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Effect of severity of acne on the mental health of Lebanese patients with acne: findings from an online survey

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Abstract

Background Acne, an inflammatory chronic skin disease, is one of the most common disorders treated worldwide. Many studies have demonstrated the bidirectional relation that exists between skin disorders, specifically acne and mental health. However, there is paucity of such data in Lebanon where acne is a prevalent skin disease. This cross-sectional study aims to assess the effect of the severity of acne on the mental health of Lebanese patients with acne.

Methods After receiving the ethical approval for research, a google form questionnaire was shared via Instagram and WhatsApp, starting from December 2021 to February 2022, with 729 Lebanese patients with acne, who were living in Lebanon, were over the age of 16, and were able to read and understand English. The questionnaire included 4 major parts: sociodemographic characteristics, physical health, mental health, and coping strategies.

Results Out of 729 participants, 57.48% were aged between 21 and 25 years old, 61.59% were females, 35.12% had a Bachelor's degree, 55% had mild acne and 35% had moderate acne. The results have shown that the severity of acne was associated with increased depression, anxiety, distress, and decreased well-being but didn't significantly affect social isolation. Female gender and higher educational level were associated with a higher risk of mental illness among acne patients. Regular eating, regular exercise, and coping strategies also played an important role in the mental health state.

Conclusions This study has confirmed that acne severity has a negative impact on the mental health of Lebanese patients. Therefore, this interaction between the mind and the skin should be addressed by focusing on the psychosocial context of skin diseases, especially acne.

Keywords Acne, Well-being, Distress, Depression, Anxiety, Social isolation, Lebanese

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Introduction

Acne vulgaris (or simply acne) [1] is one of the most common disorders treated by dermatologists and other health care providers. It is most commonly diagnosed in adolescents and young adults (roughly 85% of them are affected), however, it can also affect adults and even children [2]. Moreover, about 95% of people aged 11 to 30 are affected by acne to some extent [3]. The Global Burden of Disease Study estimates the prevalence of acne at 9.4%, ranking it as the eighth most prevalent disease worldwide [4, 5]. In addition, it is the most prevalent chronic skin disease in the United States, affecting nearly 50 million people [2].

Acne vulgaris is an inflammatory, chronic and self-limiting disorder of the pilosebaceous unit [6]. When the skin becomes oily, hair follicles become blocked with sebum and skin cells, and bumps form [7]. Acne can display as non-inflammatory lesions; whiteheads and blackheads which are closed and open comedones respectively, and inflammatory lesions; papules, pustules, nodules/cysts, and can even develop into fibrosis and scarring [1, 6, 7]. Consequently, physical manifestations such as soreness, pain, and pruritus are common concomitant symptoms of acne lesions [7, 8]. Prescription medications for treating acne include: topical retinoids, topical antibiotics, azelaic acid, antibiotic tablets, the combined contraceptive pill for women. For mild to moderate or moderate to severe acne, treatment typically begins with a combination of topical treatments or antibiotic tablets along with topical treatments. Hormonal therapies or the combined oral contraceptive pill can be effective for women with acne, however, the progestogen-only pill or contraceptive implant may sometimes worsen acne. It can take 2 to 3 months for many of these treatments to show results [3].

Moreover, the mind and the skin are undoubtedly inextricably linked, in other terms, "the skin and the central nervous system are intertwined, both being derived from the same embryological source," as said by Adam Friedman, MD, FAAD, an Associate Professor of Dermatology in the Department of Dermatology at George Washington School of Medicine and Health Sciences in Washington, DC [9]. So, if somebody is suffering from a chronic inflammatory skin disease such as acne, they may become psychologically distressed and vulnerable [10]. Effectively, it has been proven that acne can lead to anxiety, depression, embarrassment and low self-esteem [11]. Furthermore, it can be even more complicated since it induces poor facial aesthetics and social withdrawal [6]. But equally, if somebody is experiencing a chronic mental health problem, that may trigger or exacerbate their skin condition, or it may decrease their ability to cope with their condition and comply with a specific therapeutic strategy. It can also have a detrimental impact on skin functions as well as a negative effect on skin aging [12].

In the Northern Finland Birth Cohort 1966 (NFBC1966), patients with adult acne (mean age: 46) had more (18.9%) depressive symptoms (BDI-II > 14 points) compared with those without acne (9.7%) but the severity of acne did not correlate with psychological symptoms [13], a significant association was found between the severity of acne and anxiety and depression in an Indian study done by Rayapureddy et al. [14], and a study done in Saudi Arabia revealed a significant difference with the control group for overall anxiety but not for the depression score and a positive correlation between anxiety and depression scores in patients with acne [15]. However, a Turkish study demonstrated that no relationship was found between acne severity and depression or anxiety but the risk of eating disorders among acne patients can be increased by these conditions [16].

In Lebanon, acne is a widespread skin disorder responsible for more than 23% of skin complaints among Lebanese adolescents and young adults diagnosed as outpatients [17]. But there is a lack of studies assessing the impact of acne on mental health in the Lebanese population. Effectively, there's only one prospective cohort study that involved only 62 patients (of whom 79% were females) between 15 and 40 years old, with moderate-to-severe acne, who were distributed between 2 groups: one group treated with isotretinoin, the other one with systemic antibiotics combined with topical treatments, then they were followed for a period of 6 months. Patients with mild acne, those previously treated with oral isotretinoin, and those with psychiatric diseases were excluded from the study and the aim of this study was to measure the effect of acne on the quality of life by using the Dermatology Life Quality Index (DLQI), Cardiff Acne Disability Index (CADI), and Rosenberg Self-esteem Scale (RSES) before treatment, after 3 months, and after 6 months [18].

Therefore, our cross-sectional research study aims to assess the effect of the severity of acne on the mental health _including well-being, distress, depression, anxiety, and social isolation_ of a large proportion of Lebanese patients with severe, moderate, and even mild acne which is the most frequently encountered severity. All Lebanese patients having acne and who are over the age of 16 could be included, regardless of treatment (taken or not). In addition, it emphasizes the importance of early screening for mental health problems in patients with physical conditions such as acne.

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Materials and methods

Study design and population

An observational cross-sectional study was carried out starting from December 2021 to February 2022. The study enrolled 729 Lebanese patients with acne, who were living in Lebanon and were over the age of 16. Added to that, the participants were able to read and understand English in order to be able to give their informed consent and answer all the online survey questions. Finally, they had access to an Instagram or WhatsApp account since the link to the Google form was communicated by using these platforms. Patients who were living outside Lebanon and were under the age of 16 were excluded from the study. Subjects who refused to participate and those with obvious mental disability that precluded them from answering questions were not included.

Procedure

After an Ethical approval for research was granted by the INSPECT-LB Research and Ethics Committee, a Google form was used as a tool to collect participants' replies. The link of the online survey was shared using social media platforms (WhatsApp and Instagram; two of the most popular social media platforms) in order to reach the highest number of participants possible.

Outcome measures

The questionnaire was divided into four major parts:

– Sociodemographic characteristics.
– Participants' physical health including:

  • Severity of acne (subjectively assessed by participants, based on their global assessment): mild, moderate, severe, very severe.
  • Other physical health conditions.
  • Regular exercise and regular eating.

– Participants' mental health which was assessed by using 5 scales:

  • The World Health Organization-5 Well-Being Index (WHO-5) was used to assess the subjective well-being of the respondents over time (over the last two weeks if they had acne when the questionnaire was administered and filled out or, for the purpose of our study, over the period of time during which they had acne; reliability test yields a Cronbach's alpha of 0.924). It is a short questionnaire consisting of 5 simple and non-invasive questions with each question scored based on a Likert scale coding (0 = at no time, 1 = some of the time, 2 = less than half the time,

3 = more than half the time, 4 = most of the time, 5 = all of the time) [19]. A 0 represents the worst well-being possible and 25 represents the best well-being possible.

  • The Beirut Distress Scale-10 (BDS-10) is a 10-item scale used to assess mental and psychological distress (for the purpose of our study, participants' psychological distress was assessed over the period of time during which they had acne; reliability test yields a Cronbach's alpha of 0.769). Each question has a score ranging from 0 to 3 (never = 0, a little bit = 1, moderately = 2, very much = 3) and the total score ranges from 0 to 30 [20]. The higher the score, the more the participants tend to exhibit depressive behaviors.

  • The Generalized Anxiety Disorder-7 (GAD-7) is a 7-item scale that has reporting scores from 0 to 3 on all the questions. It investigates how often the patient has been bothered by seven different symptoms of anxiety over the last two weeks if he had acne when the questionnaire was administered and filled out, with response options such as: "not at all", "several days", "more than half the days", and "nearly daily" scored as 0, 1, 2, and 3, respectively. For the purpose of our study, we also considered participants who have been affected by anxiety symptoms over the period of time during which they had acne. Reliability test yields a Cronbach's alpha of 0.801. The total GAD-7 score ranges from 0 to 21 [21].

  • The Patient Health Questionnaire-9 (PHQ-9) is a 9-item scale. As a severity measure of the depressive symptoms experienced over the last two weeks if he had acne when the questionnaire was administered and filled out. For the purpose of our study, we also considered participants who have been affected by depressive symptoms over the period of time during which they had acne. Reliability test yields a Cronbach's alpha of 0.784. The PHQ-9 score can range from 0 to 27, since each of the 9 items can be scored from 0 (not at all) to 3 (nearly every day) [22].

  • The Lubben Social Network Scale-6 (LSNS-6) is a validated instrument designed to gauge social isolation in older adults by measuring the number and frequency of social contacts with friends and family members and the perceived social support received from these sources [23]. In our study, it was used to assess social isolation of the participants over the period of time during which they had acne. Reliability test yields a Cronbach's alpha of 0.790. The scale consists of 6 items with each item scored from 0 to 5 (none = 0, one = 1, two = 2, three or four = 3,

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five thru eight = 4, nine or more = 5) and the total score ranges from 0 to 30.

– Coping strategies adopted by the participants to overcome all the physical and mental health challenges encountered were extracted from a validated questionnaire based on a 5-point Likert scale (0 = Strongly Disagree, 1 = Disagree, 2 = Unsure, 3 = Agree, 4 = Strongly Agree) developed from the previous published studies [24–26] and were used as independent variables.

Statistical analysis

The collected data was entered in Excel and analysed using the Statistical Package of the Social Sciences (SPSS). In the univariate statistical analysis, mean ± standard deviation (SD) was used for quantitative variables and percentages used for qualitative variables. In the bivariate statistical analysis, Spearman correlation was used. Scores' percentages and reliability tests were also used. Statistical tests used were Student's t test, ANOVA, Kruskal─Wallis test, and Mann─Whitney U test (the 2 last tests were used for nonparametric measures when data was not normally distributed and sample size in each group was less than 30 participants). A P value < 0.05 was considered statistically significant and then, only significant results were reported. In the multivariate statistical analysis, variables with a P value < 0.2 were considered and a MANCOVA was done, comparing multiple dependent variables among subgroups of the population.

