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Acne Vulgaris and its Association with Stress, Sleep Deprivation, and Dietary Intake Among Medical Students in Tabuk University, KSA

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ABSTRACT— The prevalence of acne vulgaris is on the rise in Saudi Arabia. However, limited research work has been reported with no studies found on medical students. The current study aimed to estimate the prevalence of acne vulgaris among medical students at Tabuk University and to investigate its association with lifestyle, including stress, sleep, and dietary habits. This cross-sectional survey study was carried out during April to July 2021. A structured questionnaire was designed and presented to 429 students with a response rate of 70.2%. This study included 301 medical students of Tabuk University. The prevalence of acne vulgaris was 71.1%, where 42.2% of students reported current acne and 28.9% reported past acne. Less than half (45.3%) got medical consultation for treatment. Mild, moderate, and severe were reported in 41.1%, 51.9%, and 7% respectively. Hormonal changes, sleep deprivation, or combinations of factors are the most aggravating factors (74.8%). While food was the culprit in 32.9%. Female gender, oily skin type, face cleanser (only once/month), and moderate to major stress were significantly associated with the development of acne ($p<0.001$) with 78.4% accuracy, 91.1% sensitivity, and 47.1% specificity. Oily skin type and major stress showed the highest odds ratios (7.46 and 6.75, respectively). Acne vulgaris affects large percentage (71.1%) of medical students at Tabuk University. Risk factors that increased the likelihood or aggravated acne included stress and lack of face washing by a cleanser, besides being a female with an oily skin type.

KEYWORDS: acne vulgaris, prevalence, medical student, Tabuk, Saudi Arabia, risk factor, stress

1. INTRODUCTION

Acne vulgaris is a chronic inflammatory dermatologic disease affecting sebaceous glands. It is the eighth most common disease, having a worldwide prevalence of about 10% [25], [40].

The major etiological factors responsible for this condition include sebum hyperproduction, altered follicular keratinization, inflammation, and an organism called Propionibacterium acnes [20], [42].

Environmental and lifestyle factors, such as air pollution, psycho-social stress, and certain dietary habits are

also incriminated [40].

The relationship between diet and acne has been previously investigated. Research work has some controversy regarding spicy food, high sugar diet, milk, and dairy products as being risk factors for acne [1], [2], [31], [41].

Good sleep is essential to good health, and individuals with poor sleep may have higher levels of trans epidermal water loss, which may represent a risk for development of acne [22].

Psychological stress and psychiatric disorders like depression may play a part in acne development [41]. Higher stress levels are reported in patients with acne from several areas of the world, such as Japan [29], India [23], and South Korea [38].

Acne is not a life-threatening disease; however, its chronicity and recurrence put patients under great economic burden. Also, chronic facial scars represent a cosmetic problem that could add a psychological stress on the patients if not treated and may impact their quality of life [37].

Risk factors for acne may emerge from both environmental and genetic background. Earlier studies focused on some epidemiological and social factors with conflicting results [13], [21], [36].

During the past two decades studies indicate increasing prevalence of acne vulgaris in Saudi Arabia [7], [11] however, limited research work has been reported with no studies found on medical students.

Therefore, the current study was performed to estimate the prevalence of acne among medical students at Tabuk University and to investigate its association with lifestyle including stress, sleep, and dietary habits in order to achieve a better understanding of this disease and to help design effective awareness and intervention programs for proper management and reduction of the prevalence and the disease burden.

2. Methods

2.1 Study design, setting, and date

This cross-sectional survey study was carried out during April to July 2021. We recruited medical students of Tabuk University. A structured questionnaire was designed and presented to the students to collect data.

2.2 Sample size calculation

The sample size was calculated using “Raosoft program” based on the results of a previous study [9] where the prevalence of acne vulgaris among medical students was estimated to be 55%. With 5% margin of error, 95% confidence interval, and 800 students as the number of total population, the required sample size was 258, to be recruited randomly from all male and female medical students at Tabuk University.

