

Original Article

Acne vulgaris and its association with dietary intake: a Malaysian perspective

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Background and Objectives: Acne vulgaris is a common skin condition among adolescents and young adults. Its relationship with the dietary intake is highly debatable and equivocal. This study aimed to identify the association between acne vulgaris and dietary intake among Malaysians. **Methods and Study Design:** A case-control study was conducted involving 57 acne vulgaris patients and 57 age-, gender- and ethnicity-matched controls. All participants were aged 14 and above. The Comprehensive Acne Severity Scale (CASS) was used to categorise patients (grades 2 to 5) and controls (grades 0 to 1). Information such as the demographics, family history, smoking habits and dietary intake were collected using a self-administered questionnaire. **Results:** In the patient arm, the gender ratio of male to female was 1.5:1. 43 patients (75.4%) had a family history of acne vulgaris. No significant association was found for acne in patients with a history of smoking. Milk consumption was significantly higher in patients (63.2%, n=36) versus controls (43.9%, n=25), (OR=2.19, $p<0.05$). In addition, chocolate consumption was also significantly higher in patients (43.9%, n=25) versus controls (24.6%, n=14), (OR=2.4, $p<0.05$). No significant association was found with the intakes of sweets, potatoes, chips, nuts, yoghurt, ice-cream or carbonated drinks. **Conclusions:** Dietary intake of milk and chocolate may play a role in acne vulgaris. Prospective cohort and intervention studies are recommended to explore whether a causal relationship might obtain.

Key Words: acne vulgaris, diet, dairy products, chocolate, comprehensive acne severity scale (CASS)

INTRODUCTION

Acne vulgaris can be defined as a chronic inflammatory disorder affecting the pilosebaceous units. This condition affects most individuals at some point of their lives, especially during adolescence.¹ 85% of adolescents, as well as two-thirds of adults aged 18 years and older are affected by acne vulgaris.² Acne vulgaris is the most common form of acne, characterised by various clinical presentations including comedones, papules, pustules, nodules, and cysts; with or without scarring.

The prevalence of facial acne vulgaris among Malaysian teenagers is 67.5%.³ A study conducted among adolescents in Muar reported that facial acne affects 71.1% of boys and 64.6% of girls.⁴ Acne prevalence rate among medical students of Universiti Kebangsaan Malaysia was found to be 68.1% (n=246); of which males and females were equally affected.⁵ Observational findings showed that the increased prevalence of acne resulted from the adaptation of a Western lifestyle, particularly their diet.⁶

In the past, the relationship between acne and dietary habits had been controversial. In the early 30's to 60's, one's diet were assumed to play a major role in acne pathogenesis.⁷ Studies by Fulton et al and Anderson et al in the 70's refuted the idea; there was no correlation found between the consumption of chocolates and the development of acne.⁸ Recently, the uncertainties about

acne and diet resurfaced. A review article concluded that refined carbohydrates and some dairy products can be associated with acne.⁷ This prompted researchers to investigate the role of dietary factors in the exacerbation of acne. In addition to that, there were very few studies on the consumption of sweets, chocolates, nuts and oily foods.⁹ The outcomes of these studies were often equivocal.³

A comprehensive knowledge and understanding about the association between daily diet and acne vulgaris are vital for acne management, as well as to educate the community for prevention and treatment.³ These will assist dermatologist in providing patients with well-substantiated dietary recommendations and to dispel any misconceptions and myths.¹⁰ Therefore, this study is aimed to determine the association between dietary variables and acne vulgaris among Malaysian population in

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Table 1. Comprehensive Acne Severity Scale (CASS)¹²

Grade	Description
Clear	0 No lesions to barely noticeable ones. Very few scattered comedones and papules.
Almost clear	1 Hardly visible from 2.5 metre away. A few scattered comedones, few small papules and very few pustules.
Mild	2 Easily recognisable; less than half of the affected area is involved. Many comedones, papules and pustules.
Moderate	3 More than half of the affected area is involved. Numerous comedones, papules and pustules.
Severe	4 Entire area is involved. Covered with comedones, numerous pustules and papules, a few nodules and cyst.
Very severe	5 Highly inflamed acne covering the affected area, with nodules and cyst present.