Results
Descriptive statistics
Out of 729 participants enrolled in the study, 57.48% were aged between 21 and 25 years old, 61.59% were females, 99.31% were single, 45.54% were living in Mount Lebanon, 35.12% had a Bachelor's degree, 82.85% weren't working, 50.21% had a monthly income above 5 000 000 L.L., and 35.53% stated that their number of people at home was 5 (Table 1 in the appendix).

Physical health
55% of participants had mild acne and 35% had moderate acne (Fig. 1 in the appendix); 60% didn't have other physical health condition. However, approximately 15% of participants had also another skin disease (Fig. 2 in the appendix). Approximately 80% of participants ate sweets, fruits and/or vegetables, and meat and/or fish regularly. However, approximately 50% ate cereals and low-fat products regularly (Fig. 3 in the appendix). Also, 54% of participants regularly exercised few days and 25% never regularly exercised

(Fig. 4 in the appendix). Identifying with role models and listening to music were the coping mechanisms that had the highest level of agreement from participants. However, the highest level of disagreement was for watching TV for news (Fig. 5 in the appendix).

Mental health: scores percentages, interpretation, and reliability tests
WHO-5
Most of the participants, more than half the time, woke up feeling fresh and rested (25.2%) and had their daily life filled with things that interested them (29.6%). Also, most of the time, 31.4% (response 4) of the participants have felt cheerful and in good spirits and 28% (response 4) had felt calm and relaxed (Table 2 in the appendix). In this sample, the Cronbach's alpha = 0.924, indicating a high reliability. Added to that, in the inter-item correlation matrix, no value is equal or smaller than 0.3, indicating a good discrimination of the questions. The lowest raw score was 2 while the highest raw score was 20. In addition, given that a score below 13 indicates poor well-being, most of the participants had a good well-being score since the score below 13 was equal to 38.6%.

BDS-10
Almost 35 to 38% of the participants experienced a little bit rapid mood changes for tiny matters, got angry for ridiculous reasons, had puzzled ideas, difficulty concentrating, and difficulty to relax, and less than 10% of them experienced very much self-isolation, constipation or diarrhea, stomach cramps and heartburn.

52% of them never experienced memory loss and 60.4% of them never experienced stomach heartburn (Table 3 in the appendix). The Cronbach's alpha of the scale was 0.769, indicating a good reliability. Added to that, in the inter-item correlation matrix, no value is equal or smaller than 0.3, indicating a good discrimination of the questions. Many of the respondents (8.9%) had manifested no distress (score of 0). A score of 10 came second with a percentage of 7.3%.

PHQ-9
About 40% of the participants were feeling down, depressed or hopeless, had little interest or pleasure in doing things as well as feeling tired or having little energy. Less than 10% of all participants experienced all the below depressive symptoms. It is worth mentioning that 18% of the participants had suicidal and self-hurt thoughts several days and 4% of them have these thoughts nearly every day (Table 4 in the appendix).

The Cronbach's alpha was 0.784, indicating a good reliability concerning the data and the sample collected (good sample size of 729 participants). Added to that, in the inter-item correlation matrix, no value was less than 0.3, indicating a good discrimination of the questions. Moreover, 38.2% and 28% of all participants exhibited, none to minimal depressive symptoms and mild depressive symptoms, respectively (Table 5 in the appendix).

GAD-7

The below percentages are relatively close and about 40% of the participants were feeling, for several days, nervous, anxious or on edge, as well as worrying and becoming easily annoyed or irritable. Between 6 and 15% of the participants felt all the related symptoms nearly every day, which is a higher percentage than those noted with the other mental health scales used above (Table 6 in the appendix). The Cronbach's alpha was 0.801, indicating a good reliability. Added to that, in the inter-item correlation matrix, no value less than 0.3 was noted, indicating a good discrimination of the questions. Most of the participants had a score ranging between 0 and 4 (38.8%), and 30.4% had a score from 5 to 9. This indicates that they exhibited none to minimal and mild anxiety symptoms respectively (Table 7 in the appendix).

LSNS-6

Since a score of 12 and lower delineates "at risk" for social isolation, 41.2% of the participants had a risk of social isolation and 58.8% did not have this risk (having as a majority about two, three or four friends or relatives) (Table 8 in the appendix). The Cronbach's alpha = 0.790, indicating a good reliability. Added to that, in the inter-item correlation matrix, no value was less than 0.3, indicating a good discrimination of the questions.

Bivariate analysis

In Table 1, independent variables with a P value less than 0.05 seem to affect the BDS-10 and GAD-7 scores. In Table 2, independent variables with a P value less than 0.05 seem to affect the PHQ-9 and WHO-5 scores.

Effect of severity of acne on mental health

Concerning the WHO-5 score (validated from literature), P value = 0.345 (for the homogeneity of variance), which is not significant and the model is adequate to the data besides, P value (ANOVA) < 0.001 (Table 3), which is highly significant. In addition, we have a negative association. Therefore, when severity of acne increases, the general well-being decreases.

Concerning the BDS-10 score (validated from literature), P value = 0.221 (for the homogeneity of variance), which is not significant and the model is adequate to the data besides, P value (ANOVA) < 0.001 (Table 3), which is highly significant. In addition, we have a positive association. Therefore, when severity of acne increases, distress increases.

Concerning the PHQ-9 score (validated from literature), P value (Kruskal—Wallis) < 0.001 (Table 3), which is highly significant. In addition, we have a positive association. Therefore, when severity of acne increases, depression increases.

Concerning the GAD-7 score (validated from literature), P value = 0.148 (for the homogeneity of variance), which is not significant and the model is adequate to the data besides, P value (ANOVA) < 0.001 (Table 3), which is highly significant. In addition, we have a positive association. Therefore, when severity of acne increases, anxiety increases.

Lastly, concerning the LSNS-6 score (validated from literature), P value (Kruskal—Wallis) = 0.437 (Table 3), which is not significant. Consequently, the severity of acne does not affect social isolation.

Multivariate analysis
MANCOVA

Box's test of equality of covariance matrices is highly significant. Homogeneity of covariance matrices across groups is not assumed. However, since the sample size is large (729 participants), we can continue the analysis using the Pillai's Trace P value. Table 4 indicates that the following covariates, with a P value less than 0.05, adjust the value of our outcome.

For tests of between-subject effects, please refer to Table 5. There is a significant main effect between the dependent variables and the covariates, referring to the descriptive analysis of the covariates.

Coping strategies "Clearing/finishing my piled-up work" was found to be insignificant for all the dependent variables and was eliminated.

The partial eta squared measures the effect size of the variables included in the study; **0.01** for small effect size, **0.06** for medium effect size, and **0.14 or higher** for large effect size.

A small to medium effect is observed with the BDS-10 score, for being female (0.029), eating well (0.031), sleeping (0.022), and doing mundane house chores (0.020). This effect is also small to medium for the severity of acne, with a partial eta squared of 0.024, showing the significant effect that very severe acne has on the distress score.

A small to medium effect is observed with the WHO-5 score, for the reproductive health and childbirth disease (0.027) and for regularly eating fruits

Table 1 BDS-10 and GAD-7 with all the independent variables

Variables		BDS-10					GAD-7				
		Number of participants	Mean	Standard deviation	Mean rank	P value	Number of participants	Mean	Standard deviation	Mean rank	P value
Age						0.625					0.363
Under 20 years old		290	9.94	6.589	369.81		290	7.53	5.916	380.95	
21 to 25 years old		419	9.86	6.702	364.50		419	6.86	5.771	355.84	
26 to 30 years old		12	7.67	6.344	302.33		12	5.92	5.885	322.21	
Over 31 years old		8	8.00	4.781	310.75		8	6.00	5.707	330.56	
Gender						**< 0.001**					**< 0.001**
Male		280	7.63	6.017			280	5.42	5.360		
Female		449	11.21	6.631			449	8.15	5.872		
Marital status						0.908					0.788
Single		724	9.83	6.628	364.93		724	7.10	5.831	364.83	
Married		5	10.40	7.893	375.80		5	7.60	6.427	390.20	
Location						0.223					0.900
Beirut		152	9.76	6.520			152	6.80	5.713		
South		83	10.37	7.165			83	7.30	6.152		
Mount Lebanon		332	9.31	6.480			332	7.14	5.831		
Bekaa		62	10.98	6.580			62	6.81	5.492		
North		100	10.55	6.813			100	7.46	6.021		
Highest educational level						**0.010**					**0.002**
Less than a high school diploma		31	12.42	6.657	450.69		31	10.29	6.409		
High school diploma or equivalent degree		121	8.95	6.141	338.33		121	6.88	5.617		
Some college credit, no degree		199	10.26	6.108	385.16		199	7.45	5.819		
Bachelor's degree		256	10.27	7.213	372.52		256	7.10	5.766		
Master's degree		70	8.84	6.650	331.38		70	6.81	6.113		
Doctorate degree		52	7.92	5.954	307.08		52	4.77	5.117		
Do you work?						**0.201**					**0.103**
Yes		125	9.14	6.454			125	6.33	5.642		
No		604	9.98	6.664			604	7.26	5.861		
Monthly income						0.222					0.312
Less than 1 000 000 L.L.		21	10.14	7.806	366.48		21	8.48	7.264	394.50	
1 000 000 L.L. – 2 000 000 L.L.		57	12.40	7.991	430.02		57	8.30	6.047	408.26	
2 000 000 L.L. – 3 000 000 L.L.		90	9.57	5.691	365.23		90	7.52	5.709	384.30	
3 000 000 L.L. – 4 000 000 L.L.		86	10.00	6.846	369.49		86	7.47	6.143	375.21	
4 000 000 L.L. – 5 000 000 L.L.		109	9.91	6.180	370.83		109	7.03	5.555	366.44	
More than 5 000 000 L.L.		366	9.42	6.575	351.94		366	6.67	5.732	349.00	
Number of people at home						**0.198**					**0.172**
1		3	5.33	5.508	222.00		3	2.33	4.041	175.83	
2		14	12.14	9.662	412.25		14	8.00	5.948	399.25	
3		62	9.92	6.090	372.31		62	7.55	6.018	380.29	
4		197	9.09	6.689	338.09		197	7.13	6.063	363.36	
5		259	9.99	6.989	367.27		259	7.64	6.084	382.01	
More than 5		194	10.26	5.945	385.76		194	6.22	5.076	339.52	
Severity of acne						**< 0.001**					**< 0.001**
Mild		403	8.69	6.581	327.25		403	5.84	5.473	318.31	
Moderate		256	10.90	6.203	403.01		256	8.12	5.628	407.00	
Severe		60	12.13	6.917	434.78		60	10.10	6.144	468.40	
Very severe		10	14.70	8.179	494.45		10	13.80	7.554	550.95	
Physical health	Other skin disease					0.941					0.975
	Yes	94	9.88	6.667			94	7.09	5.797		
	No	635	9.83	6.631			635	7.11	5.840		

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Table 1 (continued)

