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## Does Diet Really Affect Acne?

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### ABSTRACT

*Acne vulgaris has anecdotally been attributed to diet by individuals affected by this skin condition. In a 2009 systematic literature review of 21 observational studies and 6 clinical trials, the association between acne and diet was evaluated. Observational studies, including 2 large controlled prospective trials, reported that cow's milk intake increased acne prevalence and severity. Furthermore, prospective studies, including randomized controlled trials, demonstrated a positive association between a high-glycemic-load diet, hormonal mediators, and acne risk. Based on these findings, there exists convincing data supporting the role of dairy products and high-glycemic-index foods in influencing hormonal and inflammatory factors, which can increase acne prevalence and severity. Studies have been inconclusive regarding the association between acne and other foods.*

**Key Words:** *acne, diet, milk, glycemic index, glycemic load, dairy products, hormonal factors*

More than 17 million Americans suffer from acne vulgaris.<sup>1</sup> Approximately 80-90% of all adolescents experience some degree of acne.<sup>2</sup> Adults are also affected. Acne has been associated with other clinically relevant issues, including depression.<sup>3</sup> While studies have demonstrated patients' perceptions about a link between diet and acne,<sup>3-7</sup> reviews published in or prior to 2005 have not shown a conclusive correlation.<sup>8-10</sup> In addition, methodological issues have limited conclusions that could be drawn from the literature before 2005. A 2009 review evaluated the published literature on the association between diet and acne risk and severity. Authors showed that dairy products and high-glycemic-index foods increased the risk for acne, whereas the studies did

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not conclusively demonstrate an association between acne and other foods, such as chocolate or salt.<sup>11</sup>

### Pathophysiology

Acne forms as a result of obstruction and inflammation of hair follicles and their accompanying sebaceous glands (pilosebaceous units). Acne can be inflammatory or noninflammatory and may involve colonization of the follicle with bacteria (most commonly *Propionibacterium acnes*). With increased hormonal activity, sebum production and blocking of follicles also increase; the latter leading to closed comedones (whiteheads) or open comedones (blackheads).

### Dairy Products

Migration studies have demonstrated that as populations shifted toward a more Westernized diet, either through relocation or a local cultural change, the prevalence of acne increased. This trend was observed in Canadian Inuit<sup>12</sup> who increased their consumption of soda, beef, dairy products, and processed foods, as well as among Okinawan Japanese<sup>13</sup> who decreased their starch intake and increased their total animal product intake.

Authors of a large case-control study<sup>14</sup> evaluated the association between milk and acne in the adolescent diets of more than 47,000 nurses. Among participants who had been diagnosed with severe acne as teenagers, those with the highest level of total milk intake (>3 servings per day) reported having acne more frequently, when compared with individuals with the lowest level of intake (≤1 serving per week). This association was strongest (a 44% increase) for skim milk intake, suggesting fat content was not the determining factor for acne risk. Researchers hypothesized that the hormones found in milk played a role in acne risk.

Two large prospective cohort studies examined the association between diet and acne among 9-15 year-old children, including 6094 girls<sup>15</sup> and 4273 boys.<sup>16</sup> For girls, there was a significant association with acne severity for all categories of cow's milk (total, whole, low-fat, skimmed, and chocolate). For boys, the association was significant for total and skimmed milk. Girls were approximately 20% more likely to experience severe acne if they consumed ≥2 servings of milk per day, when compared with girls who consumed ≤1 serving of milk per week. Boys were approximately 16% more likely to experience severe acne if they consumed ≥2 servings of milk per day, when compared with boys who consumed ≤1 serving of milk per week.

A study from 2005 showed that components of milk, other than lipids, have insulin-stimulating abilities.<sup>17</sup> Insulin drives insulin-like growth factor 1 (IGF-1), which in turn increases testosterone and decreases the production of sex hormone-binding globulin (SHBG). Another study observed a positive correlation between levels of IGF-1 and acne.<sup>18</sup>

### High-Glycemic-Index Foods

Authors of 2 large cross-sectional studies<sup>19</sup> in Papua New Guinea (n=1200) and Paraguay (n=115) found no cases of acne in



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either population. Researchers speculated that the rural populations' low-fat and low-glycemic-index diets could be the reason for the absence of acne in these groups.

Authors of a randomized controlled trial<sup>20</sup> examined the effect of low-glycemic-load diets on acne risk and insulin sensitivity. Individuals assigned to the low-glycemic-load diet experienced improvement in the mean number of acne lesions, when compared with the control group. In addition, the low-glycemic-load diet group's mean weight decreased, and insulin sensitivity and SHBG levels increased.<sup>21</sup> Increases in SHBG levels correlated with decreased lesion counts. As SHBG levels increase, free androgen levels would be expected to decrease accordingly. These investigative findings support the role of low-glycemic-load diets in influencing hormonal levels, as well as improving insulin sensitivity and acne.<sup>20-22</sup>

### Fat and Fatty Acid Intake

Although there have been no published, large, well-controlled studies that examine the effect of fat or fatty acid intake on acne risk, omega-6 fatty acids are pro-inflammatory and their pro-inflammatory mediators have been associated with acne.<sup>23</sup> By contrast, omega-3 fatty acids have anti-inflammatory properties<sup>24</sup> and may be associated with decreased risk of acne by decreasing IGF-1 levels and follicle inflammation. Typically, Western diets have a low ratio of omega-3 to omega-6 fatty acids, as compared with diets observed in non-industrialized nations.<sup>25</sup>

Additionally, diets high in saturated fats have been associated with increased IGF-1 levels, while diets that are low-fat and high in fiber have been linked with decreased IGF-1 levels.<sup>26</sup>

### Chocolate

In a crossover trial examining the effect of chocolate intake on acne, 65 participants consumed 112g of dairy-free cocoa-enriched bars of chocolate each day for 4 months. Researchers compared the results to the same group's consumption of chocolate bars without the cocoa enrichment and found no significant difference between the groups.<sup>27</sup> Similarly, other intervention trials showed no effect of chocolate on acne.<sup>28,29</sup> However, these trials had no control groups and the results were not quantified.

### Conclusion

Population-based and migration studies have suggested a correlation between diet and acne. Large, well-controlled, observational studies have demonstrated that diets high in dairy products are associated with an increase in the risk for and severity of acne. Researchers have found significant associations between all varieties of cow's milk and acne. The relationship between milk and acne severity may be explained by the presence in dairy of normal reproductive steroid hormones or the enhanced production of polypeptide hormones such as IGF-1, which can increase androgen exposure, and thus, acne risk. Recent findings also describe an association between a high-glycemic-index diet and longer acne duration. In addition, randomized clinical trials have



demonstrated that a low-glycemic-load diet can influence hormonal levels and improve insulin sensitivity and acne. No study has established a positive association between acne and chocolate, saturated fat, or salt intake.

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