with obesity now having reached epidemic proportions in the US, it is perhaps fair to say that we are a nation of overfed but nutritionally deprived people. The “quantity over quality” nature of the Western Diet has no doubt contributed to the rise of several chronic diseases, such as diabetes, cancer, and cardiovascular disease. In addition, these nutritional trends in the American diet may also affect skin health, with many studies in recent years particularly drawing a link between diet and acne.

Ahead, I will highlight some of the key studies on the links between food and acne. Specifically, I will focus on the top five dietary factors implicated in acne: carbohydrates, dairy, antioxidants, fish oil, and probiotics. I will then translate the growing knowledge concerning acne and diet to day-to-day clinical practice with practical tips for patients.

CARBOHYDRATES

Whereas fat-free diets were once a craze, carbohydrates have become the new enemy within the last few decades. As the discussion of carbs relates to acne, several studies have uncovered compelling links. In a 2002 cross-sectional study evaluating 1,200 subjects who were either Kitavan Islanders of Papua, New Guinea, or Ache hunter-gathers of Paraguay, no cases of acne were reported.\(^1\) One of the common threads linking these two societies is that they both adhered to a non-Westernized diet, meaning they consumed virtually no processed foods or refined sugars. In other words, their diet was a low glycemic load (LGL) diet. While there are a few different aspects of such a hunter-gatherer diet, the authors chose to focus on the LGL aspect of their diet.

- **Glycemic Index (GI)** = a relative comparison of the potential of various foods to increase blood glucose based on equal amounts of carbohydrates in the food
- **Glycemic Load** = calculated by multiplying the GI times the carbohydrate content/serving size

Examples of high GI foods include white bread, pretzels, dates, baked potato, chips, and cornflakes. Examples of low GI foods include multi-grain bread, barley, cherries, sweet potato, peanuts, and vegetables and beans.

Other studies have shown that a low GI diet can improve acne severity. In one 12-week randomized controlled trial, 23 males between the ages of 15 and 25 who adhered to a strict low GI diet had a significant improvement in acne severity in addition to significant reduction in weight, BMI, and free androgen index, as well as improved insulin sensitivity.\(^2\)

In a more recent study with a slightly older cohort, 32 Korean patients between the ages of 20 and 27 years ate a LGL diet for 10 weeks and also exhibited significant improvement in acne severity despite no change in weight and BMI. The authors took this study one step further by...
Evidence suggests that foods high in carbohydrates, such as white bread, pretzels, and potato chips, may exacerbate acne. These foods should therefore be avoided. On the other hand, low GI diets could potentially help control acne flares. Thus, it is important to counsel patients about the glycemic index.

Studies increasingly show that frequency of milk and ice-cream consumption is associated with an increased risk of acne. Some studies have also found that skim milk has a higher association with acne than non-skim milk. Milk proteins may be implicated.

Recent evidence suggests that ROS, free radicals, and oxidative stress play a role in the initiation of acne. One theory is that free radical damage to sebum, or “Lipid peroxidation,” appears to be a match that lights the inflammatory process in acne.

Data suggest that the relative intake of omega-6 to omega-3 polyunsaturated fatty acids appears to be an important modulator of inflammation. Eating foods rich with omega-3 fatty acids or taking fish oil supplements with 1,000-2000 mg/day of EPA might benefit both acne and mood.

Oral probiotics have been shown to regulate the release of inflammatory cytokines within the skin (specifically IL-1-a), and improve insulin sensitivity. Eating yogurt with “live cultures” or taking a daily probiotic supplement might have a positive influence on the skin and the mind.

Performing skin biopsies and found that the size of sebaceous glands was significantly reduced, while inflammatory cells and inflammatory cytokines such as IL-8 were also decreased.3

These data suggest that high glycemic index diets exacerbate acne while low GI diets could potentially help control acne flares. Thus, it is important to counsel patients about the glycemic index, specifically how food can increase blood glucose and insulin. Ingestion of high GI foods triggers a cascade of endocrine responses that may trigger acne through androgens, growth hormones, and cell signaling pathways. Patients should consider adding foods with a low GI (<55) to their diet and try to avoid those considered high GI (> 70) when possible.

**DAIRY**

Controversy has long swirled around the potential link between dairy products and acne. Within the last decade, several studies have helped to clarify this link further. In a 2005 study, researchers used data from the Nurses Health Study to conduct a retrospective study of 47,355 adult women who were asked to recall their high school diet.4 They were also asked to recall if they had “physician-diagnosed acne.” Results showed that acne was positively associated with reported quantity of milk ingestion, particularly skim milk. In fact, they found a 44 percent increased risk in those who drank two or more glasses of skim milk per day. The study was criticized for its retrospective design, so the authors set out to uphold these findings, this time using two prospective study designs.5,6 They found that in girls, acne was associated with total milk intake (whole milk, low-fat milk, and skim milk). In boys, acne was associated with intake of skim milk but not total milk consumption.

In a case control study, 88 Malaysian subjects between the ages of 18 and 30 kept a three-day food diary.7 While no association was found with cheese or yogurt, the frequency of milk and ice-cream consumption was associated with a four-fold increased risk of acne. Interestingly, acne cases also had a higher GL diet. These findings were echoed in an Italian case control study that also found a risk of acne increased with increased milk consumption.8

**Skim Milk.** The recent findings related to skim milk are particularly intriguing. One might hypothesize that skim milk has a higher GI than whole milk, and perhaps that’s why we see a stronger association between acne and skim milk. In fact, the GI of skim milk and full fat milk are not very different, and neither one is considered high. Milk ingestion results in unexpectedly high insulin levels, much greater than that predicted by its GI. However, the GI alone cannot account for such a physiological response. If it’s not the GI of skim milk that accounts for its strong relationship with acne, could it be the hormones in skim milk? Hormones may indeed play a role. In fact, milk is known to contain both T and DHT precursors. However, one would expect bovine hormones to be concentrated in the lipid fraction of milk, and of course full fat milk has...
more lipids than skim. Again, this doesn’t seem to account for the skim milk phenomenon.