Variables		BDS-10					GAD-7				
		Number of participants	Mean	Standard deviation	Mean rank	*P* value	Number of participants	Mean	Standard deviation	Mean rank	*P* value
	Hematological disease					0.944					0.683
	Yes	15	9.47	5.680	368.80			7.20	4.663	386.90	
	No	714	9.84	6.653	364.92		15	7.10	5.856	364.54	
	Cancer and neoplasms					0.748	714				0.713
	Yes	2	11.00	7.071	412.75		2	9.00	9.899	419.50	
	No	727	9.83	6.635	364.87		727	7.10	5.826	364.85	
	Cardiovascular disease					0.888					0.669
	Yes	8	10.00	6.279	375.38		8	7.88	6.221	396.50	
	No	721	9.83	6.639	364.88		721	7.09	5.830	364.65	
	Congenital disorder					**0.025**					**0.080**
	Yes	6	17.00	8.877	556.33		6	12.83	8.727	514.42	
	No	723	9.78	6.585	363.41		723	7.06	5.786	363.76	
	Ear disease					0.461					**0.186**
	Yes	6	8.33	9.180	301.92		6	4.00	4.940	252.08	
	No	723	9.85	6.614	365.52		723	7.13	5.834	365.94	
	Eye disease					**0.011**					**0.077**
	Yes	52	12.10	7.044			52	8.48	5.504		
	No	677	9.66	6.572			677	7.00	5.846		
	Infectious disease					**0.205**					**0.165**
	Yes	13	12.69	8.731	438.23		13	9.69	7.064	445.04	
	No	**716**	9.78	6.584	363.67		716	7.06	5.801	363.55	
	Inflammatory and immune disease					**0.121**					0.333
	Yes	23	12.00	7.039	431.89		23	8.26	6.092	406.63	
	No	706	9.76	6.611	362.82		706	7.07	5.823	363.64	
	Injurial and accidental disease					0.723					0.974
	Yes	12	8.83	5.474	343.63		12	7.25	6.621	366.96	
	No	717	9.85	6.651	365.36		717	7.10	5.822	364.97	
	Metabolic and endocrine disease					**0.034**					**0.143**
	Yes	28	12.57	6.735	447.68		28	9.14	7.028	421.96	
	No	701	9.73	6.609	361.70		701	7.02	5.769	362.72	
	Musculoskeletal disease					0.697					0.716
	Yes	8	8.50	4.408	336.19		8	6.13	5.249	338.19	
	No	721	9.85	6.652	365.32		721	7.11	5.839	365.30	
	Neurological disease					0.677					0.295
	Yes	6	8.50	6.686	329.42		6	10.33	8.066	454.25	
	No	723	9.85	6.634	365.30		723	7.08	5.809	364.26	

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Table 1 (continued)

Variables		BDS-10					GAD-7				
		Number of participants	Mean	Standard deviation	Mean rank	P value	Number of participants	Mean	Standard deviation	Mean rank	P value
	Oral and gastrointestinal disease					**0.098**					0.372
	Yes	30	11.80	6.950			30	8.03	5.904		
	No	699	9.75	6.610			699	7.06	5.829		
	Renal and urogenital disease					0.955					0.879
	Yes	5	9.80	3.564	370.30		5	7.40	6.229	379.20	
	No	724	9.84	6.649	364.96		724	7.10	5.833	364.90	
	Reproductive health and childbirth disease					**<0.001**					**<0.001**
	Yes	24	15.29	7.105	514.73		24	11.83	6.812	511.60	
	No	705	9.65	6.540	359.90		705	6.94	5.732	360.01	
	Respiratory disease					0.478					**0.005**
	Yes	33	10.64	6.693			33	9.91	6.715		
	No	696	9.80	6.631			696	6.97	5.757		
	Stroke					**0.208**					**0.200**
	Yes	3	13.67	3.215	517.50		3	10.67	4.726	520	
	No	726	9.82	6.638	364.37		726	7.09	5.833	364.36	
	Not relevant					**0.001**					**<0.001**
	Yes	438	9.18	6.557			438	6.46	5.611		
	No	291	10.81	6.634			291	8.07	6.029		
Do you eat regularly?	Sweets					0.320					0.734
	Yes	573	9.70	6.437			573	7.06	5.820		
	No	156	10.34	7.300			156	7.24	5.888		
	Fruits and/or vegetables					**0.031**					0.330
	Yes	596	9.59	6.741			596	7.00	5.910		
	No	133	10.95	6.011			133	7.55	5.461		
	Meat and/or fish					**0.002**					**<0.001**
	Yes	626	9.52	6.535			626	6.74	5.617		
	No	103	11.73	6.924			103	9.32	6.601		
	Cereals					**<0.001**					**<0.001**
	Yes	399	8.98	6.404			399	6.41	5.687		
	No	330	10.87	6.762			330	7.95	5.900		
	Low-fat products					**0.143**					0.720
	Yes	377	9.49	6.724			377	7.18	6.040		
	No	352	10.21	6.520			352	7.02	5.606		
Do you exercise regularly?						**0.014**					**0.033**
Never		181	10.81	6.848			181		8.02	6.211	
Few days		394	9.78	6.418			394		7.05	5.536	
More than half the days		102	9.53	6.798			102		6.27	6.046	
Nearly every day		52	7.50	6.644			52		5.92	5.897	
Coping strategies											

Table 1 (continued)

Variables	BDS-10					GAD-7				
	Number of participants	Mean	Standard deviation	Mean rank	P value	Number of participants	Mean	Standard deviation	Mean rank	P value
Identifying yourself with other role models who prioritize their quality of life					0.313					**0.131**
Strongly disagree	132	10.41	7.404	376.08		132	6.99	5.721		
Disagree	125	10.65	6.437	392.74		125	8.22	5.955		
Neutral	245	9.65	6.041	363.62		245	6.94	5.778		
Agree	186	9.25	6.451	346.93		186	6.52	5.496		
Strongly agree	41	9.24	8.485	334.96		41	7.66	7.231		
Respecting my physical limits, avoiding spending many hours without sleeping					**0.001**					**< 0.001**
Strongly disagree	59	12.53	8.363	427.03		59	8.53	6.353	411.68	
Disagree	87	11.53	6.046	425.90		87	9.56	6.399	447.81	
Neutral	153	9.90	6.461	372.80		153	7.19	6.028	366.66	
Agree	299	9.21	6.150	346.67		299	6.52	5.284	349.10	
Strongly agree	131	8.85	6.948	329.35		131	6.05	5.652	323.34	
Cooking					0.564					0.262
Strongly disagree	94	10.65	7.155			94	7.23	5.938		
Disagree	116	10.31	6.005			116	8.15	5.916		
Neutral	237	9.71	6.787			237	7.00	5.708		
Agree	205	9.51	6.245			205	6.62	5.570		
Strongly agree	77	9.36	7.388			77	6.97	6.541		
Eating well					**< 0.001**					**< 0.001**
Strongly disagree	47	12.98	7.643			47	9.68	6.172		
Disagree	67	12.09	6.936			67	9.70	6.100		
Neutral	161	10.99	6.625			161	7.43	5.868		
Agree	326	9.17	6.034			326	6.64	5.523		
Strongly agree	128	7.74	6.625			128	5.56	5.585		
Reading non-medical literature/novels, etc.					**0.057**					**0.135**
Strongly disagree	83	10.83	7.265			83	7.83	6.072	390.31	
Disagree	110	10.73	6.924			110	7.76	6.142	387.11	
Neutral	239	9.11	6.244			239	6.48	5.352	346.32	
Agree	210	9.42	6.297			210	6.70	5.619	351.94	
Strongly agree	87	10.75	7.228			87	8.28	6.699	395.74	
Listening to music, etc.					0.252					**0.137**
Strongly disagree	39	11.05	7.420			39	6.97	5.945		
Disagree	54	9.80	6.634			54	7.02	5.189		
Neutral	107	9.90	6.170			107	6.72	5.779		
Agree	292	9.22	6.536			292	6.62	5.657		
Strongly agree	237	10.37	6.791			237	7.91	6.138		

Table 1 (continued)

Variables	BDS-10					GAD-7				
	Number of participants	Mean	Standard deviation	Mean rank	P value	Number of participants	Mean	Standard deviation	Mean rank	P value
Watching television for movies/dramas/sports/religious, etc.					**0.182**					**0.047**
Strongly disagree	44	10.82	7.589			44	7.39	5.554		
Disagree	54	11.11	6.567			54	8.83	6.848		
Neutral	124	9.68	6.524			124	6.32	5.275		
Agree	307	9.25	6.191			307	6.75	5.707		
Strongly agree	200	10.27	7.093			200	7.60	6.024		
Social networking – Facebook, Instagram, Twitter					0.497					0.269
Strongly disagree	50	10.46	7.407	372.82		50	7.62	6.057	382.54	
Disagree	90	9.57	5.938	357.56		90	6.86	5.196	365.31	
Neutral	144	10.01	6.824	374.23		144	6.65	5.974	345.86	
Agree	284	9.29	6.218	349.94		284	6.82	5.628	355.23	
Strongly agree	161	10.60	7.236	385.04		161	7.99	6.267	393.74	
Taking solace in offering prayers					0.491					**0.158**
Strongly disagree	78	10.62	6.885			78	8.47	6.458	408.37	
Disagree	77	10.45	7.052			77	7.45	5.503	384.63	
Neutral	211	9.29	6.471			211	6.76	5.691	353.87	
Agree	240	9.73	6.260			240	6.59	5.528	348.00	
Strongly agree	123	10.09	7.172			123	7.60	6.311	377.48	
Participating/playing indoor sports					**< 0.001**					**< 0.001**
Strongly disagree	97	12.31	7.149	439.07		97	9.33	6.567	436.07	
Disagree	99	11.23	6.393	412.80		99	8.21	5.467	412.94	
Neutral	204	9.44	6.473	354.61		204	6.71	5.659	351.35	
Agree	226	8.60	5.904	326.50		226	5.96	5.354	325.44	
Strongly agree	103	9.67	7.400	354.36		103	7.23	6.106	365.82	
Sleeping					**0.060**					**0.019**
Strongly disagree	34	10.21	6.554	378.35		34	7.62	5.779		
Disagree	63	10.59	6.472	392.39		63	7.68	5.861		
Neutral	132	9.87	6.052	373.82		132	7.03	5.831		
Agree	323	9.02	6.221	339.74		323	6.38	5.634		
Strongly agree	177	10.95	7.638	392.21		177	8.17	6.051		
Listening to religious videos					**0.045**					**0.044**
Strongly disagree	117	11.17	6.689			117	8.42	6.488	404.94	
Disagree	99	10.55	6.577			99	7.62	5.110	394.75	
Neutral	231	8.99	6.360			231	6.46	5.643	341.86	
Agree	196	9.73	6.589			196	6.80	5.927	351.99	
Strongly agree	86	9.70	7.185			86	7.13	5.733	368.20	

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Table 1 (continued)

