



The link between dietary habits and acne development and management in adolescents: A Literature Review

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Abstract

Acne vulgaris is one of the most common skin conditions among adolescents and is a health concern that affects both physical and mental health (Rygula et al., 2024; Łożyńska & Głąbska, 2022). Although genetics and hormones are implicated in its onset, a connection between dietary habits and acne also exists. Recent research shows that dietary habits such as high-glycemic foods, dairy, saturated fats, and processed foods are associated with inflammation, hormonal disturbances, and excess sebum production, which contribute to worsening acne symptoms (Rygula et al., 2024). Accordingly, adopting dietary habits such as consuming low-glycemic foods and foods high in nutrients such as omega-3 fatty acids and vitamin A has been found to improve acne management by reducing inflammation (Baldwin et al., 2020). As research continues to develop, evidence shows that diet can affect acne through the gut and skin microbiomes, which are involved with immune and inflammatory pathways that induce acne (Sánchez-Pellicer et al., 2022). This literature review will analyze and compare evidence from scholarly research papers that explore the influence of dietary habits on acne vulgaris, including its cause, severity, prevention, and treatment, with a focus on adolescents and the biological mechanisms that trigger these relationships. The purpose of this review is to provide readers with a better understanding of how nutrition can contribute to acne management and medical treatment, intending to help adolescents and healthcare professionals provide valuable information about improving dietary habits and skin health.

Literature Review

Physiological Mechanisms Mediating Skin Health and Dietary Habits

Acne vulgaris is a common skin condition caused by excessive sebum production, blocked hair follicles, bacterial growth, and inflammation (Rygula et al., 2024). Increased hormonal disturbances in insulin, insulin-like growth factor 1 (IGF-1), and androgen levels also contribute to its onset (Meixiong et al., 2022; Rygula et al., 2024). It is more common in adolescents during puberty, when hormonal shifts occur and levels of androgen and insulin tend to naturally increase, which causes excess sebum production (Chen et al., 2025). However, acne vulgaris can arise due to genetics, the environment in which one lives, and dietary habits (Meixiong et al., 2022).

Dietary habits have been found to influence acne through similar pathways (Baldwin et al., 2020). Foods with a high glycemic index, such as sugary foods and beverages and refined carbohydrates, cause blood glucose levels to increase and trigger insulin production (Baldwin et al., 2020). As insulin levels increase, so does the activity of IGF-1, a hormone linked to excess sebum production and inflammation, which contributes to the formation of acne (Baldwin et al., 2020). Dairy products, especially those that contain whey and casein proteins, can stimulate insulin hormone activity as well, increasing IGF-1 activity and potentially worsening acne (Baldwin et al., 2020).

Another biological mechanism that connects diet and acne is the gut-skin axis, which links digestive health with skin health through processes such as hormonal activity and inflammation (Sánchez-Pellicer et al., 2022). The gut microbiome consists of microorganisms, including bacteria and viruses, that have a large impact on digestion, inflammation, and the immune system (Sánchez-Pellicer et al., 2022). Similarly, the skin microbiome contains the microorganisms that live on the skin and protect against pathogens (Sánchez-Pellicer et al., 2022). Gut dysbiosis, which is an imbalance in the community of microorganisms living in the

gastrointestinal tract, often caused by poor dietary habits, is linked to increased acne (Sánchez-Pellicer et al., 2022). Skin bacteria can increase with such dietary habits, especially *Cutibacterium acnes*, a bacterium responsible for triggering innate immune cells to release cytokines such as TNF- α , IL-6, IL-8, and IL-12 that promote inflammation and also modulate sebum production (Dessinioti & Katsambas, 2024).

Overall, current research implies that dietary habits can influence hormone levels, inflammation, and the balance of gut and skin microorganisms. These biological mechanisms suggest that poor dietary habits can be associated with the development and severity of acne.

Dietary Habits Associated with Acne Development and Severity

Research has shown that certain dietary patterns can influence acne development and severity, worsening symptoms. (Ryguła et al., 2024). Although diet is not the only factor that can contribute to acne vulgaris development, there are many associations with specific foods and the biological processes involved with acne (Ryguła et al., 2024). The strongest evidence for these associations involves high-glycemic foods (which raise blood glucose levels), dairy products, and Western-style diets, which consist of red meat, refined sugars, and processed foods (Ryguła et al., 2024). These specific dietary habits are associated with inflammation, hormone stimulation, and changes in the gut and skin microbiomes (Ryguła et al., 2024).

Foods with a high glycemic index have the strongest evidence in association with acne severity (Ryguła et al., 2024). Examples of high-glycemic foods are refined carbohydrates, saturated fats, and sugary foods, which increase blood glucose levels rapidly (Ryguła et al., 2024). Rising blood glucose levels cause insulin to increase as well, which specifically increases the levels of the hormone IGF-1 (Ryguła et al., 2024). Elevated levels of insulin and IGF-1 stimulate the mTORC1 pathway, which promotes excess sebum production, sebaceous gland

and keratinocyte proliferation, leading to clogged pores and growth of *Cutibacterium acnes* (Ryguła et al., 2024). This inflammatory pathway increases the likelihood of acne development (Ryguła et al., 2024). Notably, having a low-glycemic diet is linked to fewer acne lesions (Baldwin et al., 2020). Low-glycemic diets can assist in preventive acne care, but additional treatment such as medication may be necessary, and further research is needed to support this connection (Baldwin et al., 2020).

Dairy products are also associated with acne, and research has shown that skim milk has the strongest association with acne risk (Meixiong et al., 2022). The association between dairy and acne seems to be stronger for skim milk than for other types of milk, implying that the relationship depends on the specific components of dairy products rather than dairy alone (Meixiong et al., 2022). Additionally, whey and casein proteins in milk are found to stimulate the release of insulin and increase IGF-1 activity, and thus induce the inflammation associated with acne onset (Baldwin et al., 2020). However, current research shows an association instead of proving that dairy directly causes acne (Meixiong et al., 2022).