2.3 Data collection

Data collection was carried out using a self-administered questionnaire comprised of the following items: (1) demographic information such as age, weight, height, gender, grade, nationality, and residence; (2) personal information regarding the skin type, the use of facial cleanser and sun-block cream, smoking and sleep habits, physical exercise, and exposure to stress; (3) the prevalence and pattern of acne, family history, severity, pattern, and management; (4) events and foods aggravating acne; and (5) dietary history of respondents who had acne.

The weight and height of all the participants was reported, and the body mass index (BMI) was calculated using the formula: BMI = weight in kilograms/height in meters^2.

2.4 Ethical considerations

The study protocol obtained ethical approval from the Research Ethics Committee of the Faculty of Medicine, Tabuk University, Tabuk, Saudi Arabia (Ref. UT-188-47-2022, dated, 16/3/2022).

Participants were informed about the study objectives, methodology, risks, and benefits. Subjects who agreed to fill the questionnaire implied that they agreed to participate in the study.

The study conserved participants' privacy. Investigators were responsible for keeping the security of the data. Personal data (e.g. name, contact info) were not entered in our data entry software to conserve the participants' privacy. Each subject got a unique identifier code.

2.5 Statistical analysis

The data were represented and analyzed by using SPSS Ver 22 (IBM Corp. USA). Categorical data were represented as frequencies and percentages. Categorical variables were expressed as numbers and percentages, and the possible associations between categorical variables were analyzed using Pearson's Chi-square and Fisher's Exact tests as appropriate. Continuous data were tested for normality by the Shapiro Wilk test, normally distributed data were presented as mean ± standard deviation (SD) and were compared by the Independent's T test. Further, binary logistic regression analysis (backward stepwise method) was performed to show the risk factors associated with having acne vulgaris. A p value of <0.05 was considered statistically significant.

3. Results

This study included 301 medical students at the Faculty of Medicine, Tabuk University, Tabuk, Saudi Arabia. They answered a self-administered questioner. Their mean (SD) age was 21.7 (2.5) years, and the majority were females (59.5%). All grades from the 1st up to the 6th were homogeneously represented in the studied sample. The highest percent were Saudi (99.7%) and from Urban regions (95.0%) (Table 1).

Personal information of the study participants was illustrated in Table (2). Oily and combined skin types were frequently reported (33.6% and 48.5%, respectively). About 28.6% of participants don't use facial cleanser, while 25.6% reported using it once/day. Use of sunblock was denied by 74.1% of the students. The highest percent were non-smokers (87.0%), have no chronic illness (92.4%), and about one-third (30.2%) exercise 1-2 times/week. The students reported different levels of stress; moderate (19.9%), serious (15.6%), and major (4.0%).

The prevalence of acne vulgaris was 71.1%, where 42.2% reported current acne and 28.9% reported past acne. Less than half (45.3%) got medical consultation for treatment. Severity of the disease varied between mild (41.1%), moderate (51.9%), and severe (7.0%). High percent (86.0%) of the affected students stated distribution of acne in more than one site in the body. The majority (65.1%) had a close family member having acne. Less than half consulted the doctor for treatment (45.3%), where combination of different types of local treatment was the most frequently used (29.7%) (Table 3).

Factors and foods that aggravate acne as reported by students having acne was demonstrated in Table (4). Most of them (74.8%) identified more than one factor including hormonal changes, lack of sleep, exercise/excessive sweating, facial cosmetics, heredity, not cleaning the skin properly, removal of hair by

laser, and/or obesity. Regarding types of food, chocolate alone or in combination with fast food, nuts, or soft drinks were frequently identified as culprits for acne (32.9%).

Table (5) demonstrates that female gender, oily skin types, lack of face cleaning, positive family history of acne, serious and major stress were significantly associated with having acne ($p<0.05$).