Variables	BDS-10					GAD-7				
	Number of participants	Mean	Standard deviation	Mean rank	P value	Number of participants	Mean	Standard deviation	Mean rank	P value
Doing mundane house chores like cleaning, washing, etc.					0.464					0.616
Strongly disagree	119	10.20	6.558	377.03		119	7.77	6.369	383.94	
Disagree	118	9.86	6.619	364.18		118	6.86	5.124	365.66	
Neutral	245	9.20	6.488	345.53		245	6.61	5.554	349.10	
Agree	195	10.18	6.283	379.81		195	7.30	5.800	372.95	
Strongly agree	52	10.60	8.534	375.56		52	7.69	7.267	365.26	
Clearing/finishing my piled-up work					**0.025**					**0.182**
Strongly disagree	74	10.74	6.985			74	7.58	6.240		
Disagree	86	11.48	7.292			86	7.56	5.479		
Neutral	210	9.93	6.405			210	7.43	5.864		
Agree	**268**	8.99	6.172			268	6.40	5.552		
Strongly agree	91	9.84	7.227			91	7.59	6.436		
Participating in online courses					**<0.001**					**<0.001**
Strongly disagree	106	12.54	7.141			106	9.60	6.568	444.97	
Disagree	129	10.64	6.738			129	7.38	5.039	387.51	
Neutral	247	9.13	6.216			247	6.62	5.737	346.56	
Agree	183	8.86	6.296			183	6.23	5.548	334.16	
Strongly agree	64	9.27	6.848			64	6.77	6.166	346.53	
Taking up a new hobby: gardening, landscaping, etc.					**0.001**					**0.003**
Strongly disagree	97	11.31	7.197			97	8.30	6.562	400.55	
Disagree	140	11.28	6.685			140	7.54	4.855	396.16	
Neutral	230	9.39	6.086			230	6.86	6.006	352.67	
Agree	198	8.59	6.288			198	5.95	5.255	326.08	
Strongly agree	64	9.89	7.668			64	8.75	6.930	407.66	
Watching television for news exclusively					**0.012**					**0.089**
Strongly disagree	**216**	10.74	6.496			216	7.68	5.968	384.81	
Disagree	176	10.50	6.300			176	7.32	5.282	382.13	
Neutral	190	9.15	6.564			190	6.56	6.055	340.33	
Agree	106	8.56	6.663			106	6.23	5.464	335.01	
Strongly agree	41	8.73	8.096			41	7.90	6.899	379.00	

P values typed in bold are the ones to be considered in the multivariate analysis

and/or vegetables (0.022). This effect is also small to medium for the severity of acne with a partial eta squared of 0.025, specifically for mild acne.

A small to medium effect is observed with the PHQ-9 score, for eating well (0.027), sleeping (0.025), and doing mundane house chores (0.020). This effect is also small to medium for very severe acne, with a partial eta squared of 0.034.

A small to medium effect is observed with the GAD-7 score, for eating well (0.026) and sleeping (0.020). A medium effect is observed for very severe acne, with a partial eta squared of 0.055. (Tables 5 and 6)

In the estimated marginal means, the following graphs show the variation of each dependent variable. Effectively, well-being, distress, depression, and

Table 2 PHQ-9 and WHO-5 with all the independent variables

Variables	PHQ-9					WHO-5				
	Number of participants	Mean	Standard deviation	Mean rank	*P* value	Number of participants	Mean	Standard deviation	Mean rank	*P* value
Age					**0.112**					0.708
Under 20 years old	290	7.6793	6.39722	387.83		290	13.92	5.646	355.27	
21 to 25 years old	419	6.6468	6.35921	348.93		419	14.31	5.871	372.72	
26 to 30 years old	12	7.7500	7.54532	381.21		12	13.58	5.351	348.04	
Over 31 years old	8	6.2500	5.57418	355.00		8	13.50	4.781	338.75	
Gender					**< 0.001**					**< 0.001**
Male	280	5.6357	6.02707			280	15.51	5.593		
Female	449	7.9666	6.46013			449	13.28	5.698		
Marital status					0.904					0.472
Single	724	7.0704	6.39409	364.92		724	14.15	5.763	364.55	
Married	5	7.2	7.22496	376.30		5	11.40	4.336	430.60	
Location					0.458					0.410
Beirut	152	6.5921	5.88562			152	14.73	5.729		
South	83	7.1205	6.57860			83	13.28	5.354		
Mount Lebanon	332	6.8916	6.51888			332	14.22	5.895		
Bekaa	62	7.9677	6.38638			62	13.79	5.338		
North	100	7.8000	6.57974			100	13.87	5.903		
Highest educational level					**0.001**					**0.002**
Less than a high school diploma	31	10.5806	6.77630			31	12.65	6.248		
High school diploma or equivalent degree	121	6.7851	6.15928			121	14.14	5.473		
Some college credit, no degree	199	7.7789	6.46915			199	13.27	5.443		
Bachelor's degree	256	7.0664	6.41991			256	14.32	5.931		
Master's degree	70	5.7143	6.02204			70	14.61	5.998		
Doctorate degree	52	4.7885	5.68568			52	16.79	5.300		
Do you work?					**0.137**					0.413
Yes	125	6.2960	6.40819			125	14.52	6.281		
No	604	7.2318	6.38530			604	14.06	5.645		
Monthly income					0.530					**0.128**
Less than 1 000 000 L.L.	21	7.6190	6.11127	389.98		21	13.62	6.136	357.02	
1 000 000 L.L. – 2 000 000 L.L.	57	8.1579	6.38858	404.84		57	12.65	6.388	308.82	
2 000 000 L.L. – 3 000 000 L.L.	90	6.8111	5.90923	364.15		90	13.48	5.724	337.72	
3 000 000 L.L. – 4 000 000 L.L.	86	7.5698	6.66782	381.63		86	13.70	5.607	352.47	
4 000 000 L.L. – 5 000 000 L.L.	109	7.0367	6.16280	367.53		109	14.34	5.898	368.86	
More than 5 000 000 L.L.	366	6.8279	6.54262	352.91		366	14.60	5.607	382.71	
Number of people at home					0.425					0.346
1	3	4.3333	5.13160	283.83		3	18.67	4.163	544.50	
2	14	8.0000	6.98350	393.21		14	13.07	6.133	318.61	
3	62	7.0323	5.79985	372.50		62	14.69	5.443	375.73	
4	197	6.6802	6.60738	347.35		197	14.20	5.838	368.53	
5	259	7.6641	6.56446	384.35		259	13.65	6.044	348.86	
More than 5	194	6.6649	6.09392	353.91		194	14.54	5.339	380.11	
Severity of acne					**< 0.001**					**< 0.001**
Mild	403	5.9677	5.91620	327.80		403	15.03	5.815	399.88	
Moderate	256	7.8828	6.13715	399.29		256	13.42	5.265	333.41	
Severe	60	10.0667	8.01453	445.11		60	12.07	5.949	293.02	
Very severe	10	12.8000	9.29516	505.85		10	8.90	6.624	200.10	

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Table 2 (continued)

Variables		PHQ-9					WHO-5				
		Number of participants	Mean	Standard deviation	Mean rank	P value	Number of participants	Mean	Standard deviation	Mean rank	P value
Physical health	Other skin disease					0.765					0.829
	Yes	94	7.2553	5.80125			94	14.26	5.902		
	No	635	7.0441	6.48156			635	14.12	5.740		
	Hematological disease					**0.118**					0.570
	Yes	15	9.4	6.25414	448.63		15	13.13	5.927	336.27	
	No	714	7.0224	6.39267	363.24		714	14.16	5.756	365.60	
	Cancer and neoplasms					0.274					0.606
	Yes	2	11.5	6.36396	527.00		2	19.00	4.243	556.00	
	No	727	7.0591	6.39478	364.55		727	14.12	5.757	364.47	
	Cardiovascular disease					**0.186**					**0.051**
	Yes	8	12.25	10.62006	462.38		8	10.50	6.803	239.50	
	No	721	7.0139	6.32037	363.92		721	14.18	5.737	366.39	
	Congenital disorder					**0.057**					**0.034**
	Yes	6	14.3333	10.40513	527.25		6	8.17	4.262	147.92	
	No	723	7.0111	6.32761	363.65		723	14.19	5.744	366.80	
	Ear disease					0.745					0.794
	Yes	6	5.8333	5.03653	337.33		6	12.83	4.875	309.00	
	No	723	7.0816	6.40639	365.23		723	14.15	5.765	365.46	
	Eye disease					**0.198**					**0.177**
	Yes	52	8.1731	6.54912			52	13.10	5.524		
	No	677	6.9867	6.37962			677	14.22	5.771		
	Infectious disease					**0.118**					**0.039**
	Yes	13	11.0769	9.17843	455.15		13	10.69	6.933	259.62	
	No	716	6.9986	6.31847	363.36		716	14.20	5.720	366.91	
	Inflammatory and immune disease					**0.048**					**0.133**
	Yes	23	9.9565	7.41300	450.07		23	11.39	5.417	267.89	
	No	706	6.9773	6.34266	362.23		706	14.23	5.749	368.16	
	Injurial and accidental disease					0.547					0.914
	Yes	12	8.0000	6.64694	401.13		12	15.25	5.065	400.96	
	No	717	7.0558	6.39393	364.40		717	14.12	5.769	364.40	
	Metabolic and endocrine disease					**0.018**					**0.005**
	Yes	28	10.75	8.55312	456.70		28	10.79	6.286	246.77	
	No	701	6.9244	6.25631	361.34		701	14.27	5.699	369.72	
	Musculoskeletal disease					0.574					0.321
	Yes	8	5.5	4.34248	323.56		8	16.50	4.598	442.19	
	No	721	7.0888	6.41356	365.46		721	14.11	5.766	364.14	
	Neurological disease					0.611					0.515
	Yes	6	9.1667	8.65833	408.33		6	16.00	4.147	429.00	
	No	723	7.0539	6.37765	364.64		723	14.12	5.768	364.47	

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Table 2 (continued)

