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Original Research Article

Investigation of the effect of diet on acne: a case-control study

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ABSTRACT

Background: This study aimed to explore the association between acne vulgaris and dietary habits among young individuals.
Methods: A case-control study was conducted involving 100 individuals with acne and 100 without. Detailed dietary intake, demographic data, body mass index, and family history of acne were collected using questionnaires. The severity of acne was evaluated by physicians.
Results: The body mass index (BMI) was significantly lower in the acne group (21.97±3.74) than in the control group (23.67±3.96) ($p=0.001$). Family history of acne was more common in patients with acne ($p=0.034$). The consumption of bakery products, French fries, nuts, and pumpkin seeds once a week, once a week, once a day, and once a week, respectively, in the control group was significantly higher than that in the acne group ($p<0.05$). French fries consumption 3-4 times a week was higher in patients with acne ($p<0.05$).
Conclusions: Low BMI and a positive family history of acne were identified as risk factors for acne. While excessive consumption of French fries is frequently observed in patients with acne, normal consumption of nuts and pumpkin seeds may be beneficial for acne, and warrants investigation in large-scale studies.

Keywords: Acne vulgaris, Diet, Risk factors

INTRODUCTION

Acne vulgaris is one of the most prevalent chronic inflammatory skin conditions, affecting approximately 85% of teenagers and young adults worldwide.[1] Although acne is often viewed as a temporary issue during puberty, it can greatly affect the quality of life, lead to emotional distress, and cause lasting scars if not treated properly.[2] Excess sebum production, hyperkeratinization, proliferation of *Cutobacterium acnes*, and inflammation play a role in the pathogenesis of acne.[3] Genetic predisposition affects the likelihood of developing acne.[4] In addition to genetic influences, eating patterns have been identified as potentially adjustable factors in the development of acne.

Several studies have indicated a link between diets with a high glycemic load, intake of dairy products—especially skim milk—and acne severity.[3,5-7]

Dietary factors affect all four pathophysiological factors of acne. Refined sugars increase blood IGF-1 levels, leading to hyperkeratinization and increased sebum production.[3] Milk contains IGF-1, which can lead to acne.[8] Omega-3 fatty acids suppress inflammation and downregulate IGF-1, leading to beneficial effects on acne.[5]

Studies investigating the effects of specific foods on acne are limited.[7] We designed a case-control study to investigate the effects of individual food items and demographic characteristics on acne vulgaris.

METHODS

This case-control study was conducted with 100 individuals (50 men and 50 women) with acne and 100 participants (50 men and 50 women) serving as a control group without acne who attended Izmir Atatürk Education and Research Hospital's dermatology outpatient clinics between May 2024 and July 2024. The control group comprised patients with localized dermatologic diseases, including verruca vulgaris (n=35), seborrheic dermatitis (n=11), hair loss (n=9), anogenital verruca (n=7), scabies (n=6), callus (n=5), pityriasis versicolor (n=3), dermatitis (nonspecific) (n=3), hyperpigmentation (n=2), hand dermatitis (n=2), and one patient with each of the other localized diseases. The physicians assessed the acne severity. The global acne severity scale was used.[9]

Body mass index (BMI) was calculated. The sample size was not predetermined, and all consecutive eligible patients were enrolled during the study period. Patients who volunteered to participate in the study and had acne were included in the patient group, while those with localized dermatological disease were included in the control group.

A questionnaire on dietary characteristics was administered to both groups of participants. The frequency of food consumption in the questionnaire was "never, once/week, 3–4 times/week, every day, more than once/day." Cheese, yogurt, fatty milk, skimmed milk, sweet/sugar, chocolate, bakery food (pastry and similar), bread, fast food (hamburger), fast food (french fries), carbonated beverages, fruit, vegetables, legumes (beans, chickpeas, and similar foods), chips, eggs, olives, tea, fish, red meat, chicken, nuts (hazelnut, peanut, almond, walnut, and cashew), sunflower seeds, and pumpkin seeds were assessed in terms of their specific portions (serving, slice, grams, glasses, pieces, packets, matchbox size, and bowls).