Pulau Pinang. It was hypothesized that diet plays a role in incidences of acne vulgaris in Malaysia.^{3,10,11}

METHODS

Study design

This is a case-control cross-sectional questionnaire study. It was calculated that 55 subjects were required to provide 80% power at a significant level of 5% in reference to Ismail et al study which was conducted in the Kuala Lumpur General Hospital.³ The dropout rate of 20% was taken into consideration. As such, 66 acne vulgaris patients being recruited as case and 66 participants as controls.

Study population

The study population consisted of citizens aged 14 and above and were seeking medical consultations at a private clinic in Georgetown, Pulau Pinang. The Comprehensive Acne Severity Scale (CASS) grading system was used to grade acne severity. Clinical assessments for identification of facial acne were conducted at a distance of 2.5 meters (Table 1). Cases were defined as patients with CASS grade of two to five.¹² Thereafter, controls were recruited and matched by age, gender and ethnicity. Controls had CASS grade 0 (clear) or 1 (almost clear).¹² Participants with chronic diseases such as diabetes mellitus and polycystic ovarian disease (PCOS) were excluded from this study. Participants who were on any form of medication for acne were also excluded.

Questionnaires

A self-administered questionnaire which was adopted from Halvorsen et al study; was used to collect information regarding the participants' dietary intake.¹³ Dichotomized responses were utilized to identify the frequency of food intake. The frequency for beverages such as milk and carbonated drinks were defined as "seldom" (none to one glass daily) versus "often" (two or more glasses daily). Meanwhile, the frequency for food such as chocolate, sweets, potato chips, nuts, ice cream and yogurt were defined as "seldom" (never to once a week) versus "often" (twice a week or more). Cigarette smoking habits were identified via trichotomized responses of "never", "quitted" or "currently smoking".

Ethical clearance

This study protocol was reviewed and granted ethical approval by the UCSI University Ethics Committee (Proj-FHMS-EC-2013-234). All participants were provided with a respondent information sheet detailing research objectives, methodology and use of data. Written in-

formed consent was obtained prior to their participation.

Data analysis

Data analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 20. The Shapiro-Wilk test was used to determine data normality. Categorical data were described as percentages; while continuous data were described as the mean and standard deviation. The associations between categorical variable were analyzed using the Pearson Chi-Square test. Continuous quantitative variables such as the dietary intakes were compared using independent samples t-test. Binary Logistic regressions were used to tabulate odds ratio. Statistical significance was determined at a *p*-value of less than 0.05 with 95% confidence intervals.

RESULTS

Demographic data

66 patients with acne vulgaris were recruited, out of which 9 patients were excluded during the initial screening due to coexisting medical conditions and/or was undergoing acne treatment. As such, 57 patients were recruited as cases and was matched with 57 controls; totaling 114 participants. Most patients were 14 to 20 years old (*n*=50, 87.7%); followed by 21 to 30 years old (*n*=3, 5.3%) and above 30 years old (*n*=4, 7%). There were more male patients (*n*=34; 59.6%) compared to female patients (*n*=23, 40.4%). The ethnicities of the participants were Malays (5.3%), Chinese (89.5%) and Indian (5.3%) for both the case and control groups. Participants of both the case and control groups were mostly single or divorced with 89.5% and 93% respectively. The majority (91.2%) of patients were students; followed by 7% employed personnel and 1.8% of housewives. Meanwhile, in the control group, 87.7% were students, 10.5% employed personnel and 1.8% housewives (Table 2).

Family history of acne vulgaris

The majority of patients (*n*=43, 75.4%) had at least one immediate family members with a history of acne vulgaris; which was more than the controls. Only 14 controls (24.6%) reported a family history of acne vulgaris. Most controls (*n*=27, 47.4%) showed no family history of acne vulgaris (Table 3). The family history of acne vulgaris was significantly (*p*<0.001) associated with incidences of acne.