Variables		PHQ-9					WHO-5				
		Number of participants	Mean	Standard deviation	Mean rank	P value	Number of participants	Mean	Standard deviation	Mean rank	P value
	Oral and gastrointestinal disease					0.324					0.495
	Yes	30	8.2	7.05838			30	13.43	5.594		
	No	699	7.0229	6.36561			699	14.17	5.766		
	Renal and urogenital disease					0.925					0.472
	Yes	5	7.2	6.97854	373.80		5	11.60	6.066	271.40	
	No	724	7.0704	6.39560	364.94		724	14.15	5.755	365.65	
	Reproductive health and childbirth disease					**0.002**					**< 0.001**
	Yes	24	12.2917	8.66517	497.00		24	8.04	5.433	161.58	
	No	705	6.8936	6.23464	360.51		705	14.34	5.657	371.92	
	Respiratory disease					**0.128**					0.939
	Yes	33	8.7273	7.44258			33	14.06	5.739		
	No	696	6.9928	6.33603			696	14.14	5.762		
	Stroke					**0.078**					0.540
	Yes	3	13	5.29150	578.00		3	14.67	8.083	395.00	
	No	726	7.0468	6.39034	364.12		726	14.13	5.753	364.88	
	Not relevant					**< 0.001**					**0.009**
	Yes	438	6.3402	6.03921			438	14.59	5.744		
	No	291	8.1718	6.75773			291	13.46	5.720		
Do you eat regularly?	Sweets					0.220					0.529
	Yes	573	6.9197	6.32404			573	14.21	5.673		
	No	156	7.6282	6.63832			156	13.88	6.069		
	Fruits and/or vegetables					**0.104**					**< 0.001**
	Yes	596	6.8893	6.41043			596	14.61	5.672		
	No	133	7.8872	6.28207			133	12.02	5.682		
	Meat and/or fish					**0.005**					**< 0.001**
	Yes	626	6.8035	6.29677			626	14.52	5.739		
	No	103	8.6990	6.76617			103	11.83	5.337		
	Cereals					**< 0.001**					**< 0.001**
	Yes	399	6.2080	5.97266			399	14.87	5.794		
	No	330	8.1152	6.73277			330	13.24	5.592		
	Low-fat products					0.845					**0.013**
	Yes	377	7.0265	6.59137			377	14.65	5.977		
	No	352	7.1193	6.18586			352	13.59	5.467		
Do you exercise regularly?						**0.012**					**< 0.001**
Never		181	8.2652	7.01873			181	12.40	5.745		
Few days		394	6.7970	6.07706			394	14.37	5.529		
More than half the days		102	6.9020	6.36903			102	15.40	5.490		
Nearly every day		52	5.3269	6.00889			52	15.94	6.614		
Coping strategies											

Table 2 (continued)

Variables	PHQ-9					WHO-5				
	Number of participants	Mean	Standard deviation	Mean rank	*P* value	Number of participants	Mean	Standard deviation	Mean rank	*P* value
Identifying yourself with other role models who prioritize their quality of life					**0.116**					**0.077**
Strongly disagree	132	7.7879	7.06030	380.36		132	14.48	6.161	378.01	
Disagree	125	7.9040	6.14925	400.29		125	13.54	5.513	345.94	
Neutral	245	6.8449	6.15314	360.95		245	13.58	5.475	342.20	
Agree	186	6.2204	5.88813	339.12		186	14.99	5.183	394.95	
Strongly agree	41	7.4390	8.04689	349.59		41	14.29	8.412	381.59	
Respecting my physical limits, avoiding spending many hours without sleeping					**< 0.001**					**0.006**
Strongly disagree	59	9.6780	8.14193	426.08		59	12.73	6.992	321.62	
Disagree	87	9.4598	6.53933	448.21		87	12.62	5.416	310.75	
Neutral	153	7.2092	6.64084	366.14		153	14.32	5.865	373.77	
Agree	299	6.2742	5.50153	346.39		299	14.27	5.251	365.40	
Strongly agree	131	5.9695	6.36932	323.38		131	15.25	6.097	409.42	
Cooking					0.457					0.212
Strongly disagree	94	7.6064	7.29150			94	13.50	5.891		
Disagree	116	7.8190	6.46408			116	13.35	5.553		
Neutral	237	7.0253	6.32450			237	14.19	5.670		
Agree	205	6.6049	5.89075			205	14.77	5.489		
Strongly agree	77	6.6753	6.64007			77	14.25	6.716		
Eating well					**< 0.001**					**< 0.001**
Strongly disagree	47	10.3617	8.04181	452.76		47	13.57	6.603	351.70	
Disagree	67	9.8358	6.78813	456.49		67	12.30	6.358	301.35	
Neutral	161	7.7329	6.55339	386.80		161	12.75	5.746	315.60	
Agree	326	6.3681	5.66550	348.09		326	14.68	5.216	382.00	
Strongly agree	128	5.3750	6.16569	300.54		128	15.66	5.873	422.02	
Reading non-medical literature/ novels, etc.					**0.048**					**0.203**
Strongly disagree	83	7.8675	6.98216			83	13.75	6.286		
Disagree	110	8.3818	6.78907			110	13.48	5.766		
Neutral	239	6.5481	5.93848			239	14.74	5.566		
Agree	210	6.4952	6.24557			210	14.26	5.620		
Strongly agree	87	7.4828	6.65576			87	13.39	5.995		
Listening to music, etc.					**0.071**					0.282
Strongly disagree	39	6.8205	6.39025			39	14.67	5.953		
Disagree	54	7.5185	6.61542			54	15.33	5.252		
Neutral	107	7.1495	6.72759			107	13.53	6.041		
Agree	292	6.3082	5.92631			292	14.34	5.604		
Strongly agree	237	7.9156	6.67855			237	13.79	5.874		

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Table 2 (continued)

Variables	PHQ-9					WHO-5				
	Number of participants	Mean	Standard deviation	Mean rank	*P* value	Number of participants	Mean	Standard deviation	Mean rank	*P* value
Watching television for movies/dramas/sports/religious, etc.					**0.048**					0.786
Strongly disagree	44	7.1818	6.73164			44	15.02	6.193		
Disagree	54	8.8704	7.14551			54	13.85	5.705		
Neutral	124	6.6613	6.03767			124	14.44	5.723		
Agree	307	6.4756	6.03166			307	14.01	5.355		
Strongly agree	200	7.7300	6.76431			200	14.03	6.298		
Social networking – Facebook, Instagram, Twitter					0.389					0.964
Strongly disagree	50	7.8400	7.57644	378.09		50	14.28	6.121	368.74	
Disagree	90	6.7889	5.46181	369.22		90	14.52	4.805	377.37	
Neutral	144	7.3611	7.10029	363.87		144	14.06	6.005	368.66	
Agree	284	6.4296	5.82234	348.36		284	14.15	5.522	362.55	
Strongly agree	161	7.8634	6.72263	388.94		161	13.91	6.338	357.98	
Taking solace in offering prayers					**0.121**					0.898
Strongly disagree	78	8.0513	7.52985	383.71		78	14.06	6.692	370.43	
Disagree	77	8.2987	6.58360	407.83		77	13.90	5.276	357.47	
Neutral	211	7.2938	6.64608	369.64		211	14.30	5.690	371.55	
Agree	240	6.1750	5.65562	340.26		240	14.35	5.348	367.88	
Strongly agree	123	7.0488	6.26839	366.63		123	13.63	6.324	349.41	
Participating/playing indoor sports					**< 0.001**					**0.008**
Strongly disagree	97	9.6804	7.94453	430.64		97	13.00	6.750	325.08	
Disagree	99	8.0303	5.90305	408.64		99	13.13	5.162	323.17	
Neutral	204	6.9902	6.35795	362.78		204	13.94	5.686	358.35	
Agree	226	5.7655	5.53236	325.04		226	14.95	5.347	392.95	
Strongly agree	103	6.7184	6.30191	353.33		103	14.79	6.040	394.65	
Sleeping					**0.002**					0.327
Strongly disagree	34	7.8529	7.02434	384.13		34	14.74	6.676	388.59	
Disagree	63	8.0317	6.27326	402.57		63	14.13	5.615	369.80	
Neutral	132	7.2879	6.26578	376.03		132	13.62	5.798	345.98	
Agree	323	5.9319	5.66577	330.39		323	14.58	5.268	379.88	
Strongly agree	177	8.4972	7.29112	402.88		177	13.59	6.395	345.80	
Listening to religious videos					**0.086**					0.545
Strongly disagree	117	8.0598	7.19230			117	13.57	6.273		
Disagree	99	8.1717	6.37764			99	13.84	5.074		
Neutral	231	6.5931	6.11902			231	14.39	5.551		
Agree	196	6.6531	6.11027			196	14.51	5.880		
Strongly agree	86	6.6977	6.46815			86	13.72	6.048		

Table 2 (continued)

Variables	PHQ-9					WHO-5				
	Number of participants	Mean	Standard deviation	Mean rank	P value	Number of participants	Mean	Standard deviation	Mean rank	P value
Doing mundane house chores like cleaning, washing, etc.					0.989					0.321
Strongly disagree	119	7.5714	7.30982	369.57		119	14.16	6.427	370.30	
Disagree	118	6.7966	5.80827	363.25		118	14.53	5.210	379.65	
Neutral	245	6.8776	6.24839	360.56		245	13.56	5.802	341.76	
Agree	195	6.9385	5.95744	366.07		195	14.62	5.253	379.61	
Strongly agree	52	7.9615	7.68488	375.42		52	14.12	6.810	374.33	
Clearing/finishing my piled-up work					**0.050**					**0.086**
Strongly disagree	74	8.3514	7.94576	385.36		74	13.45	6.439	344.60	
Disagree	86	8.2907	6.33917	409.70		86	13.55	5.637	344.67	
Neutral	210	7.3857	6.43843	377.46		210	13.53	5.612	341.98	
Agree	268	6.2985	5.67672	344.78		268	14.85	5.334	388.01	
Strongly agree	91	6.4286	6.67357	337.00		91	14.56	6.605	386.16	
Participating in online courses					**< 0.001**					**< 0.001**
Strongly disagree	106	10.1226	7.99846	443.01		106	12.13	6.428	293.06	
Disagree	129	7.6434	5.90921	395.10		129	13.50	5.470	337.73	
Neutral	247	6.5506	6.19438	348.64		247	14.52	5.387	379.20	
Agree	183	6.1038	5.72493	335.85		183	15.17	5.412	403.30	
Strongly agree	64	5.6406	5.31356	321.61		64	14.30	6.640	374.82	
Taking up a new hobby: gardening, landscaping, etc.					**0.006**					**0.046**
Strongly disagree	97	8.1134	7.24982	390.16		97	13.21	6.469	331.97	
Disagree	140	8.3071	6.13270	414.66		140	13.74	5.347	348.18	
Neutral	230	6.8783	6.50314	355.55		230	13.87	5.516	355.09	
Agree	198	5.9495	5.58347	333.10		198	15.10	5.566	400.49	
Strongly agree	64	6.9531	7.00437	350.88		64	14.38	6.615	377.67	
Watching television for news exclusively					**0.007**					**0.039**
Strongly disagree	**216**	8.0833	7.06333	392.51		216	13.53	5.916	341.54	
Disagree	176	7.4034	5.63882	389.20		176	13.94	4.922	353.07	
Neutral	190	6.5474	6.37168	345.32		190	14.17	5.812	368.24	
Agree	106	5.6132	5.40118	320.06		106	15.49	5.774	414.25	
Strongly agree	41	6.5122	7.43344	323.57		41	14.54	7.396	397.45	

P values typed in bold are the ones to be considered in the multivariate analysis

anxiety are shown to be affected by the severity of acne. (Figures 1, 2, 3, 4 and 5) Female gender and highest educational level (bachelor's degree) were also significantly affecting those 4 mental health states among acne patients.