Statistical method

Data analysis was performed using IBM statistical package for social sciences (SPSS) statistics 21 software. Descriptive statistics for the variables included the mean, standard deviation, median, and interquartile values for continuous variables and frequency (N) and percentage (%) distributions for categorical variables. The distributional characteristics of continuous variables were examined using the Shapiro-Wilk test and graphical methods (histograms and Q-Q plots). Nonparametric methods were used for group comparisons of variables such as age and body mass index, where non-normal distributions were observed.

The Mann-Whitney U test was used to assess the differences in continuous variables between the control and patient groups. The Pearson chi-square test was used to compare categorical variables, in accordance with the contents of the tables. All multi-category variables, such as food consumption, acne severity classes, and family history, were analyzed for correlations between the two groups using the chi-square test. Statistical significance was set at $p<0.05$. All analyses were conducted in a two-tailed manner, and the results are presented in tables.

RESULTS

The body mass index (BMI) was notably lower in individuals with acne, averaging 21.97±3.74, than in the control group, which had a BMI of 23.67±3.96 ($p=0.001$). Additionally, a family history of acne was more frequently observed in patients with acne ($p=0.034$) (Table 1). According to the global acne severity scale, the distribution of acne severity among the participants was as follows: almost clear (4), mild (17), moderate (53), severe (25), and very severe (1).

The dietary findings are presented in Tables 2-5. The control group showed a significantly higher frequency of consumption of bakery items once a week, French fries once a week, pumpkin seeds once a week, and nuts once a day ($p<0.05$). In contrast, patients with acne consumed french fries 3-4 times a week more frequently ($p<0.05$). Posteriori (post hoc) power analysis test was performed to determine whether the patient and control groups had sufficient numbers. The total sample size was 200, the significance level was $\alpha=0.05$, and the degrees of freedom were df=4. The power of the test for statistically significant variables ($p<0.05$) was found to be over 80%.

Table 1: Age, body mass index, gender, acne severity and family history comparison.

Variable		Control (n=100) N (%)	Patient (n=100) N (%)	P value*
Age: mean±SD, median (IQR)		18.29±2.45, 17 (3)	18.34±2.46, 18 (4)	0.659+
BMI: mean±SD, median (IQR)		23.67±3.96, 23.11 (4.58)	21.97±3.74, 21.16 (4.33)	0.001+
Gender	Female	50 (50.0)	50 (50.0)	1.000*
	Male	50 (50.0)	50 (50.0)	
Acne severity	Almost none	0 (0.0)	4 (4.0)	
	Mild	0 (0.0)	17 (17.0)	
	Moderate	0 (0.0)	53 (53.0)	
	Severe	0 (0.0)	25 (25.0)	
	Very severe	0 (0.0)	1 (1.0)	
Family history	No	59 (59.0)	44 (44.0)	0.034*
	Yes	41 (41.0)	56 (56.0)	

+Mann Whitney U test, *Pearson Chi-Square test.

Table 2: Comparison of dietary items between the groups.

