

Update on Diet and Acne

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Acne is a common condition that most often affects adolescents but is not uncommon in adults. It can result in considerable anxiety, depression, and medical and pharmaceutical costs. Additionally, oral antibiotics, the standard treatment for acne, are increasingly under suspicion for causing bacterial resistance as well as disruption of the cutaneous and gut microbiomes.^{1,2} These factors are among those that often drive patients and physicians to search for alternative and complementary treatments, including dietary modification.

Over the last few decades, the interaction between diet and acne has been one of the most fluid areas of research in dermatology. The role of diet in acne incidence and presentation has evolved from the general view in the 1970s that there was no connection to today's more data-driven understanding that the acne disease course likely is modified by specific dietary components. Better designed and more rigorous studies have supported a link between acne severity and glycemic index (GI)/glycemic load (GL) and possibly dairy consumption. The ability to use data-driven evidence to counsel patients regarding dietary treatment of acne is increasingly important to counteract the pseudo advice that patients can easily find on the Internet.

This article summarizes the history of beliefs about diet and acne, reviews more recent published data regarding dietary components that can modify acne severity, and outlines the current American Academy of Dermatology (AAD) guidelines and recommendations for diet and acne.

History of Diet and Acne

In most of the current literature, acne frequently is referred to as a disease of modern civilization or a consequence of the typical Western diet.³ For clarity, the Western diet is most commonly described as "a dietary regimen characterized by high amounts of sugary desserts, refined grains, high protein, high-fat dairy products, and high-sugar drinks."⁴ The role of dairy in the etiology of acne typically is discussed separately from the Western

diet. It has been reported that acne is not found in non-westernized populations where a Paleolithic diet, which does not include consumption of high-GI carbohydrates, milk, or other dairy products, is common.⁵

Extending this line of argument, acne vulgaris has been called a metabolic syndrome of the sebaceous follicle and one of the mammalian target of rapamycin complex 1–driven diseases of civilization, along with cancer, obesity, and diabetes mellitus.³ This view seems somewhat extreme and discounts other drivers of acne incidence and severity. Twin studies have shown that acne is highly heritable, with 81% of the population variance attributed to genetic factors.⁶ Similar incidence numbers for acne vulgaris have been reported worldwide, and global incidence in late adolescence is rising; however, it is unknown whether this increase is a result of the adoption of the Western diet, which is thought to encourage early onset of puberty; genetic drift; changes in regional and cultural understanding and reporting of acne; or a byproduct of unknown environmental factors.⁴ More nuanced views acknowledge that acne is a multifactorial disease,⁷ and therefore genetic and possibly epigenetic factors as well as the cutaneous and gut microbiomes also must be taken into account. An interesting historical perspective on acne by Mahmood and Shipman⁸ outlined acne descriptions, diagnoses, topical treatments, and dietary advice going back to ancient Greek and Egyptian civilizations. They also cited recommendations from the 1930s that suggested avoiding "starchy foods, bread rolls, noodles, spaghetti, potatoes, oily nuts, chop suey, chow mein, and waffles" and listed the following foods as suitable to cure acne: "cooked and raw fruit, farina, rice, wheat, oatmeal, green vegetables, boiled or broiled meat and poultry, clear soup, vegetable soup, and an abundance of water."⁸

More Recent Evidence of Dietary Influence on Acne

Importantly, the available research does not demonstrate that diet causes acne but rather that it may influence or aggravate existing acne. Data collection for acne studies

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also can be confounded by the interplay of many factors, such as increased access to health care, socioeconomic status, and shifting cultural perceptions of skin care and beauty.⁴ An important facet of any therapeutic recommendation is that it should be supported by confirmable mechanistic pathways.

GI and GL—Over the last few decades, a number of observational and intervention studies have focused on the possible influence of the GI/GL of foods on acne incidence and/or severity. A high GI diet is characterized by a relatively high intake of carbohydrate-containing foods that are quickly digested and absorbed, increasing blood glucose and insulin concentrations. Glycemic load takes the portion size of dietary carbohydrates into consideration and therefore is a measure of both the quality and quantity of carbohydrate-containing foods.⁹ The GI/GL values of more than 2480 food items are available in the literature.¹⁰

Evidence from several studies supports the role of high GI/GL diets in exacerbating acne and suggests that transitioning to low GI/GL diets may lead to decreased lesion counts after 12 weeks.¹¹⁻¹³ In one randomized controlled trial, male participants aged 15 to 25 years with mild to moderate facial acne were instructed either to eat a high protein/low GI diet or a conventional high GL control diet.¹³ After 12 weeks, total lesion counts had decreased more in the low GI diet group than the control. As partial confirmation of a mechanistic pathway for a high GI diet and acne, the low GI group demonstrated lower free androgen index and insulin levels than the control group.¹³ In a Korean study, a 10-week low GL regimen led to a reduction in acne lesion count, a decrease in sebaceous gland size, decreased inflammation, and reduced expression of sterol regulatory element-binding protein 1 and IL-8.¹⁴