Last, growth factors might also be at play. The ingestion of milk and skim milk in particular, is correlated with higher plasma insulin and IGF-1 levels.

A quart of skim milk will contain more milk protein than whole milk, but only marginally. Despite these low values, milk ingestion results in unexpectedly high plasma insulin levels. One relatively new insight into the association of dairy and acne is how whey protein and casein affect insulin and IGF-1, which are both implicated in the cascade leading to acne. Also worth noting is that bodybuilders and athletes on whey protein supplements tend to develop acne. Moreover, recent studies show that whey protein precipitates moderate to severe acne flares in teenaged athletes, and that incidence of acne vulgaris is increased among young adult users of protein calorie supplements. Thus, this is certainly an area that deserves more study. In light of these recent findings, the take-home message is that the mechanism behind this association of milk and acne is still not completely clear.

In terms of what to tell patients about dairy, I suggest informing them that although the mechanism remains unclear, milk proteins, hormones, and/or growth factors in dairy products might be the culprit. I then suggest that they try some dairy-free alternatives that also have a low GI such as almond, soy, or coconut milk. Most almond milks on the market are heavily fortified with calcium and vitamin D, so calcium fortification is not an issue when substituting dairy. Also, for those consuming a plant-based diet, tofu and leafy greens like kale can be excellent calcium sources.

**ANTIOXIDANTS**

Recent evidence suggests that ROS, free radicals, and oxidative stress play a role in the initiation of acne. In fact, cellular antioxidants such as superoxide dismutase (SOD), glutathione peroxidase (GSH-Px) and even antioxidant vitamins like A and E are lower in patients with acne. It appears as though the burden of oxidation in acne is significant.

When we think about the sequence of events of acne pathogenesis, we were classically taught that follicular plugging preceded *P. acnes* colonization, which subsequently resulted in inflammatory papules and pustules. Recent studies suggest that inflammation might come before the other events. In fact, the release of inflammatory mediators such as IL-1 is one of the earliest events to occur in the acne process.

One theory is that free radical damage to sebum, or “Lipid peroxidation,” appears to be a match that lights the inflammatory process in acne. Not surprisingly, some preliminary studies suggest a possible role for certain oral and topical antioxidants in the treatment of acne. These include stable vitamin C precursors, lycopene (found in tomatoes), and zinc and nicotinamide (nutrients that support antioxidant pathways).

When it comes to talking to patients about antioxidants, it’s important to point out that a number of bench studies and a few prelim studies in humans show encouraging results. However, it’s also important to note that no large-scale clinical trials have proven that antioxidants really change the course of acne.

**FISH OIL**

Fish oil has been purported to have positive health effects. For example, Omega-6 FAs are pro-inflammatory, while current omega 6:omega-3 intake ratio in North America is 20:1, the ideal ratio, and the ratio found is most hunter-gatherer societies, is closer to 2:1. Some studies have long shown that fish oil can impact acne. In one study published in 1961, adolescents consuming large amounts of fish were shown to be less likely to have acne. More recently, Korean patients with acne were shown to consume significantly less fish than controls. In addition, decreasing the Omega-6:Omega-3 ratio appears to decrease C-reactive protein levels, improve insulin sensitivity, and reduce testosterone levels.

In terms of talking to patients about the potential benefits of fish oil, I explain that the relative intake of omega-6 to omega-3 polyunsaturated fatty acids appears to be an important modulator of inflammation. Eating foods rich with omega-3 fatty acids or taking fish oil supplements with 1,000-2000 mg/day of EPA might benefit both acne and mood.

**PROBIOTICS**

In 2011, I published with Dr. Alan Logan on what we call the gut-brain-skin axis and the role of probiotics. In
Given what we have learned over the last decade, we now recognize that notion is incorrect. Diet does indeed might have a positive influence on the skin and the mind.

If we have patients with acne, I introduce the concept of the gut-brain-skin unifying theory indicating that intestinal microflora might influence the skin and the brain. Thus, eating yogurt with “live cultures” or taking a daily probiotic supplement might have a positive influence on the skin and the mind.”

Regarding what to tell patients about the role of probiotics in acne, I introduce the concept of the gut-brain-skin unifying theory indicating that intestinal microflora might influence the skin and the brain. Thus, eating yogurt with “live cultures” or taking a daily probiotic supplement might have a positive influence on the skin and the mind.

A COMPLICATED RELATIONSHIP

Just a few years ago most dermatology textbooks dismissed the idea that nutrition could impact the skin. Given what we have learned over the last decade, we now recognize that notion is incorrect. Diet does indeed impact the skin, but this relationship is complicated and deserves further study. Based on what we currently know, I do counsel patients that their diet might impact upon the condition of their skin. I encourage my patients to keep a food diary if they suspect that what they are eating or drinking is impacting their skin. I then spend time discussing possible dietary modifications based on the evidence available thus far. However, I spend just as much time emphasizing that any dietary modifications we make are only a small part of the treatment plan, and are meant to be used in conjunction with tried and true standard therapies for acne.