Variable		Control (n=100) N (%)	Patient (n=100) N (%)	P value*
Desserts (servings)	Never	4 (4.0)	3 (3.0)	0.494*
	Once/week	37 (37.0)	30 (30.0)	
	3–4/week	37 (37.0)	40 (40.0)	
	Every day	13 (13.0)	21 (21.0)	
	More than once/day	9 (9.0)	6 (6.0)	
Chocolate bar (40 g)	Never	7 (7.0)	9 (9.0)	0.950*
	Once/week	32 (32.0)	30 (30.0)	
	3–4/week	39 (39.0)	41 (41.0)	
	Every day	16 (16.0)	16 (16.0)	
	More than once/day	6 (6.0)	4 (4.0)	
Bakery products (servings)	Never	4 (4.0) [a]	10 (10.0) [a]	0.010*
	Once/week	41 (41.0) [a]	22 (22.0) [b]	
	3–4/week	44 (44.0) [a]	45 (45.0) [a]	
	Every day	10 (10.0) [a]	19 (19.0) [a]	
	More than once/day	1 (1.0) [a]	4 (4.0) [a]	
Bread (2–3 slices)	Never	5 (5.0)	8 (8.0)	0.609*
	Once/week	12 (12.0)	8 (8.0)	
	3–4/week	27 (27.0)	34 (34.0)	
	Every day	44 (44.0)	38 (38.0)	
	More than once/day	12 (12.0)	12 (12.0)	
Fast-food Hamburger (servings)	Never	32 (32.0)	32 (32.0)	0.286*
	Once/week	57 (57.0)	50 50.0)	
	3–4/week	8 (8.0)	17 (17.0)	
	Every day	2 (2.0)	1 (1.0)	
	More than once/day	1 (1.0)	0 (0.0)	
Fast-food French fries (servings)	Never	14 (14.0) [a]	14 (14.0) [a]	0.017*
	Once/week	72 (72.0) [a]	55 (55.0) [b]	
	3–4/week	12 (12.0) [a]	29 (29.0) [b]	
	Every day	1 (1.0) [a]	2 (2.0) [a]	
	More than once/day	1 (1.0) [a]	0 (0.0) [a]	
Olives (10–12 pieces)	Never	19 (19.0)	29 (29.0)	0.211*
	Once/week	23 (23.0)	25 (25.0)	
	3–4/week	36 (36.0)	28 (28.0)	
	Every day	17 (17.0)	17 (17.0)	
	More than once/day	5 (5.0)	1 (1.0)	
Tea (glasses)	Never	5 (5.0)	11 (11.0)	0.061*
	Once/week	10 (10.0)	17 (17.0)	
	3–4/week	20 (20.0)	24 (24.0)	
	Every day	36 (36.0)	33 (33.0)	
	More than once/day	29 (29.0)	15 (15.0)	

*Pearson Chi-square test; [a, b]: each superscript letter denotes a subset of group categories whose column proportions do not differ significantly from each other at the 0.05 level.

Table 3: Comparison of dietary items between the groups.

Variable		Control (n=100) N (%)	Patient (n=100) N (%)	P value*
Carbonated beverages (glasses)	Never	23 (23.0)	27 (27.0)	0.185*
	Once/week	39 (39.0)	31 (31.0)	
	3–4/week	26 (26.0)	31 (31.0)	
	Every day	6 (6.0)	10 (10.0)	
	More than once/day	6 (6.0)	1 (1.0)	
Fruit (pieces)	Never	6 (6.0)	4 (4.0)	0.301*
	Once/week	27 (27.0)	34 (34.0)	
	3–4/week	32 (32.0)	39 (39.0)	
	Every day	26 (26.0)	15 (15.0)	
	More than once/day	9 (9.0)	8 (8.0)	

Continued.

Variable		Control (n=100) N (%)	Patient (n=100) N (%)	P value*
Vegetables (servings)	Never	7 (7.0)	4 (4.0)	0.427*
	Once/week	23 (23.0)	32 (32.0)	
	3–4/week	50 (50.0)	51 (51.0)	
	Every day	16 (16.0)	11 (11.0)	
	More than once/day	4 (4.0)	2 (2.0)	
Legumes (beans, and chickpeas)-(servings)	Never	9 (9.0)	7 (7.0)	0.704*
	Once/week	52 (52.0)	43 (43.0)	
	3–4/week	35 (35.0)	46 (46.0)	
	Every day	3 (3.0)	3 (3.0)	
	More than once/day	1 (1.0)	1 (1.0)	
Chips (packet)	Never	33 (33.0)	30 (30.0)	0.485*
	Once/week	51 (51.0)	45 (45.0)	
	3–4/week	12 (12.0)	22 (22.0)	
	Every day	3 (3.0)	2 (2.0)	
	More than once/day	1 (1.0)	1 (1.0)	
Eggs (pieces)	Never	13 (13.0)	18 (18.0)	0.204*
	Once/week	30 (30.0)	30 (30.0)	
	3–4/week	35 (35.0)	25 (25.0)	
	Every day	13 (13.0)	22 (22.0)	
	More than once/day	9 (9.0)	5 (5.0)	

*Pearson Chi-square test.