Comparison of dietary habits between students having or not having acne revealed significant differences only for fruits/juices and nuts ($p<0.05$). The percent of students eating fruits 1-2 times/day was significantly lower in diseased students than non-diseased ones (7.0% vs 18.4%, respectively), further the percent of students never eating fruits was significantly higher among those having acne. Students who never eat nuts were 33.3% versus 30.4% in non-diseased compared to the diseased (Table 6).

Binary logistic regression model for the risk factors associated with having acne vulgaris revealed that female gender, oily skin type, face cleanser (only once/month), and moderate to major stress were significantly associated with the development of acne ($p<0.001$) with 78.4% accuracy, 91.1% sensitivity, and 47.1% specificity. Oily skin type and major stress showed the highest odds ratios (7.46 and 6.75, respectively).

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4. Discussion

The present study demonstrates high prevalence of acne vulgaris among medical students with higher prevalence among females. Significant risk factors for acne included stress of moderate to major degree, oily skin type, and poor face cleaning. Furthermore, the most frequently reported aggravating foods were chocolate alone or in combination with fast food, nuts, or soft drinks. The prevalence of acne vulgaris among medical students was 71.1%, where 42.2% reported current acne and 28.9% reported past acne. A similar study that included medical students at King Saud University, Riyadh, Saudi Arabia reported a lower prevalence of 55.5% [8]. A recent survey has estimated a 78% prevalence of acne among the general population in Riyadh, Saudi Arabia [9], whereas an earlier study in Jeddah in 2013 showed that 64.5% of participants had acne [6].

It is known that acne vulgaris mostly starts in adolescence between the ages of 13 and 18 years. Several studies from different countries including China, Japan, and Turkey revealed that the prevalence of acne among adolescents ranged between 50% and 93% [4], [18], [24], [28], [41]. Moreover, in the United States, the prevalence rate of acne is 85% in individuals aged 12 to 24 years [15].

It is worth to mentioning that the prevalence rate of acne depended on a self-administered questioner rather than the physician's examination. However, different studies showed that self-reported acne prevalence was lower than that reported by the trained observer diagnosis [32], [44]. More than half of the diseased participants (51.9%) had moderate acne and 7.0% had severe acne; however, less than half (45.3%) got medical consultation for treatment. Similarly, 41% of medical students with acne at Jeddah acquired a medical advice from a dermatologist [44]. Further, [9] found that only one-third of their participants received treatment by health-care providers. This finding is in line with [5], [33] who reported that a great percent of individuals did not perceive acne as a disease, nonetheless they consider it a normal phase of adolescence. In this context, it is known that receiving medical care early is vital for preventing sequels. Therefore, it is important to increase the awareness of the adolescents to seek medical help early.

Students with acne reported a number of factors that can cause or aggravate the problem. These included hormonal changes, lack of sleep, exercise/excessive sweating, facial cosmetics, heredity, not cleaning the skin properly, removal of hair by laser, and/or obesity. In this regard, a previous study in Greece that recruited secondary school pupils reported diet (62.3%), hormones (55.1%), poor hygiene (42.4%), stress (31.9%), infection (14.9%), and genetics (5.7%) as precipitating or exacerbating factors [35]. Furthermore, studies on twins and families proved that a first-degree relative acne history has a strong influence on the age of onset, severity, and response to treatment of acne [27].

Respondents having acne identified chocolate alone or in combination with fast food, nuts, or soft drinks as aggravating factors for acne. Further, comparing the dietary habits between diseased and non-diseased students revealed that insufficient intake of fruits/juices was associated with having acne. The relation between acne and diet have been extensively examined. Similar surveys based on the subjective retrieval of the respondent's thoughts about foods that cause or aggravate acne explored comparable findings including chocolates, nuts, fatty foods, sweet, and soft drinks [12], [28], [43]. A recent study also reported that 11.1% and 7.4% of the respondents stated that their acne increases after eating chocolate and junk food, respectively [9]. Alternatively, [37] reported absence of an association between acne and dietary habits.

