Consumption of dairy in teenagers with and without acne

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Background: Recent literature has implicated dairy as having a potential acne-inducing effect.

Objectives: The aim of this study was to investigate the link between dairy consumption and acne in teenagers. We tested the hypothesis that teenagers with facial acne consume more dairy than those without acne.

Methods: A case-control study was conducted among 225 participants, ages 14 to 19 years, with either moderate acne or no acne. Moderate acne was determined by a dermatologist using the Global Acne Assessment Scale. Participants who met inclusion criteria then completed up to three 24-hour diet recall interviews using the Nutrition Data System for Research software and food and nutrient intake were compared between groups.

Results: The amount of low-fat/skim milk consumed by participants with acne with significantly higher (P = .01) than those with no acne. No significant difference was found among total dairy intake, saturated fat or trans-fat, or glycemic load. No significant difference was found for total energy intake or body mass index.

Limitations: Limitations include self-report of diet and portion size, and association does not determine causation.

Conclusions: Consumption of low-fat/skim milk, but not full-fat milk, was positively associated with acne. (J Am Acad Dermatol 2016;75:318-22.)

Key words: acne; acne vulgaris; dairy; diet; glycemic index; glycemic load; milk; skim milk.

Acne vulgaris affects approximately 45 million individuals in the United States.[1] The pathogenesis of acne is a complex process that involves multiple factors, including innate immunity, hormonal influences, and genetics. The impact of environmental factors including the role of diet in acne pathogenesis is still being elucidated.

Early research into a link between diet and acne yielded mixed results. Dairy[2] and diets high in iodide[3] were suggested to worsen acne. Other studies tested foods commonly thought of as acne triggers and found no association.[4,5] The discussion was quiescent for years until a study found virtually no acne in select non-Westernized populations, leading researchers to infer that a Western diet may be to blame.[6] Subsequent studies suggested an association between dairy, particularly skim milk, and acne. In 2005, Adebamowo et al[7] found that milk intake was increased among adolescents with acne in a retrospective analysis of women who had experienced acne in their teenage years. Two studies of large cohorts of adolescent boys and girls with acne found the association to be stronger with skim milk.[8,9] Other studies implicated glycemic load and

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milk consumption.[10-12] Much of this prior research was flawed with design errors, recall bias, small sample size, and use of nonvalidated food diaries for data collection.

METHODS

This study used a case-control method to study dietary intake in people aged 14 to 19 years. We recruited 225 participants from dermatology and pediatric clinics at the Hershey Medical Center in Hershey, PA, and Pinnacle Health System in Harrisburg, PA. The institutional review board at Pennsylvania State College of Medicine approved the study. A total of 120 participants with moderate facial acne, evaluated by a dermatologist using the Global Acne Assessment Scale, were included in the acne group. The control group was composed of 105 participants with no evidence of acne. Participants completed a questionnaire that included information on height and weight, medications, and dietary restrictions. Participants on medications requiring dietary alteration, and those previously on isotretinoin or starting oral contraceptive pills within the last 6 months, were excluded. Participants with dietary dairy restrictions, such as lactose intolerance or vegans, and those with a history of eating disorder were also excluded. Participants completed up to 3 telephone interviews using a 24-hour diet recall technique and the Nutrition Data System for Research software. Telephone interviews were conducted at random and included 2 weekdays and 1 weekend day to obtain an accurate sampling of the participants' typical food intake. Specific data regarding intake of milk and other dairy products along with nutrient totals for the acne group were compared with those of the control group.

CAPSULE SUMMARY

- Several studies have implicated a role for dairy consumption in acne vulgaris.
- This study shows that low-fat/skim milk, but not full-fat milk, is positively associated with moderate acne.
- Studies documenting the impact of dietary interventions are needed before dietary recommendations can be made.

Statistical methods

The primary outcome variables in this study were dairy intake values, including total daily dairy serving, and total daily servings of full-fat (3.5%), reduced-fat (2%), and low-fat (1%)/fat-free (skim, nonfat) milk and other dairy products. The program grouped low-fat and skim milk into 1 measurement that was inseparable in analysis. Other measured outcome variables included total energy intake and total daily carbohydrates/fat/protein intake. The main independent variable in this study was acne. Descriptive statistics, such as mean and SD of these continuous variables, were constructed, firstly for all subjects and then for subjects in the acne and control groups separately. The relationships between the outcome variables and the group variable were examined by linear mixed models for repeated measurements: group (acne vs control) served as the primary independent variable while adjusting for multiple demographic variables, including age, gender, and body mass index. Variance components covariance structure was used in the linear mixed model while other covariance structures were explored and examined. The demographic variables were compared between 2 groups by 2-sample t test or χ^2 test when appropriate. All hypothesis tests were 2-sided and analyses were performed using statistical software (SAS, Version 9.3, SAS Institute, Cary, NC). The significance level used was .05.