Discussion

Our study enrolled 729 Lebanese patients with acne above 16 years of age from all over Lebanon, unlike other studies that used less inclusive samples [14–16]. Added to that, we used five validated mental health scales, in contrast to other studies that examined mental health less extensively, and we have taken into

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Table 3 Comparison of severity of acne on mental health scores (means, standard deviations) and reporting of *P* value assessed by ANOVA and Kruskal─Wallis tests

	Descriptive Statistics				
	Severity of acne	**Mean**	**Standard deviation**	**Number of participants**	***P* value**
WHO-5 Score	Mild	15.03	5.815	403	
	Moderate	13.42	5.265	256	
	Severe	12.07	5.949	60	
	Very severe	8.90	6.624	10	
	Total	14.14	5.757	729	< 0.001
BDS-10 Score	Mild	8.69	6.581	403	
	Moderate	10.90	6.203	256	
	Severe	12.13	6.917	60	
	Very severe	14.70	8.179	10	
	Total	9.84	6.631	729	< 0.001
PHQ-9 Score	Mild	5.9677	5.91620	403	
	Moderate	7.8828	6.13715	256	
	Severe	10.0667	8.01453	60	
	Very severe	12.8000	9.29516	10	
	Total	7.0713	6.39457	729	< 0.001
GAD-7 Score	Mild	5.84	5.473	403	
	Moderate	8.12	5.628	256	
	Severe	10.10	6.144	60	
	Very severe	13.80	7.554	10	
	Total	7.10	5.831	729	< 0.001
LSNS-6 Score	Mild	13.89	6.699	403	
	Moderate	13.38	5.507	256	
	Severe	13.42	5.564	60	
	Very severe	13.20	5.116	10	
	Total	13.66	6.189	729	0.437

Table 4 Covariates' descriptive analysis after MANCOVA test, after post-hoc adjustment (Bonferroni correlation)

Covariates	F Exact Statistic	*P* value Pillai's Trace	Partial Eta Squared
Gender	5.767	< 0.001	0.039
Highest educational level	3.628	0.003	0.025
Monthly income	4.804	< 0.001	0.033
Severity of acne	3.062	< 0.001	0.021
Physical health			
Reproductive health and childbirth disease	4.358	0.001	0.030
Cardiovascular disease	3.001	0.011	0.021
Do you eat regularly?			
Fruits and/or vegetables	3.900	0.002	0.027
Meat and/or fish	2.968	0.012	0.021
Cereals	2.887	0.014	0.020
Coping strategies			
Respecting my physical limits, avoiding spending many hours without sleeping	3.238	0.007	0.022
Eating well	5.461	0.007	0.022
Watching television for movies/dramas/sports/religious, etc.	4.113	0.001	0.028
Sleeping	4.890	< 0.001	0.033
Doing mundane house chores like cleaning, washing, etc.	4.012	0.001	0.028
Clearing/finishing my piled-up work	2.669	0.021	0.019
Participating in online courses	2.633	0.023	0.018

Table 5 Covariates and dependent variables (*p* value and partial Eta squared)

Covariates	Dependent variables	*P* value	Partial eta squared
Gender (female)	WHO-5 score	0.048	0.006
	BDS-10 score	< 0.001	0.029
	GAD-7 score	0.002	0.014
Highest educational level	WHO-5 score	0.004	0.011
	PHQ-9 score	0.001	0.016
	GAD-7 score	0.008	0.010
Monthly income	WHO-5 score	0.013	0.009
	LSNS-6 score	< 0.001	0.024
Severity of acne	WHO-5 score	0.001	0.025
	BDS-10 score	0.001	0.024
	PHQ-9 score	< 0.001	0.034
	GAD-7 score	< 0.001	0.055
Physical health			
Reproductive health and childbirth disease	WHO-5 score	< 0.001	0.027
	BDS-10 score	0.005	0.011
	PHQ-9 score	0.003	0.012
	GAD-7 score	0.009	0.010
Cardiovascular disease	PHQ-9 score	0.023	0.007
Do you eat regularly?			
Fruits and/or vegetables	WHO-5 score	< 0.001	0.022
Meat and/or fish	WHO-5 score	0.003	0.012
	GAD-7 score	0.005	0.011
Cereals	WHO-5 score	0.020	0.008
	BDS-10 score	0.008	0.010
	PHQ-9 score	0.006	0.011
	GAD-7 score	0.026	0.007
Coping strategies			
Respecting my physical limits, avoiding spending many hours without sleeping	PHQ-9 score	0.013	0.009
	GAD-7 score	0.016	0.008
	LSNS-6 score	0.002	0.014
Eating well	WHO-5 score	0.003	0.012
	BDS-10 score	< 0.001	0.031
	PHQ-9 score	< 0.001	0.027
	GAD-7 score	< 0.001	0.026
Watching television for movies/dramas/sports/religious, etc.	LSNS-6 score	< 0.001	0.020
Sleeping	WHO-5 score	0.001	0.014
	BDS-10 score	< 0.001	0.022
	PHQ-9 score	< 0.001	0.025
	GAD-7 score	< 0.001	0.020
Doing mundane house chores like cleaning, washing, etc.	WHO-5 score	0.008	0.010
	BDS-10 score	< 0.001	0.020
	PHQ-9 score	< 0.001	0.020
	GAD-7 score	0.035	0.006
Participating in online courses	WHO-5 score	0.023	0.007
	BDS-10 score	0.006	0.010
	PHQ-9 score	0.001	0.014
	GAD-7 score	0.017	0.008

consideration other aspects of physical health and coping strategies.

In our study, the results have shown that the severity of acne vulgaris can be associated with depression, anxiety, distress, and decreased well-being. Effectively, WHO-5 score decreased from roughly 15 with mild acne to 10 with very severe acne; a score below 13, indicating poor well-being, was noted with severe and very severe acne. Distress score increased from 9 to 14, depression score from 6 to 12 (with 18% of the

Table 6 Comparison of the estimated marginal means and standard deviations for the dependent variables (WHO-5, BDS-10, PHQ-9 and GAD-7 scores) with the covariate (severity of acne)

		Estimated marginal means	Standard deviation
Severity of acne	**WHO-5 score**	12.688	**0.461**
Mild		**14.699**	**0.264**
Moderate		13.783	0.331
Severe		12.604	0.678
Very severe		9.668	1.663
	BDS-10 score	11.141	**0.531**
Mild		9.047	0.304
Moderate		10.548	0.381
Severe		11.485	0.781
Very severe		**13.484**	**1.914**
	PHQ-9 score	8.811	**0.509**
Mild		6.296	0.291
Moderate		7.557	0.365
Severe		9.386	0.749
Very severe		**12.006**	**1.835**
	GAD-7 score	9.093	**0.463**
Mild		6.117	0.265
Moderate		7.853	0.332
Severe		9.596	0.681
Very severe		**12.835**	**1.668**

participants having suicidal and self-hurt thoughts several days and 4% of them having these thoughts nearly every day), anxiety score from 6 to 13, when passing from mild to very severe acne respectively. However, the severity of acne didn't seem to have any impact on social isolation (*P* value = 0.437).

The relationship between acne severity and mental health is complex and multifaceted. Severe acne can significantly affect an individual's self-esteem and body image, leading to feelings of embarrassment and social anxiety [27], individuals with more severe acne may avoid social interactions or public settings, fearing judgment or negative attention [28]. On the other hand, societal beauty standards often emphasize clear skin, which can exacerbate feelings of inadequacy in those with acne [29]. Different cultures may have varying levels of stigma associated with skin conditions. Moreover, adolescents are particularly vulnerable to the psychological effects of acne due to ongoing identity formation and peer dynamics [30]. The impact may lessen in adulthood, but severe acne can still lead to lasting effects. Finally, access to effective treatment can mitigate psychological distress, but stigma around seeking help for skin conditions can prevent individuals from pursuing care [31].

Acne's negative impacts on social isolation may have been unintentionally obscured by the COVID-19 pandemic's significant influence on social behavior, despite the fact that mask use could have caused acne [32]. Many people with acne experienced fewer in-person encounters as a result of the change to online communication, which would have lessened the immediate social constraints linked to acne. Additionally, the epidemic raised awareness of general health and well-being, which may have caused people to focus on more urgent health issues rather than aesthetic ones like acne. Furthermore, as people dealt with the pandemic's stress and mental strain, personal issues like acne might have taken a backseat. These facts are expected to have driven the results toward the null hypothesis.

Female patients had a higher risk of depression, anxiety, distress, and decreased well-being, this observation can be justified by the fact that women give a higher importance to their physical appearance. Another finding was the correlation between the higher educational level and the higher risk of mental illnesses, which can be explained by a higher involvement in the workplace and a greater need to look and feel attractive and good-looking. Regular eating also had a significant effect on the risk of mental illness, most probably because it may reduce acne severity and therefore, decrease the stress related to it. Last but not least, the coping strategies, that significantly affected each psychological state, can represent efficient means to decrease the burden of physical illness, to improve treatment compliance, and to promote mental health.

There is paucity of studies showing the effect of acne on mental health in Lebanon. But there's one prospective cohort study from Lebanon, showing the impact of acne treatment on quality of life and self-esteem, that had proven the social obstacle that acne creates and its recurrence in women of child-bearing age [18]. However, in this study, a low number of patients was targeted since it is a cohort study, the number of participants was unevenly distributed between genders (79%, the great majority, were females), age restriction and exclusion criteria rendered the study sample more limited (particularly, patients with mild severity of acne weren't included so the variation of acne severity wasn't studied), the effect of many treatments was studied, and the investigated effect was the effect of acne on the quality of life and self-esteem only.