Dietary patterns can influence acne beyond the effects of individual foods alone (Ryguła et al., 2024). Research has shown that entire diets, like the Western-style diet, which is high in processed foods, refined carbohydrates, fast food, sugary beverages, and saturated fats, and low in vegetables, fiber, and fruit, are associated with acne severity (Ryguła et al., 2024). A Western diet can contribute to acne through its high glycemic load, which contributes to insulin and IGF-1 release (Baldwin et al., 2020). Moreover, processed foods and saturated fats increase inflammation by activating the TLR2 pathway, which stimulates the release of cytokines (Baldwin et al., 2020). These cytokines promote keratinocyte proliferation and inflammation and contribute to acne formation (Baldwin et al., 2020). Dietary habits low in fiber and rich in

processed foods affect the composition of the gut microbiome, causing gut dysbiosis and stimulating inflammation (Sánchez-Pellicer et al., 2022). The inflammatory responses associated with the Western diet cause excess sebum production, bacterial growth, and further inflammation of existing acne lesions (Sánchez-Pellicer et al., 2022). A 2020 study investigating the effects of diet on acne development and treatment among individuals with acne vulgaris found that those with more traditional diets, such as Mediterranean and Paleolithic diets containing low glycemic loads and healthy fats, have lower rates of acne, while those adopting Western dietary patterns have higher rates of acne in comparison (Baldwin et al., 2020). Therefore, certain dietary habits that have specific nutritional properties may influence acne development and severity.

Dietary Habits Associated with Improved Acne Symptoms

While several dietary factors are associated with exacerbating acne severity, research also suggests that certain nutrients can help reduce acne severity by acting on the same biological pathways involved in acne formation (Ryguła et al., 2024). These foods can help reduce inflammation, regulate hormone activity, strengthen the skin barrier, and facilitate a healthy gut-skin microbiome (Ryguła et al., 2024).

Omega-3 fatty acids have the strongest evidence as a nutrient that improves acne because of their anti-inflammatory effects (Baldwin et al., 2020). Higher amounts of this nutrient can be found in foods such as fatty fish like salmon, mackerel, and tuna (Ryguła et al., 2024; NIH Office of Dietary Supplements, 2024). The omega-3 fatty acid found in fish is known as eicosapentaenoic acid (EPA), which regulates the mTORC1 pathway and insulin levels (Ryguła et al., 2024). In doing so, inflammation is reduced, and excess sebum production and blocked pores are less likely to occur (Baldwin et al., 2020).

Probiotics, which are generally found in fermented foods such as yogurt, are also associated with fostering and balancing healthy bacteria and supporting the gut microbiome (Sánchez-Pellicer et al., 2022). Evidence has shown that probiotics can produce antimicrobial bacteria that prevent the growth of the proacnegenic bacterium *Cutibacterium acnes* (Sánchez-Pellicer et al., 2022). Bacteria that probiotics produce, such as *Streptococcus salivarius* K12 and *Lactobacillus paracasei* CNCM I-2116, are associated with anti-inflammatory responses and promotion of a healthier skin barrier (Sánchez-Pellicer et al., 2022). The mineral zinc has also been of interest in acne therapy because of its association with reduced severity of acne lesions (in comparison with no zinc therapy) (Baldwin et al., 2020). With such evidence, researchers suggest that probiotics or zinc could be utilized in the clinical management of acne treatment, although more definitive evidence and associations are needed (Sánchez-Pellicer et al., 2022).

Furthermore, specific dietary patterns are linked to reducing acne severity (Baldwin et al., 2020). A low-glycemic diet, which consists of whole grains, vegetables, fruits, and other non-processed foods, has the strongest evidence in association with improving acne (Baldwin et al., 2020). A 2020 study investigating the effects of diet on acne found that a low-glycemic diet reduces androgen hormone activity and decreases IGF-1 levels, which reduces the amount and severity of acne lesions (Baldwin et al., 2020). Low-glycemic diets are one of the most supported methods for diet-based acne interventions, given the many studies and strong evidence linked to their improvement of acne (Baldwin et al., 2020). Altogether, the evidence presented suggests that dietary habits containing low-glycemic foods may influence pathways involved with acne positively, which can be valuable insight for acne treatment.

Conclusion

Although dietary patterns are not the sole treatment for acne or a complete prevention, data suggest that dietary habits rich in healthy fats, probiotics, and low-glycemic foods can help reduce inflammation along proacnegenic pathways. Adopting these dietary patterns can contribute to a healthier gut-skin microbiome. In contrast, diets high in glycemic load, dairy products, and Western-style patterns may increase insulin and IGF-1 levels and activity, promoting inflammation and stimulating proacnegenic pathways. The findings discussed in this review demonstrate potential connections between diet and acne rooted in hormones and endocrine-related pathways, like mTORC1.

These findings may be useful for healthcare professionals and adolescents when discussing acne management, preventative care, and treatment. Here, professionals may augment their care plan to include dietary pattern changes alongside treatment in order to benefit acne management outcomes. Adolescent patients may benefit from these findings by gaining a better understanding of how certain dietary choices can affect the processes in their bodies involved in acne. From there, they can collaborate with their healthcare providers to make informed decisions about their skin health. To build on these findings, future research can investigate how specific dietary components and exactly how they influence, stimulate, or mitigate specific proacnegenic pathways within the human body, rather than just habits or diet groupings. Although more research is needed to comprehensively elucidate the connection between dietary habits and the extent to which they affect acne, diet presents as one of the many potential factors involved in the pathogenesis of acne vulgaris.

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