More recent studies have further solidified the role of high GI/GL diets in acne severity.^{9,15,16} High GI/GL diets are believed to stimulate acne pathways by stimulating insulinlike growth factor 1 (IGF-1), which induces proliferation of both keratinocytes and sebocytes and stimulates androgen production.¹⁷ An excellent diagram showing the connection between high GI diets (and dairy) and IGF-1, insulin and its receptors, androgen and its receptors, mammalian target of rapamycin, and the pilosebaceous unit was published in the literature in 2016.⁴ Interestingly, metformin has been shown to be an effective adjunctive therapy in the treatment of moderate to severe acne vulgaris.^{18,19}

Milk and Dairy Consumption—Milk consumption also has been examined for its potential role in the pathogenesis of acne, including its ability to increase insulin and IGF-1 levels and bind to the human IGF-1 receptor as well as the fact that it contains bovine IGF-1 and dihydrotestosterone precursors.²⁰ Although not studied quite as extensively or rigorously as GI/GL, consumption of milk and dairy products does appear to have the potential to exacerbate acne lesions. Beginning with a

series of retrospective and prospective epidemiologic studies published from 2005 to 2008,²¹⁻²³ a link between clinical acne and milk or dairy consumption in adolescent subjects was reported. A recent meta-analysis found a positive relationship between dairy, total milk, whole milk, low-fat milk, and skim milk consumption and acne occurrence but no significant association between yogurt/cheese consumption and acne development.²⁴

AAD Guidelines

In their public forum, the AAD has advised that a low-glycemic diet may reduce the number of lesions in acne patients and highlighted data from around the world that support the concept that a high-glycemic diet and dairy are correlated with acne severity. They stated that consumption of milk—whole, low fat, and skim—may be linked to an increase in acne breakouts but that no studies have found that products made from milk, such as yogurt or cheese, lead to more breakouts.²⁵

Other Considerations

Acne can be a serious quality-of-life issue with considerable psychological distress, physical morbidity, and social prejudice.⁹ Consequently, acne patients may be more willing to accept nonprofessional treatment advice, and there is no shortage of non-health care “experts” willing to provide an array of unfounded and fantastical advice.

Key Points for Dietary Counseling of Acne Patients

- Data-driven evidence supports a role for high GI/GL diets and dairy products (particularly whole, low-fat, and skim milk) as exacerbating factors for acne vulgaris; however, patients should be advised that dietary factors do not independently cause acne
- There is little evidence that chocolate without accompanying sugar or milk is a notable factor in acne development
- It should be noted that changes in acne due to any pharmaceutical treatment or dietary changes are likely to take at least 10 to 12 weeks
- Acne patients should be encouraged to discontinue any whey protein supplements they might be taking
- Nutrition counseling as a first-line or adjunctive therapy can be suggested for individuals with mild to moderate acne. Providers should discuss dietary changes for patients who are ingesting high GI foods and beverages. A low GL diet may not resolve the patient's acne but may have a positive effect on other health risk factors such as cardiovascular disease, diabetes, and some cancers

Abbreviations: GI, glycemic index; GL, glycemic load.

Dietary recommendations found online range from specific “miracle” foods to the more data-driven suggestions to “avoid dairy” or “eat low GI foods.” An important study recently published in *Cutis* concluded that most of the information found online regarding diet and acne is unfounded and/or misleading.²⁶ A quick perusal of results from a Google search conducted on May 28, 2019, using the terms *diet* and *acne* included claims such as “salty and oily foods cause acne,” as well as lists provided by so-called experts of “superfoods” that supposedly cure or fight acne, including coconut and olive oil, avocados, oranges, lemons, and kiwis. Problems can arise when this advice is taken seriously.

Two additional reasons for recommending that acne patients consider dietary modification are not directly related to the disease: (1) the general health benefits of a lower GI/GL diet, and (2) the potential for decreasing the use of antibiotics. Antibiotic resistance is a growing problem across medicine, and dermatologists prescribe more antibiotics per provider than any other specialty.¹⁷ Dietary modification, where appropriate, could provide an approach to limiting the use of antibiotics in acne.

Final Thoughts

When advising acne patients, dermatologists can refer to the Table for general guidelines that incorporate the most current data-driven information on the relationship between diet and acne. Dietary modification, of course, will not work for all but can be safely recommended in cases of mild to moderate acne.