There is supporting evidence that acne might be related to high-glycemic-index diets and dietary fatty. It has been reported that high glycemic index diets may result in hyperinsulinemia that contributes to hyperkeratinization and obstruction of sebaceous follicles, increased sebum production, and inflammation of the follicles [14], [26]. As well, it has been reported that Western diet increases the amount of nutrient and growth factor sensitive kinase mTORC1, which causes increased activity of sebaceous glands [30]. Previous studies also observed lower prevalence of acne in rural regions compared to urban ones, where people in rural areas mostly consumes healthy diet rich in vegetables and fruits [3]. The risk factors significantly associated with increased likelihood of having acne in the current study were female gender, oily skin type, lack of use of face cleanser (only once/month), and moderate to major stress. The highest odds ratios were for oily skin type and major stress (7.46 and 6.75, respectively).

Previous studies in Pakistan [10] and Riyadh [9] also reported higher prevalence of acne in females. In contrast, another study [5] found no significant association between gender and occurrence of acne, and it has been reported that adolescent males are more likely to develop acne but females are more likely to report it [39].

A multicenter case-control study enrolled adult females in Italy and confirmed that a high level of psychological stress is associated with acne (odds ratio = 2.95) [19]. Further, the impact of psychological and mental stress as one of the triggers and aggravating factors of acne has been demonstrated in various studies [26]. A recent study demonstrated that high stress mediators (catecholamines) could precipitate acne by mediating the *Cutibacterium acnes* [16].

Face washing helps removing excess sebum, possibly reducing acne occurrence [34]. [17] investigated the effect of frequency of face washing on acne vulgaris in a single-blinded, randomized, controlled clinical trial on males with mild to moderate acne vulgaris. There was only statistically significant improvement in the study group washing the face twice daily.

5. Conclusions

Acne vulgaris affected large percentage of the medical students in Tabuk University, Saudi Arabia (71.1%,). Yet, less than half (45.3%) consulted the health care provider for treatment. Risk factors that

increase the likelihood of acne or aggravate it included stress, lack of face washing by a cleanser, besides being a female with an oily skin type. Furthermore, Respondents having acne identified chocolate alone or in combination with fast food, nuts, or soft drinks as aggravating factors for acne. Further, it has been observed that insufficient intake of fruits/juices was associated with having acne. Efforts should be made to increase awareness about acne vulgaris, its risk factors, and the importance of seeking medical early care.

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Table (1): Demographic data of the study participants (N=301)

Age (years)	Minimum-Maximum	17.0-35.0	
	Mean±SD	21.7±2.5	
BMI	Minimum-Maximum	15.62-45.28	
	Mean±SD	24.57±5.58	
sex	Female	179	59.5%
	Male	122	40.5%
Grade	Grade 1	57	18.9%
	Grade 2	46	15.3%
	Grade 3	50	16.6%
	Grade 4	48	15.9%
	Grade 5	66	21.9%
	Grade 6	34	11.3%
Nationality	Saudi	300	99.7%
	Non-Saudi	1	0.3%
Residence	Urban	286	95.0%
	Rural	15	5.0%

Table (2): Personal information of the study participants (N=301)

		N=301	%
Skin type	Combination	146	48.5%
	Oily	101	33.6%
	Dry	54	17.9%
Use of facial cleanser	Do not use	86	28.6%
	Once/day	77	25.6%
	Once/month	42	14.0%
	3-4 times/week	39	13.0%
	Twice/day	29	9.6%
	Twice/month	28	9.3%

Use of sunblock cream	Do not use	223	74.1%
	Regular use	78	25.9%
Smoking	No	262	87.0%
	Yes	28	9.3%
	Previous smoker	11	3.7%
Physical exercise	Never	108	35.9%
	1-2 times/week	91	30.2%
	3-4 times/week	69	22.9%
	Every day	33	11.0%
Sleep (hours/day)	Less than 5	55	18.3%
	5-7	101	32.6%
	8-10	125	42.5%
	More than 10	20	6.6%
Do you have any chronic illness?	No	278	92.4%
	Yes	23	7.6%
Types of chronic illness	Bronchial asthma	9	50.0%
	Diabetes Mellitus	4	22.2%
	Allergy	3	16.7%
	Ovarian cysts	1	5.6%
	Hypothyroidism	1	5.6%
What about your menstruation?	Regular	128	69.2%
	Irregular	57	30.8%
Stress level	Very little stress	109	36.2%
	Mild stress	73	24.3%
	Moderate stress	60	19.9%
	Serious stress	47	15.6%
	Major stress	12	4.0%