History of cigarette smoking

Fifty-four (95.7%) patients were reported to be non-smokers/ex-smokers compared to 56 (98.2%) controls (Table 3).

Table 2. Socio demographic profile of case and control groups

Parameters	Cases (n=57) n (%)	Control (n=57) n (%)
Age		
14-20	50 (87.7)	50 (87.7)
20-30	3 (5.3)	3 (5.3)
Above 30	4 (7.0)	4 (7.0)
Gender		
Male	34 (59.6)	34 (59.6)
Female	23 (40.4)	23 (40.4)
Ethnicity		
Malay	3 (5.3)	3 (5.3)
Chinese	51 (89.5)	51 (89.5)
Indian	3 (5.3)	3 (5.3)
Marital status		
Single/Divorced	51 (89.5)	53 (93)
Married	6 (10.5)	4 (7)
Occupation		
Student	52 (91.2)	50 (87.7)
Employed	4 (7)	6 (10.5)
Housewife	1 (1.8)	1 (1.8)

Dietary products and acne

The frequency of chocolate and milk consumption demonstrated a prominent role in incidences of acne vulgaris. It increases the risk by nearly two and half times (OR=2.40, 95% CI=1.08-5.33) with a frequent consumption of chocolates. Patients consumed more chocolates (43.9%) and were significantly different ($p<0.05$) than controls (24.6%). Most patients reported the consumption of chocolates two to six times a week, and some at least once a day. Likewise, the consumption of milk was also significantly higher (OR=2.19, 95% CI=1.04-4.65, $p<0.05$) among patients (63.2%) compared to controls (43.9%). Patients whose consumption of milk was 2 or more glasses daily were found to have 2-fold of increased incidences of acne. There was no significant association between acne vulgaris and other dietary intakes such as sweet, potato chips, nuts, yogurt, ice cream and carbonated drink (Refer to Table 4).

DISCUSSION**Acne and family history**

Our findings were in accordance with Ismail et al, which showed patients often had a family history of acne vulgar-

is.³ It is further supported by a large-scale twin genetic modeling study; which was conducted in the United Kingdom. It was evident that 81% of acne variances were due to genetic factors; while unshared environmental factors made up the remaining 19%.¹⁴ The progression of acne vulgaris involves cytochrome P-450-1A1 and the gene for steroid 21-hydroxylase. The same author therefore argues for acne as to have an inherited predisposition, but not an inherited condition.² The genetic risk for acne was suggested to be a vertical transmission that is X-chromosome linked; thus, the mother is the key family member contributing to an elevated risk of moderate to severe acne.¹⁵

Acne and smoking history

In this study, no statistically significant association was established between the patients and controls in terms of their history of cigarette smoking. Our findings were in agreement with Firooz et al; whose study did not establish an association between acne and cigarette smoking either.¹⁶ The role of cigarette smoking in either improving or worsening acne remains debatable. An inverse relationship was earlier established that anti-inflammatory effects from smoking may inhibit the development of acne.^{16,17} In a separate study involving schoolgoing adolescents, it was suggested that anti-inflammatory effects of smoking may inhibit the progression of inflammatory facial acne, particularly in girls than boys.¹⁸ Nevertheless, smoking as acne management is not advisable due to the lack of evidence on its beneficial effects. Further studies in this area are considered to be unethical considering all other possible adverse health effects.¹⁷ On the whole, our data available does not allow us to draw any conclusion as most patients and controls were non-smokers.