Other studies also showed that acne affects mental health, the severity of acne increases the severity of depression, females are more prone to mental illnesses, and food consumption has an impact on acne-related mental illness. A study done on outpatients with facial acne vulgaris, who visited the dermatology of the Third Xiangya Hospital, concluded that the severity of depression increases with female gender, the severity of acne and its course [33]. Besides, a cross-sectional study using an online questionnaire
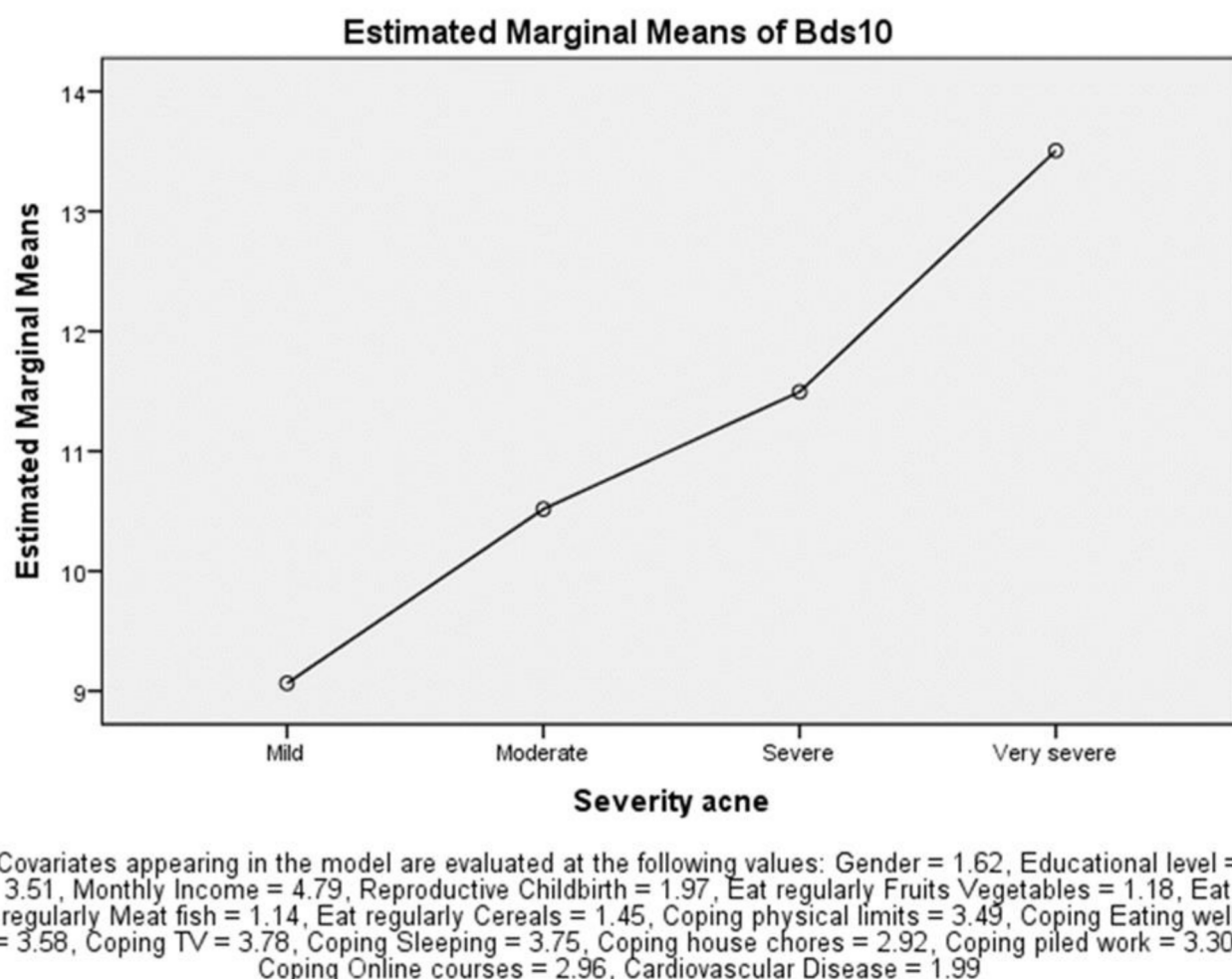
Estimated Marginal Means of Wellbeingscore

Covariates appearing in the model are evaluated at the following values: Gender = 1.62, Educational level = 3.51, Monthly Income = 4.79, Reproductive Childbirth = 1.97, Eat regularly Fruits Vegetables = 1.18, Eat regularly Meat fish = 1.14, Eat regularly Cereals = 1.45, Coping physical limits = 3.49, Coping Eating well = 3.58, Coping TV = 3.78, Coping Sleeping = 3.75, Coping house chores = 2.92, Coping piled work = 3.30, Coping Online courses = 2.96, Cardiovascular Disease = 1.99

Fig. 1 Estimated marginal means of WHO-5 score

and a paper questionnaire that was completed by the patients of dermatology clinics in Lublin, Kielce, and Rzeszów in south-eastern Poland illustrated that acne leads to moderate anxiety, feeling of less attraction, psychological discomfort, decreased emotional well-being, and is a barrier to social interactions. Patients were aware of the fact that acne aggravation and the severity of mood disorders were directly correlated with the consumption of sweets, sweetened beverages, and foods with a high glycemic index [34]. A case-control study done in Egypt showed that serum levels of vitamin B12 and folic acid are predictors for acne severity and depression in females with early-onset acne, long duration of moderate or severe acne, and positive family history [35].

A survey of 2,657 students from Turkey, aged 14–20 years, detected a prevalence of acne, anxiety and depression of 23%, 25%, and 13% respectively, no significant differences in the HAD anxiety and depression subscale scores existed between the acne and control groups, and the severity of acne was not correlated with the HAD anxiety or depression subscale scores. This absence of correlation is contradictory to our findings. However, knowing that boys and girls had the same severity of acne, adolescent girls were more vulnerable than boys to negative psychological effects such as anxiety [36]. Anxiety, depression, suicidal ideation, emotion dysregulation, and social impairment were detected in adolescents in other studies [37–39].

A qualitative study demonstrated that women with acne reported depression, anxiety, affected well-being, disrupted social and professional lives, and low self-esteem. However, those women also experienced social isolation, in contradiction to our results [40]. Another study done on one hundred and six patients with acne vulgaris who consecutively attended the dermatology outpatient clinics in Semnan city in 2008 showed that psychoticism (34.0%) and depression (31.1%), respectively, were the most common psychiatric symptoms needing treatment due to disturbed daily life activities

Estimated Marginal Means of Bds10

Covariates appearing in the model are evaluated at the following values: Gender = 1.62, Educational level = 3.51, Monthly Income = 4.79, Reproductive Childbirth = 1.97, Eat regularly Fruits Vegetables = 1.18, Eat regularly Meat fish = 1.14, Eat regularly Cereals = 1.45, Coping physical limits = 3.49, Coping Eating well = 3.58, Coping TV = 3.78, Coping Sleeping = 3.75, Coping house chores = 2.92, Coping piled work = 3.30, Coping Online courses = 2.96, Cardiovascular Disease = 1.99

Fig. 2 Estimated marginal means of BDS-10 score

[30]. A third study done on clinical participants with dermatologist-validated diagnoses of psoriasis, atopic dermatitis, or acne who were currently taking systemic medication, proved that those skin conditions lead to a more negative cutaneous body image not significantly related to a drive for thinness or to dietary restraint, anxiety and depression in comparison with participants without skin conditions [41]. Finally, a meta-analysis published in 2021 concluded that acne may significantly increase suicide risk and suicide screening should be considered by clinicians when treating acne, which is in accordance with our results [42].

Furthermore, many studies showed the psychosocial burden of other skin diseases. Effectively, a scoping review including the articles published until the end of August 2017 showed that localised cutaneous leishmaniasis has a negative impact on the mental health of patients and leads to social and self-stigmatization [43], 23.5% of participants having leprosy were very likely to have a psychological disorder [44], the

prevalence of depression in patients with lichen planus was 25% with a female predominance [45], people with psoriasis [46] or atopic eczema [47] are at increased risk of mental illness, patients with vitiligo have low self-esteem, social anxiety, isolation, depression, with a higher prevalence of depression, anxiety, social anxiety and avoidance in females as well [48], and finally, rosacea was associated with a higher frequency of anxiety and depression (24.7%), a higher risk of anxiety (particularly, generalized anxiety disorder (GAD)) was noted in female patients and in patients having a lower educational level [49].

Limitations
The cross-sectional design of our study is one of its main limitations. Effectively, our participants report both exposures and outcomes. A prospective longitudinal cohort study would thus be the best study design to fulfill our aims. Moreover, a recall bias may be present due to the nature of the tools used. The acne cases
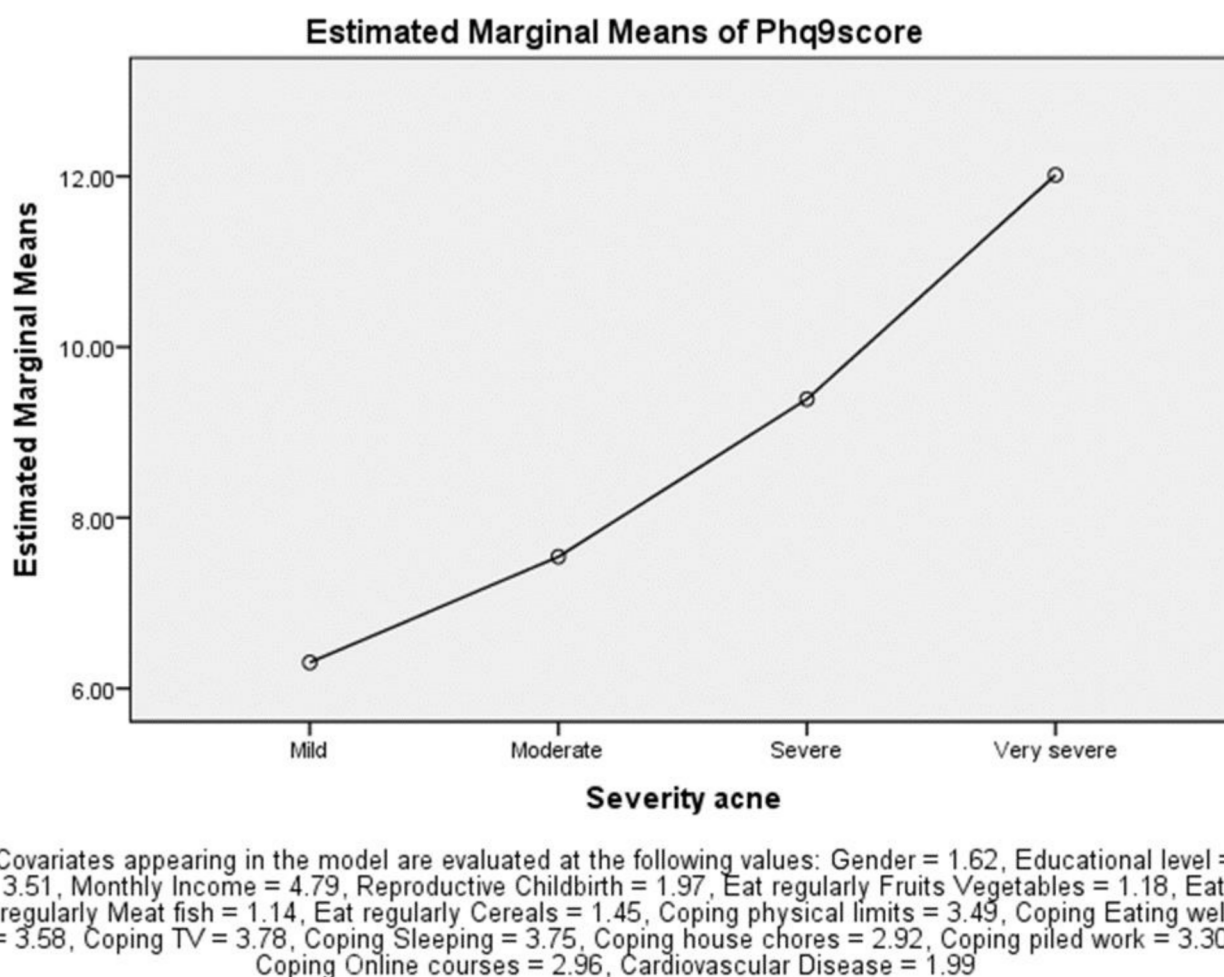
Fig. 3 Estimated marginal means of PHQ-9 score

weren't diagnosed by a dermatologist but were identified by the participants themselves, acne severity was self-reported as well without clinical validation, and the nutrition survey does not permit a thorough assessment of dietary habits. However, we suspect this bias to be nondifferential, which could underestimate the association we found and drive the results towards the null hypothesis. In addition, using online surveys for data collection introduces a potential selection bias because many patients won't be able to participate in the study because they won't have access to the link of the survey (they don't have WhatsApp or Instagram account) or they don't know how to respond online. A larger and more representative sample can lead to more accurate and generalizable conclusions.