Table (3): Prevalence and pattern of acne vulgaris among the study participants

		N	%
Do you have acne vulgaris	No	87	28.9%
	Yes, current acne	127	42.2%
	Yes, past acne	87	28.9%
Distribution	Checks	21	9.8%
	Chin	3	1.4%
	Chest	1	0.5%
	Back	1	0.5%
	More than one site	184	86.0%
	Nose	2	0.9%
	Upper arm	2	0.9%
Severity	Mild	88	41.1%
	Moderate	111	51.9%
	Severe	15	7.0%
Did you consult the doctor?	No	117	54.7%
	Yes	97	45.3%
Treatment	None	39	18.4%
	Topical medication	38	17.9%

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	Face wash	12	5.7%
	Home masks	5	2.4%
	Laser	6	2.8%
	Combined local	63	29.7%
	Oral medications	10	4.7%
	oral medications + combined local	39	18.4%
Is there any family member affected with acne?	No	105	34.9%
	Yes	196	65.1%
Who is the affected family member?	Sister	69	35.8%
	Brother	58	30.1%
	Father	5	2.6%
	Mother	3	1.6%
	Son	1	0.5%
	More than one member	57	29.5%

Table (4): Factors and foods that aggravate acne among the affected subjects

		N=214	%
Conditions that aggravate acne	Hormonal changes	13	6.1%
	Lack of sleep	5	2.3%
	Exercise/excessive sweating	2	0.9%
	Facial cosmetics	2	0.9%
	Heredity	2	0.9%
	Removal of hair by laser	2	0.9%
	Removal of hair by wax or shave	2	0.9%
	Constant exposure to sunlight and humidity	1	0.5%
	Not cleaning the skin properly	1	0.5%
	Obesity	1	0.5%
	Combination of one or more of the above factors	160	74.8%
	I don’t know	23	10.7%
Foods that aggravate acne	Chocolate alone or combined with fast food or nuts or soft drinks	70	32.9%
	Milk	20	9.4%
	Dairy products alone or combined with chocolate or oily food or soft drinks	18	8.5%
	Fast food	15	7.0%
	Fruits	4	1.9%
	Oily food	4	1.9%
	Nuts	2	0.9%
	Vegetables	2	0.9%
	None	18	8.5%
	I don’t know	60	28.2%

Table (5): Various factors associated with having acne vulgaris

	Do you have acne vulgaris?				
	No		Yes		
	N	%	N	%	P value

Sex	Female	43	49.4%	136	63.6%	0.024*
	Male	44	50.6%	78	36.4%	
BMI	Mean ± SD	25.02±5.56		24.38±5.58		0.366
Type of skin	Dry	23	26.4%	31	14.5%	<0.001*
	Oily	15	17.2%	86	40.2%	
	Combined	49	56.3%	97	45.3%	
Face cleanser	No	32	36.8%	54	25.2%	0.003*
	Once/week	18	20.7%	24	11.2%	
	Once/day	18	20.7%	59	27.6%	
	Twice/week	3	3.4%	25	11.7%	
	Twice/day	3	3.4%	26	12.1%	
	3-4 times/ week	13	14.9%	26	12.1%	
Sunblock use	No	67	77.0%	156	72.9%	0.460
	Yes	20	23.0%	58	27.1%	
Smoking	No	69	79.3%	193	90.2%	0.030*
	Past smoker	6	6.9%	5	2.3%	
	Yes	12	13.8%	16	7.5%	
Physical exercise	Never	35	40.2%	73	34.1%	0.215
	Everyday	12	13.8%	21	9.8%	
	1-2 times/ week	19	21.8%	72	33.6%	
	3-4 times/ week	21	24.1%	48	22.4%	
Do you have chronic illness?	No	80	92.0%	198	92.5%	0.866
	Yes	7	8.0%	16	7.5%	
Stress level	Major stress	2	2.3%	10	4.7%	0.014*
	Mild stress	21	24.1%	52	24.3%	
	Moderate stress	18	20.7%	42	19.6%	
	Serious stress	5	5.7%	42	19.6%	
	Very little stress	41	47.1%	68	31.8%	
Do you have any family member having acne?	No	48	55.2%	57	26.6%	<0.001*
	Yes	39	44.8%	157	73.4%	