Table 4: Comparison of dietary items between the groups.

Variable		Control (n=100) N (%)	Patient (n=100) N (%)	P value*
Fish (100 g)	Never	29 (29.0)	44 (44.0)	0.076*
	Once/week	64 (64.0)	52 (52.0)	
	3–4/week	7 (7.0)	4 (4.0)	
	More than once/day	0 (0.0)	0 (0.0)	
Red meat (100 g)	Never	10 (10.0)	20 (20.0)	0.275*
	Once/week	59 (59.0)	54 (54.0)	
	3–4/week	27 (27.0)	24 (24.0)	
	Every day	3 (3.0)	2 (2.0)	
	More than once/day	1 (1.0)	0 (0.0)	
Chicken (100 g)	Never	4 (4.0)	7 (7.0)	0.256*
	Once/week	47 (47.0)	41 (41.0)	
	3–4/week	38 (38.0)	47 (47.0)	
	Every day	9 (9.0)	5 (5.0)	
	More than once/day	2 (2.0)	0 (0.0)	
Nuts (hazelnut, almond, walnut, cashew) (50 g)	Never	4 (4.0) [a]	11 (11.0) [a]	0.003*
	Once/week	52 (52.0) [a]	64 (64.0) [a]	
	3–4/week	28 (28.0) [a]	22 (22.0) [a]	
	Every day	15 (15.0) [a]	2 (2.0) [b]	
	More than once/day	1 (1.0) [a]	1 (1.0) [a]	
Sunflower seeds (60 g, 1 pack)	Never	41 (41.0)	54 (54.0)	0.131*
	Once/week	36 (36.0)	33 (33.0)	
	3–4/week	19 (19.0)	10 (10.0)	
	Every day	2 (2.0)	3 (3.0)	
	More than once/day	2 (2.0)	0 (0.0)	
Pumpkin seeds (60 g, 1 pack)	Never	54 (54.0)[a]	76 (76.0)[b]	0.006*
	Once/week	36 (36.0)[a]	20 (20.0)[b]	
	3–4/week	9 (9.0)[a]	3 (3.0)[a]	
	Every day	1 (1.0)[a]	1 (1.0)[a]	
	More than once/day	0 (0.0)[a]	0 (0.0)[a]	

*Pearson Chi-square test; [a, b]: each superscript letter denotes a subset of group categories whose column proportions do not differ significantly from each other at the 0.05 level.

Table 5: Comparison of dietary items between the groups.

Variable		Control (n=100) N (%)	Patient (n=100) N (%)	P value*
Cheese (matchbox size)	Never	7 (7.0)	8 (8.0)	0.852*
	Once/week	24 (24.0)	25 (25.0)	
	3–4/week	34 (34.0)	39 (39.0)	
	Every day	30 (30.0)	23 (23.0)	
	More than once/day	5 (5.0)	5 (5.0)	
Yogurt (bowl)	Never	5 (5.1)	7 (7.0)	0.367*
	Once/week	24 (24.2)	36 (36.0)	
	3–4/week	43 (43.4)	32 (32.0)	
	Every day	25 (25.3)	23 (23.0)	
	More than once/day	2 (2.0)	2 (2.0)	
Whole milk (glasses)	Never	42 (42.0)	36 (36.0)	0.381*
	Once/week	35 (35.0)	34 (34.0)	
	3–4/week	16 (16.0)	21 (21.0)	
	Every day	5 (5.0)	9 (9.0)	
	More than once/day	2 (2.0)	0 (0.0)	
Skim milk (glasses)	Never	52 (52.0)	54 (54.0)	0.958*
	Once/week	39 (39.0)	35 (35.0)	
	3–4/week	5 (5.0)	7 (7.0)	
	Every day	3 (3.0)	3 (3.0)	
	More than once/day	1 (1.0)	1 (1.0)	

*Pearson Chi-Square test.