RESULTS

Table I shows the demographics of acne and control groups. The average age of patients with acne was 16.9 (SD 1.5) years compared with 16.7 (SD 1.4) years for participants in the control group. The acne group was 50.8% female and the control group was 56.2% female. The average body mass index was 22.8 (SD 3.7) in the acne group and 23.8 (SD 5.7) in the control group.

The relationship between consumption of dairy products and acne is shown in Table II. The average dairy consumption of the combined groups was 2.51 servings of dairy per day. The total dairy consumption in the acne group was slightly higher than that of the control, reaching statistical significance with a P value of .02. There were no statistically significant differences in the total amount of full-fat (P = .95) and reduced-fat (P = .36) dairy between the 2 groups. The total low-fat/fat-free dairy consumption also differed between the 2 groups with a P value of .03. In looking at milk specifically, the group with acne consumed 0.61 servings of low-fat/skim milk per day compared with 0.41 servings in the control group, with a P value of .01. There were no significant differences in the consumption of whole or reduced-fat milk between the 2 groups (P = .75 and .44, respectively). When low-fat/skim milk is removed from total dairy consumed, the difference between the acne and control groups loses statistical significance (P = .23, not shown in Table II).

Table I. Demographic information

Variables	All, N = 225	Acne, N = 120 53.3%	Control, N = 105 46.7%	*P* value
Age, y				.25
Mean (SD)	16.8 (1.4)	16.9 (1.5)	16.7 (1.4)	
Gender				.42
Male	105 (46.7%)	59 (49.2%)	46 (43.8%)	
Female	120 (53.3%)	61 (50.8%)	59 (56.2%)	
Race/ethnicity				.005
White	173 (76.9%)	102 (85%)	71 (67.6%)	
Black	15 (6.7%)	7 (5.8%)	8 (7.6%)	
Others	37 (16.4%)	11 (9.2%)	26 (24.8%)	
BMI				.13
Mean (SD)	23.2 (4.8)	22.8 (3.7)	23.8 (5.7)	

P values were obtained using 2-sample *t* test or χ^2 test when appropriate.
BMI, Body mass index.

Table III shows the mean values of glycemic index and glycemic load. Our study did not show any significant difference in the glycemic index or load between the 2 groups.

Table IV shows the mean values of macronutrients. Total energy in kilocalories did not differ significantly between groups (P = .12). Total intake of fat (P = .34), carbohydrates (P = .14), and protein (P = .08) was similar for all groups. Daily intake of saturated fat and trans-fat were not significantly different between the 2 groups. There was no significant difference in macronutrient composition: the percentage of calories from fat (P = .78), carbohydrates (P = .48), or protein (P = .10).

DISCUSSION

Our data supports previous research that an association exists between acne and skim milk consumption. We did not find an association between acne and consumption of full-fat milk, other dairy products, macronutrient composition, glycemic index, or glycemic load. Although there is statistical significance in P values for total dairy consumption and total low-fat/fat-free dairy consumption, the P values of these variables are reduced by the consumption of total low-fat/skim milk in the 2 groups, as low-fat/skim milk consumption is a component of both total dairy and total low-fat/fat-free dairy groups. Statistical differences are lost when low-fat/skim milk is removed from those groups.

The strengths of this project are its case-control design with demographically similar groups, dermatologist-assessed acne, use of validated software for data collection, large sample size, and control for age, gender, and body mass index. Telephone interviews have been shown to be as effective[13] or more effective[14] as in-person interviews for performing 24-hour diet recalls. The Nutrition Data System for Research uses a multipass method of data collection that was shown to accurately estimate nutrient intake[15] and proven to accurately calculate the Healthy Eating Index.[16]

Our study was limited by the case-control design; we are able to make associations but unable to determine causation. We relied on participant self-reporting of diet, but random timing of telephone interviews and use of the Nutrition Data System for Research multipass methodology helped to decrease inaccuracies. We also relied on participant estimation of serving sizes, but provided a handout on portion sizes to decrease errors in serving size estimation.