*Significant at p<0.05

Table (6): Dietary habits associated with having acne vulgaris

		Do you have acne vulgaris?				
		No		Yes		
		N	%	N	%	P value
Milk	1-2 times/week	36	41.4%	93	43.5%	0.458
	1-2 times/day	9	10.3%	20	9.3%	
	3-4 times/week	28	32.2%	53	24.8%	
	Never	14	16.1%	48	22.4%	
Dairy products	1-2 times/week	43	49.4%	101	47.2%	0.876
	1-2 times/day	10	11.5%	32	15.0%	
	3-4 times/week	28	32.2%	65	30.4%	
	Never	6	6.9%	16	7.5%	
Fruits and juices	1-2 times/week	45	51.7%	110	51.4%	0.009*
	1-2 times/day	16	18.4%	15	7.0%	
	3-4 times/week	21	24.1%	59	27.6%	

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	Never	5	5.7%	30	14.0%	
Vegetables	1-2 times/week	31	35.6%	92	43.0%	0.054
	1-2 times/day	21	24.1%	26	12.1%	
	3-4 times/week	28	32.2%	69	32.2%	
	Never	7	8.0%	27	12.6%	
Fish and sea food	1-2 times/week	55	63.2%	110	51.4%	0.051
	1-2 times/day	0	0.0%	6	2.8%	
	3-4 times/week	6	6.9%	8	3.7%	
	Never	26	29.9%	90	42.1%	
Fast food	1-2 times/week	43	49.4%	127	59.3%	0.437
	1-2 times/day	7	8.0%	12	5.6%	
	3-4 times/week	26	29.9%	55	25.7%	
	Never	11	12.6%	20	9.3%	
Chocolate	1-2 times/week	38	43.7%	89	41.6%	0.607
	1-2 times/day	11	12.6%	26	12.1%	
	3-4 times/week	33	37.9%	76	35.5%	
	Never	5	5.7%	23	10.7%	
Nuts	1-2 times/week	35	40.2%	116	54.2%	0.048*
	1-2 times/day	6	6.9%	5	2.3%	
	3-4 times/week	17	19.5%	28	13.1%	
	Never	29	33.3%	65	30.4%	
Fried food	1-2 times/week	42	48.3%	102	47.7%	0.950
	1-2 times/day	4	4.6%	7	3.3%	
	3-4 times/week	29	33.3%	74	34.6%	
	Never	12	13.8%	31	14.5%	

*Significant at p<0.05

Table (7): Binary logistic regression model for the risk factors associated with having acne vulgaris

	P value	Adjusted odds ratio	95% CI		Accuracy	Sensitivity	Specificity	P value
Female sex	0.017*	2.44	1.17	5.10	78.4%	91.1%	47.1%	<0.001*
Oily skin type	<0.001*	7.46	2.94	18.94				
Face cleanser (only once/month)	0.033*	2.99	1.10	8.20				
Major stress level	0.027*	6.75	1.24	36.57				
Serious stress level	0.001*	6.51	2.20	19.28				
Moderate stress level	0.046*	2.10	1.01	4.38				

*Significant at p<0.05. CI; confidence interval