DISCUSSION

In our study, the prevalence of acne was substantially higher among individuals with a positive family history, supporting the well-established role of genetic predisposition in acne pathogenesis.[4,10]

We found that patients with acne had a lower BMI than those in the control group. In a cross-sectional study conducted on 600,404 youths, acne was reported to be more commonly observed in individuals with normal or lower BMI than in overweight patients; the conversion of androgens to estrogen in fat tissue was stated as a possible reason.[11] Some studies have found a linear relationship between BMI and acne, indicating that more severe acne is detected in obese individuals than in non-obese individuals. Increased IGF-1 levels resulting from insulin resistance in obese individuals have been suggested as a potential cause of acne.[12,13]

In our study, the consumption of bakery items once a week, french fries once a week, nuts once a day, and pumpkin seeds once a week was significantly higher in the control group ($p<0.05$). Eating french fries 3-4 times a week was more common among patients with acne ($p<0.05$). Several studies have shown a connection between high-glycemic-load diets, consumption of dairy products—particularly skim milk—and acne severity.[3,5-7,14] Bakery products and french fries are high-glycemic-load foods. The lower acne prevalence observed in our study among participants who consumed bakery products and french fries only once a week likely reflects a diet with a lower glycemic load. In contrast, frequent consumption of french fries (3–4 times per week) was associated with acne, which aligns with established acne-promoting mechanisms.[3]

Desserts, chocolate bars, hamburgers, and bread showed no effect on acne in our study, in contrast to the literature.[3,5,6] This likely reflects reverse causality (patients avoiding such foods after the onset of acne). In our study, potato chips were not significantly associated with acne, although previous studies have reported their acne-promoting effects.[15] This may indicate reverse causality. In our study, carbonated drinks were not associated with acne, probably because carbonation itself does not affect acne biology; only beverages with high sugar content or high glycemic load have shown effects in previous studies.[3,16] The potential consumption of low-sugar varieties in our study may have minimized their metabolic impact. This may also indicate reverse causality.

In our study, yogurt, cheese, whole milk, and skim milk were not significantly associated with acne vulgaris. In previous reviews, milk was found to be associated with acne, but yogurt and cheese were not.[3,8]

In our study, participants who consumed small amounts of nuts once a day had less acne, in concordance with the literature, which might reflect the protective effect of omega-3 fatty acids.[17] Omega-3 polyunsaturated fatty acids (PUFAs) are recognized for their anti-inflammatory effects and may positively affect acne progression.[5] In our study, the intake of pumpkin seeds once a week was found to be beneficial for acne. Pumpkin seeds are rich in zinc, which has anti-inflammatory and antimicrobial properties.

Zinc intake has been reported to be beneficial for acne in a review.[18]

In our study, the intake of vegetables, legumes, and fruits did not affect acne vulgaris. Increased intake of high-glycemic foods may have more acne-promoting effects than the beneficial effects of these foods.[3]

Limitations

This study had several limitations. We included all consecutive eligible patients during the 3-month study period; therefore, no priori analysis of the sample size was performed. Dietary information was self-reported, which may have introduced recall bias. Reverse causality, wherein patients may avoid harmful foods following the onset of acne, could have resulted in lower consumption of potentially harmful diets.

The results of this study may have limited generalizability because it was conducted at a single location and involved a small number of participants. Additionally, relying on frequency scores for dietary assessment instead of detailed nutrient analysis may have led to an underestimation of certain relationships.

CONCLUSION

Low BMI and a positive family history of acne were identified as risk factors for acne. While excessive consumption of French fries is frequently observed in patients with acne, normal consumption of nuts and pumpkin seeds may be beneficial for acne, and warrants investigation in large-scale studies.

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