REFERENCES

1. Barbieri JS, Bhate K, Hartnett KP, et al. Trends in oral antibiotic prescription in dermatology, 2008 to 2016 [published online January 16, 2019]. *JAMA Dermatol*. doi:10.1001/jamadermatol.2018.4944.
2. Barbieri JS, Spaccarelli N, Margolis DJ, et al. Approaches to limit systemic antibiotic use in acne: systemic alternatives, emerging topical therapies, dietary modification, and laser and light-based treatments. *J Am Acad Dermatol*. 2019;80:538-549.
3. Melnik BC. Acne vulgaris: the metabolic syndrome of the pilosebaceous follicle [published online September 8, 2017]. *Clin Dermatol*. 2018;36:29-40.
4. Lynn DD, Umari T, Dunnick CA, et al. The epidemiology of acne vulgaris in late adolescence. *Adolesc Health Med Ther*. 2016;7:13-25.
5. Cordain L, Lindeberg S, Hurtado M, et al. Acne vulgaris: a disease of Western civilization. *Arch Dermatol*. 2002;138:1584-1590.
6. Zaenglein AL, Pathy AL, Schlosser BJ, et al. Guidelines of care for the management of acne vulgaris [published online February 17, 2016]. *J Am Acad Dermatol*. 2016;74:945.e33-973.e33.
7. Rezaković S, Bukvić Mokos Z, Basta-Juzbašić A. Acne and diet: facts and controversies. *Acta Dermatovenerol Croat*. 2012;20:170-174.
8. Mahmood NF, Shipman AR. The age-old problem of acne. *Int J Womens Dermatol*. 2017;3:71-76.
9. Burris J, Shikany JM, Rietkerk W, et al. A low glycemic index and glycemic load diet decreases insulin-like growth factor-1 among adults with moderate and severe acne: a short-duration, 2-week randomized controlled trial. *J Acad Nutr Diet*. 2018;118:1874-1885.
10. Atkinson FS, Foster-Powell K, Brand-Miller JC. International tables of glycemic index and glycemic load values: 2008 [published online October 3, 2008]. *Diabetes Care*. 2008;31:2281-2283.
11. Smith RN, Braue A, Varigos GA, et al. The effect of a low glycemic load diet on acne vulgaris and the fatty acid composition of skin surface triglycerides. *J Dermatol Sci*. 2008;50:41-52.
12. Smith RN, Braue A, Varigos GA, et al. A low-glycemic-load diet improves symptoms in acne vulgaris patients: a randomized controlled trial. *Am J Clin Nutr*. 2007;86:107-115.
13. Smith RN, Mann NJ, Braue A, et al. The effect of a high-protein, low glycemic-load diet versus a conventional, high glycemic-load diet on biochemical parameters associated with acne vulgaris: a randomized, investigator-masked, controlled trial. *J Am Acad Dermatol*. 2007;57:247-256.
14. Kwon HH, Yoon JY, Hong JS, et al. 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;92:241-246.
15. Burris J, Rietkerk W, Woolf K. Differences in dietary glycemic load and hormones in New York City adults with no and moderate/severe acne. *J Acad Nutr Diet*. 2017;117:1375-1383.
16. Burris J, Rietkerk W, Woolf K. Relationships of self-reported dietary factors and perceived acne severity in a cohort of New York young adults [published online January 9, 2014]. *J Acad Nutr Diet*. 2014;114:384-392.
17. Barbieri JS, Bhate K, Hartnett KP, et al. Trends in oral antibiotic prescription in dermatology, 2008 to 2016 [published online January 16, 2019]. *JAMA Dermatol*. 2019. doi:10.1001/jamadermatol.2018.4944.
18. Lee JK, Smith AD. Metformin as an adjunct therapy for the treatment of moderate to severe acne vulgaris [published online November 15, 2017]. *Dermatol Online J*. 2017;23. pii:13030/qt53m2q13s.
19. Robinson S, Kwan Z, Tang MM. Metformin as an adjunct therapy for the treatment of moderate to severe acne vulgaris: a randomized open-labeled study [published online May 1, 2019]. *Dermatol Ther*. 2019. doi:10.1111/dth.12953.
20. Barbieri JS, Spaccarelli N, Margolis DJ, et al. Approaches to limit systemic antibiotic use in acne: systemic alternatives, emerging topical therapies, dietary modification, and laser and light-based treatments [published online October 5, 2018]. *J Am Acad Dermatol*. 2019;80:538-549.
21. Adebamowo CA, Spiegelman D, Berkey CS, et al. Milk consumption and acne in adolescent girls. *Dermatol Online J*. 2006;12:1.
22. Adebamowo CA, Spiegelman D, Berkey CS, et al. Milk consumption and acne in teenaged boys. *J Am Acad Dermatol*. 2008;58:787-793.
23. Adebamowo CA, Spiegelman D, Danby FW, et al. High school dietary dairy intake and teenage acne. *J Am Acad Dermatol*. 2005;52:207-214.
24. Aghasi M, Golzarand M, Shab-Bidar S, et al. Dairy intake and acne development: a meta-analysis of observational studies. *Clin Nutr*. 2019;38:1067-1075.
25. Can the right diet get rid of acne? American Academy of Dermatology website. <https://www.aad.org/public/diseases/acne-and-rosacea/can-the-right-diet-get-rid-of-acne>. Accessed June 13, 2019.
26. Khanna R, Shifrin N, Nektalova T, et al. Diet and dermatology: Google search results for acne, psoriasis, and eczema. *Cutis*. 2018;102:44-46, 48.