Acne and chocolate

This study found a significant association between chocolate intake and acne incidence (OR=2.40, $p<0.05$, 95% CI=1.08-5.33). A similar association had been previously reported in Norway in a study involving 3375 late adolescents.¹³ However, Ismail et al reported contradictory findings.³ An association between chocolate consumption and acne incidences remains equivocal, despite the strong belief among adolescents that chocolates do exacerbate the condition. Ambiguity may relate to chocolate type background diet, pubertal development or peer group mythology. Chocolate ingredients, additives or preserva-

Table 3. Family history and smoking habit of case and control groups

Parameters	Cases (n=57) n (%)	Control (n=57) n (%)	p-value
Family history of acne vulgaris			
Nil	2 (3.5)	27 (47.4)	<0.001
1 family member	8 (14)	2 (3.5)	
2 or more family member	35 (61.4)	12 (21.1)	
Unsure	12 (21.1)	16 (28.1)	
Cigarette smoking			
Never/has quit	54 (94.7)	56 (98.2)	0.504
Sometimes	2 (3.5)	1 (1.8)	
Daily	1 (1.8)	0	

Table 4. Comparison of dietary variables intake frequencies between cases and control

Diet product	Frequencies	Cases (n=57) n (%)	Control (n=57) n (%)	p-value	OR	95% CI
Chocolate	Often	25 (43.9)	14 (24.6)	0.030	2.40	1.08-5.33
	Seldom	32 (56.1)	43 (75.4)			
Sweets	Often	8 (14)	8 (14)	1.00	1.00	0.348-2.88
	Seldom	49 (86)	49 (86)			
Potato chips	Often	9 (15.8)	8 (14.0)	0.793	1.15	0.409-3.22
	Seldom	48 (84.2)	49 (86)			
Nuts	Often	11 (19.3)	7 (12.3)	0.304	1.71	0.611-4.78
	Seldom	46 (80.7)	50 (87.7)			
Yogurt	Often	20 (35.1)	17 (29.8)	0.548	1.27	0.580-2.79
	Seldom	37 (64.9)	40 (70.2)			
Ice cream	Often	9 (15.8)	9 (15.8)	1.00	1.00	0.365-2.74
	Seldom	48 (84.2)	48 (84.2)			
Carbonated drink	Often	18 (31.6)	13 (22.8)	0.293	1.56	0.679-3.60
	Seldom	39 (68.4)	44 (77.2)			
Milk	Often	36 (63.2)	25 (43.9)	0.039	2.19	1.04-4.65
	Seldom	21 (36.8)	32 (56.1)			

tives should be taken into consideration. Chocolate candy contains many other ingredients besides the primary cacao solids, namely cocoa butter, sugar (sucrose), milk fat, non-fat milk solids and emulsifiers (lecithin). Each of these ingredients or its combination may be capable of eliciting and exacerbating acne.¹⁹ For instance, white chocolate had been reported to be more highly associated with the exacerbation of acne compared to pure dark chocolate.²⁰

Acne and dairy product

A significant association was found between the consumption of milk and the incidences of acne vulgaris (OR=2.19, $p<0.05$, 95% CI=1.04-4.65). Our findings were in agreement with a study conducted among Malaysian young adults.³ The acnegenic property of milk could be due to its hormonal, carbohydrate or protein content. Milk contains hormones that are of the reproductive, non-reproductive and growth functions which could influence acne progression individually or synergistically.²¹ Insulin-like growth factor I (IGF- I) had been shown to play a major role in acne progression by causing higher sebum production and promoting follicular keratinization. Hormones such as testosterone and androstenedione are naturally present in cow's milk and had been associated with an endogenous increase of IGF- I level.⁹ In addition, pilosebaceous units can also be affected by IGF- I, 5 α -reduced steroids and α -lactalbumin hormones in milk leftover from milk processing, hence producing more sebum.²² Also, IGF- I levels could be elevated in the human body upon consumption of dairy products such as milk, yogurt and cheese as their lactose content could trigger high insulin response.²³ Carbohydrate content of milk results in a glycemic and insulinemic response, causing acne progression, as it mimics the effect of a high-Glycemic Index/Glycemic Load diet. The major proteins in milk such as whey and casein also aggravate acne; casein increases IGF-1 concentrations while whey protein promotes hyperinsulinemia by stimulating secretion of beta cell insulin.²¹ Apart from that, milk also contains progesterone and dihydrotestosterone precursors resulting

in comedogenesis.²³ On the contrary, there has been no association reported for the consumption of yogurt and the incidences of acne. Yogurt is not seen to play a role in acne progression as the levels of IGF- I found in natural milk are reduced by probiotic bacteria during fermentation.²⁴ Recently, lactoferrin-enriched fermented milk has been reported to reduce skin surface lipid triglycerides, thereby lowering sebum production and resulting in acne improvement.²⁵