Moreover, many residual confounding factors may lead to mental health state deterioration and would interfere with our results in a way that would make it sometimes difficult to confirm that acne is specifically responsible for mental health decline: COVID-19 pandemic, the economic crisis, the multiple stressors currently threatening the Lebanese population, and the presence of mental health problems before the occurrence of acne can all be contributing factors responsible for the confounding bias. For example, a cross-sectional study among Chinese patients with skin diseases found that isolation, income loss, and unemployment were associated with anxiety, depression, and impaired quality of life in patients with skin diseases during the COVID-19 pandemic [50].

Perspectives, practical implications, and future research
The results of this study may lead us to consider many practical implications for patients with acne: mental health support (integrating mental health support into dermatological care is crucial; screening for anxiety and depression in patients with severe acne can lead to timely interventions), education and awareness (raising awareness about the mental health effects of acne can help reduce stigma and encourage individuals
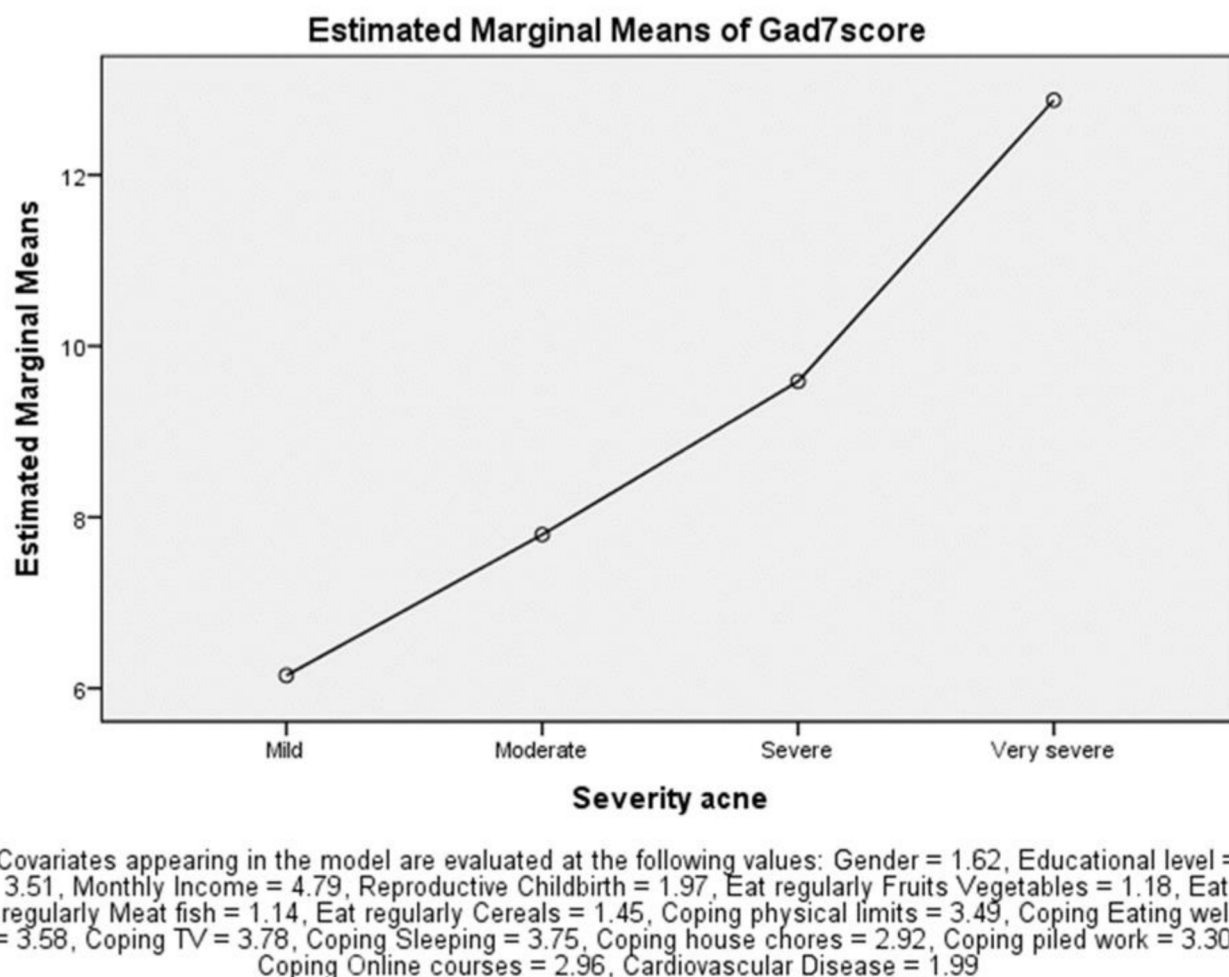
Fig. 4 Estimated marginal means of GAD-7 score

to seek help; educational programs can focus on the importance of skin health and its psychological aspects), coping strategies (providing resources for coping strategies, such as mindfulness and self-compassion exercises, can empower individuals to manage the psychological impact of acne), holistic treatment approaches (a multidisciplinary approach that includes dermatologists, psychologists, and counselors can ensure comprehensive care for those affected by acne), community and support groups (establishing support groups can help individuals share their experiences and reduce feelings of isolation, online communities can also provide valuable peer support), and long-term monitoring (ongoing assessments of mental health in patients with acne, especially during treatment, can help track changes and identify those in need of additional support).

A prospective longitudinal cohort study would be the best study design to fulfill our aims and confirm our findings. Besides, a larger and more representative sample (not only patients having Instagram or WhatsApp and who are able to read and understand English) can lead to more accurate and generalizable conclusions. Furthermore, acne severity should be assessed based on a face-to-face interview and clinical validation of acne severity should be thoroughly assessed with a more precise survey.

Conclusions

Acne has a negative influence on the mental health of patients. While treating acne, dermatologists should take into consideration this impact and adopt a holistic approach by using appropriate screening methods and investigation tools. In the era of personalised medicine, establishing a psychodermatology service can bridge the gap between skin diseases and mental health by elaborating effective lifestyle (including diet, exercise, and coping strategies) modification programmes, psychological therapies, mindfulness-based interventions, and treatment compliance promoting
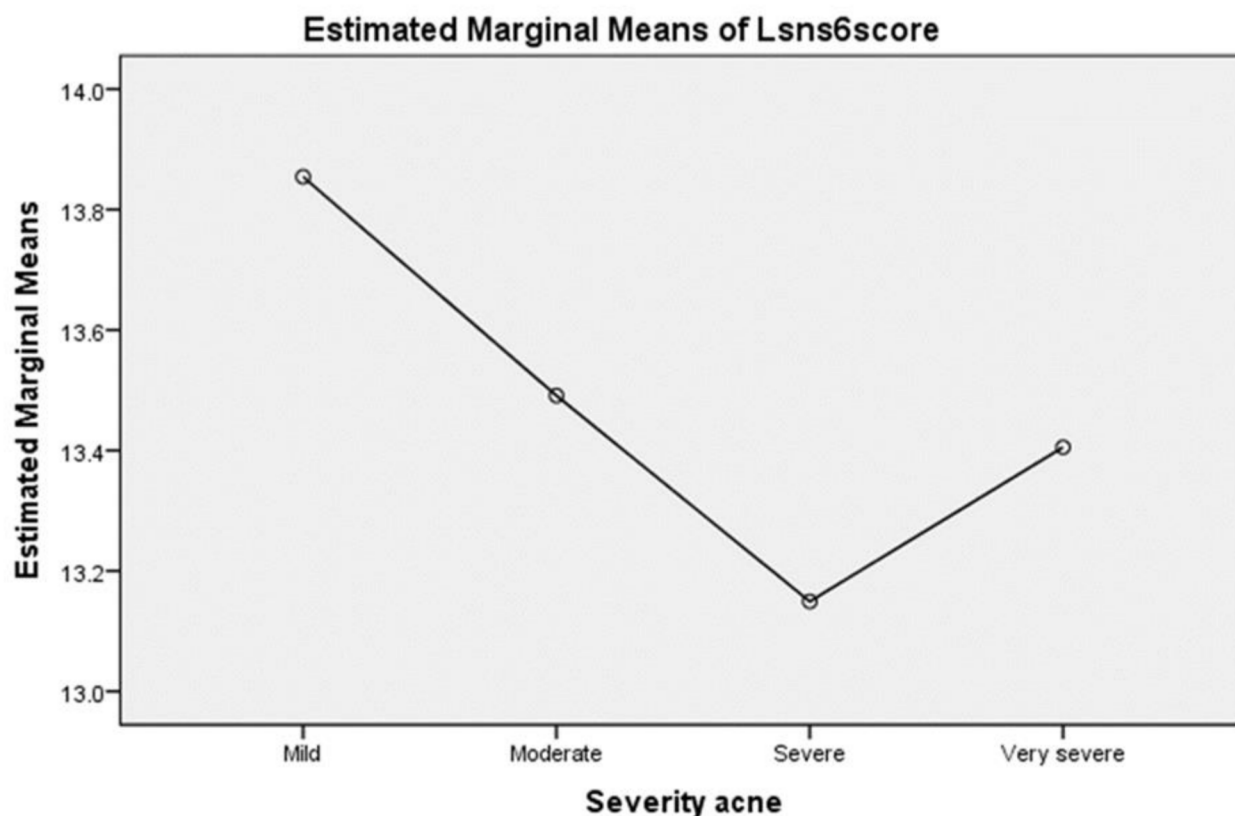
Fig. 5 Estimated marginal means of LSNS-6 score

strategies, not only to treat but also to prevent mental illnesses that may complicate the course of the skin disease and negatively affect its treatment outcomes.

Abbreviations
BDS-10   Beirut Distress Scale-10
GAD-7   Generalized Anxiety Disorder-7
LSNS-6   Lubben Social Network Scale-6
PHQ-9   Patient Health Questionnaire-9
WHO-5   World Health Organisation-5 Well-Being Index

Supplementary Information
The online version contains supplementary material available at https://doi.org/10.1186/s40359-025-02808-8.

Supplementary Material 1

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Not applicable.

Author contributions
T.E. conceived or designed the work, collected the data, wrote the manuscript, and participated in the data analysis and interpretation and critical revision of the manuscript. M.S. performed data analysis and interpretation and participated in the writing of the Results section. P.S. supervised all the research process and participated in the critical revision of the manuscript. All authors read and approved the final manuscript.

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

Declarations

Ethics approval and consent to participate
The study was conducted according to the research ethical guidelines and considerations recognized in the Declaration of Helsinki. Approval was granted by the INSPECT-LB Research and Ethics Committee (IRB ID: 2022REC-001-INSPECT-01-14). After understanding the aims of the study, the participants voluntarily agreed to take part in this research project by giving their written informed consent and completing the questionnaire and their responses were completely anonymous and confidential.

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