The role of diet in acne is a highly contentious topic that has dermatologists divided. In older studies, milk was shown to cause a disproportionate increase in insulin levels despite having a relatively low glycemic index, producing an insulinemic response 3 to 6 times higher than its corresponding glycemic index.[17] Milk also contains and induces endogenous increases in insulin-like growth factor-1. Proponents for the adverse role of milk and acne postulate that the spike in insulin promotes the phosphorylation of transcription factor Forkhead box protein O1 (FoxO1), activating the mammalian target of rapamycin complex 1 (mTORC1) receptor and causing stimulation of sebaceous glands.[18-20]

The role of dairy and its effects on overall health are complex. Many recent clinical studies examining the association between total dairy consumption and metabolic syndrome, insulin resistance, and even cardiovascular risk and stroke, found dairy consumption to be beneficial and protective, regardless of fat content.[21-24] Other studies found that participants consuming a diet higher in dairy fat actually had a lower risk of obesity[25,26] and cardiovascular disease.[27]

The data regarding acne support a positive association specifically for skim milk. All studies that differentiated the type of dairy consumed showed an association with skim milk, not full-fat milk,[7,8,28] prompting one group to conclude, "This finding suggests that skim milk contains hormonal constituents, or factors that influence endogenous hormones, in sufficient quantities to have biological effects in consumers."[9]

There are differences between full-fat and skim milk, including the overall composition of proteins, fatty acids, and cholesterol molecules.[29] Milk fat, although containing saturated fats, also contains numerous medium-chain fatty acids beneficial in promoting healthy metabolism and decreasing

Table II. Number of servings of dairy per day, mean (SD)

Variables Unit: no. of serving	All, N = 225	Acne, N = 120 53.3%	Control, N = 105 46.7%	*P* value
Total dairy	2.51 (1.66)	2.69 (1.92)	2.29 (1.29)	.02
Total full-fat dairy	0.73 (0.68)	0.75 (0.68)	0.71 (0.67)	.95
Total reduced-fat dairy	0.86 (1.07)	0.90 (1.15)	0.82 (0.98)	.36
Total low-fat/fat-free dairy	0.55 (0.84)	0.64 (0.93)	0.45 (0.72)	.03
Total full-fat milk	0.11 (0.28)	0.11 (0.29)	0.12 (0.26)	.75
Total reduced-fat milk	0.47 (0.89)	0.50 (1.00)	0.44 (0.75)	.44
Total low-fat/skim milk	0.52 (0.83)	0.61 (0.93)	0.41 (0.68)	.01

P values were calculated using repeated-measure linear mixed model to evaluate the relationship between outcome variable and acne group variable (acne vs control), while adjusting for gender, age, and body mass index.

Table III. Glycemic index and glycemic load, mean (SD)

Variables	All N = 225	Acne N = 120 (53.3%)	Control N = 105 (46.5%)	*P* value
Glycemic index—glucose reference	60.81 (4.92)	60.67 (5.09)	60.98 (4.73)	.70
Glycemic load—glucose reference	147.62 (63.77)	151.11 (73.37)	143.64 (50.69)	.18

P values were calculated using repeated-measure linear mixed model to evaluate the relationship between outcome variable and acne group variable (acne vs control), while adjusting for gender, age, and body mass index.

Table IV. Macronutrients and composition of diet, mean (SD)

Variables	All N = 225	Acne N = 120 (53.3%)	Control N = 105 (46.7%)	*P* value
Total energy, kcal	2014.07 (797.70)	2074.82 (941.41)	1944.65 (589.33)	.12
Total fat, g	75.62 (38.11)	77.80 (43.50)	73.13 (30.85)	.34
Saturated fat	27.81 (16.63)	28.76 (19.73)	26.72 (12.16)	.28
Trans-fat	2.74 (1.97)	2.70 (2.19)	2.78 (1.69)	.64
Total carbohydrates, g	257.23 (103.63)	264.24 (120.05)	249.22 (80.74)	.14
Total protein, g	81.82 (35.57)	85.36 (40.51)	77.78 (28.58)	.08
Calories from fat, %	32.54 (6.82)	32.66 (6.59)	32.41 (7.10)	.78
Calories from carbohydrates, %	50.67 (8.56)	50.13 (8.44)	51.29 (8.69)	.43
Calories from protein, %	16.78 (4.54)	17.21 (4.83)	16.28 (4.16)	.10

P values were calculated using repeated-measure linear mixed model to evaluate the relationship between outcome variable and acne group variable (acne vs control), while adjusting for gender, age, and body mass index.

insulin resistance. Dairy fat also contains bioactive branched chain fatty acids, conjugated linoleic acid and the monounsaturated fatty acids, oleic acid and trans-palmitoleic acid. All have been shown to benefit metabolic profiles.[30] In addition, dairy fat allows greater bioavailability and distribution of vitamins A and D, fat-soluble vitamins that are removed and then added back to skim milk.

Conclusions

Low-fat/skim milk consumption was positively associated with acne, whereas other types of milk and dairy products had no association. Glycemic index, glycemic load, total energy, and macronutrients showed no association with acne in this study. Further investigation, particularly studies showing the impact of skim milk elimination, are needed before making specific dietary recommendations for patients with acne.

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