Acne and other dietary variables

No associations were found between the occurrence of acne vulgaris and the intake of sweets, potato chips, nuts, ice cream and carbonated drinks. Likewise, no significant differences were found for nuts and ice cream consumption with the progression of acne vulgaris in a study conducted by Ismail et al.³ On the contrary, the consumption of nuts and carbonated drinks was higher among patients in comparison to controls.²⁶ In addition to that, the consumption of nuts and potato chips increases the risk of developing acne.⁹ Bett et al reported that sugar intake among acne patients does not differ from controls.²⁷ Factors such as excessive salt, saturated and hydrogenated fatty acid intakes may aggravate acne progression. High sodium intakes might contribute to the formation of comedones while chloride excess could be involved in inflammation and pustule formation.⁹

Conclusion

This study showed that the development of acne vulgaris is influenced by a family history of acne vulgaris. The associations between acne vulgaris and the dietary intake of chocolates and milk support the hypothesis that dietary factors may influence the development of acne vulgaris. The main limitation of this study is the lack of detailed information regarding specific types of chocolate and milk consumed. Also, recall bias among our respondents was possible. In future studies, factors such as stress, sleep quality and facial hygiene should be considered. A multifaceted assessment which includes dietary patterns should help clinicians with acne vulgaris management.

AUTHOR DISCLOSURES

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REFERENCES

- Green J, Sinclair RD. Perceptions of acne vulgaris in final year medical student written examination answers. *Australasian Journal of Dermatology*. 2001;42:98-101. doi: 10.1046/j.1440-0960.2001.00489.x.
- Durai PCT, Nair DG. Acne vulgaris and quality of life among young adults in south India. *Indian Journal of Dermatology*. 2015;60:33-40. doi: 10.4103/0019-5154.147784.
- Ismail NH, Manaf ZA, Azizan NZ. High glycemic load diet, milk and ice cream consumption are related to acne vulgaris in Malaysian young adults: a case control study. *BMC Dermatology*. 2012;12:1-8. doi: 10.1186/1471-5945-12-13.
- Hanisah A, Omar K, Shah SA. Prevalence of acne and its impact on the quality of life in school-aged adolescents in Malaysia. *J Prim Health Care*. 2009;1:20-5.
- Muthupalaniappen L, Tan HC, Puah JW, Apipi M, Sohaimi AE, Mahat NF, Rafee NM. Acne prevalence, severity and risk factors among medical students in Malaysia. *Clin Ter*. 2014;165:187-92. doi: 10.7417/ct.2014.1731.
- Smith RN, Mann NJ, Braue A, Makelainen H, Varigos GA. A low-glycemic-load diet improves symptoms in acne vulgaris patients: a randomized controlled trial. *Am J Clin Nutr*. 2007;86:107-15.
- Mahmood SN, Bowe WP. Diet and acne update: carbohydrates emerge as the main culprit. *J Drugs Dermatol*. 2014;13:428-35.
- Bowe WP, Joshi SS, Shalita AR. Diet and acne. *J Am Acad Dermatol*. 2010;63:124-41. doi: 10.1016/j.jaad.2009.07.043.
- Veith WB, Silverberg NB. The association of acne vulgaris with diet. *Cutis*. 2011;88:84-91.
- Katta R, Desai SP. Diet and dermatology: the role of dietary intervention in skin disease. *J Clin Aesthet Dermatol*. 2014;7:46-51.
