles directly contributing to elevated cortisol production [30].

Although research on the direct effects of high serum cortisol on acne is scarce, both acute and long-term psychological stress are linked to acne worsening. Due to the small sample size and the use of self-reports of worsening acne, our study has certain limitations. However, this study shows that this type of stress is not caused by the illness itself, but rather by adversity. Psychosocial stress can be a triggering factor for the worsening of acne.

5. Conclusions

In conclusion, the COVID-19 pandemic had a detrimental effect on acne sufferers. A maladaptive framework for coping with an abrupt and unanticipated social situation was developed as a result of the most significant effects, which included confinement to the home, isolation with its reduced opportunities for external relationships, changes in lifestyle and work activity coupled with a strong concern for the future, the onset of uncontrolled eating behavior, increased calorie and alcohol intake, and changes in lifestyle and work activity. Chronic stress, which has been connected to mental health issues and is a risk factor for anxiety and depression, was a result of all these factors and independently caused the pathology to get worse.

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