- Keri JE, Rosenblatt AE. The Role of Diet in acne and rosacea. *J Clin Aesthet Dermatol*. 2008;1:22-6.
- Tan JK, Tang J, Fung K, Gupta AK, Thomas DR, Sapra S et al. Development and validation of a comprehensive acne severity scale. *J Cutan Med Surg*. 2007;11:211-6. doi: 10.2310/7750.2007.00037.
- Halvorsen JA, Dalgard F, Thoresen M, Bjertness E, Lien L. Is the association between acne and mental distress influenced by diet? Results from a cross-sectional population study among 3775 late adolescents in Oslo, Norway. *BMC Public Health*. 2009;9:340-40. doi: 10.1186/1471-2458-9-340.
- Di Landro A, Cazzaniga S, Parazzini F, Ingordo V, Cusano F, Atzori L et al. Family history, body mass index, selected dietary factors, menstrual history, and risk of moderate to severe acne in adolescents and young adults. *J Am Acad Dermatol*. 2012;67:1129-35. doi: 10.1016/j.jaad.2012.02.018.
- Ghods SZ, Orawa H, Zouboulis CC. Prevalence, severity, and severity risk factors of acne in high school pupils: a community-based study. *J Invest Dermatol*. 2009;129:2136-41. doi: 10.1038/jid.2009.47.
- Firooz A, Sarhangnejad R, Davoudi SM, Nassiri-Kashani M. Acne and smoking: is there a relationship? *BMC Dermatol*. 2005;5:2. doi: 10.1186/1471-5945-5-2.
- Bhate K, Williams HC. Epidemiology of acne vulgaris. *Br J Dermatol*. 2013;168:474-85. doi: 10.1111/bjd.12149.
- Rombouts S, Nijsten T, Lambert J. Cigarette smoking and acne in adolescents: results from a cross-sectional study. *J Eur Acad Dermatol Venereol*. 2007;21:326-33. doi: 10.1111/j.1468-3083.2006.01915.x.
- Cordain L. Implications for the role of diet in acne. *Semin Cutan Med Surg*. 2005;24:84-91. doi: 10.1016/j.sder.2005.04.002.
- Dougan P, Rafikha N. Dark and white chocolate consumption and acne vulgaris: a case-control study. *Asian Journal of Clinical Nutrition*. 2014;6:35-40. doi: 10.3923/ajcn.2014.35.40.
- Burris J, Rietkerk W, Woolf K. Relationships of self-reported dietary factors and perceived acne severity in a cohort of New York young adults. *J Acad Nut Diet*. 2014;114:384-92. doi: 10.1016/j.jand.2013.11.010.
- Spencer EH, Ferdowsian HR, Barnard ND. Diet and acne: a review of the evidence. *Int J Dermatol*. 2009;48:339-47. doi: 10.1111/j.1365-4632.2009.04002.x.
- Costa A, Fidelis MC. Acne and chocolate: is there any evidence of their association? In: Watson RR, Preedy VR, Zibadi S, editors. *Chocolate in health and nutrition*. Totowa, NJ: Humana Press; 2013. pp. 517-23.
- Kang SH, Kim JU, Imm JY, Oh S, Kim SH. The effects of dairy processes and storage on insulin-like growth factor-I (IGF-I) content in milk and in model IGF-I-fortified dairy products. *J Dairy Sci*. 2006;89:402-9. doi: 10.3168/jds.S0022-0302(06)72104-X.
- Kim J, Ko Y, Park YK, Kim NI, Ha WK, Cho Y. Dietary effect of lactoferrin-enriched fermented milk on skin surface lipid and clinical improvement of acne vulgaris. *Nutrition*. 2010;26:902-9. doi: 10.1016/j.nut.2010.05.011.
- Kwon HH, Yoon JY, Hong JS, Jung JY, Park MS, Suh DH. Clinical and histological effect of a low glycaemic load diet in treatment of acne vulgaris in Korean patients: a randomized, controlled trial. *Acta Derm Venereol*. 2012;92:241-6. doi: 10.2340/00015555-1346.
- Bett DG, Morland J, Yudkin J. Sugar consumption in acne vulgaris and seborrhoeic dermatitis. *BMJ*. 1967;3:153-5.