ATHLETES SEEKING A HEALTHY GUT FOR OPTIMAL PERFORMANCE

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Introduction

For over a century, cow's milk has been touted as a healthy part of a balanced diet. Celebrity athletes pose sporting milk mustaches. Chocolate milk is promoted as an exercise recovery beverage. And the idea that milk builds strong bones and muscles is best exemplified by the advertising campaign; "Milk does a body good." All very effective marketing, but is it good science?

When we look at the evidence, cow's milk has serious negative effects on general health and is an underlying factor in numerous chronic diseases. But the most alarming truth about dairy, as it relates to an athletic audience, is that dairy impedes athletic performance—and it all starts in the gut. Microbiome dysbiosis is a chronic issue whose genesis can be closely linked to a diet rich in dairy products. And it is no wonder, as 68% of the world's population is lactose intolerant, with lactose being one of the sugars found in dairy products. There is a much higher incidence of lactose intolerance among people of African, Latin, and Asian descent, as well as other non-white minorities. Lactose intolerance can exacerbate congestion, stomach cramping, bloating, constipation, diarrhea, and unwanted skin rashes; all symptoms that can seriously negatively affect a great training session or a peak performance.

The following look at dairy's effect on the gut is based on a growing body of independent, peer-reviewed evidence about the negative effects of dairy consumption.

The gastrointestinal tract harbors 100 trillion organisms from mouth to anus. Combined, these organisms are commonly referred to as the microbiome and make up the largest organ in the body—containing 100 times more genetics than our own eukaryotic cells. Most of these organisms reside in the colon where they are involved with innumerable biochemical reactions. Based on the food one consumes, these reactions can promote health or disease. That being said, nutrition plays an essential role in athletic performance. Generally, in sports performance, we want to maintain adequate nutrition, a healthy weight, optimal protein (including branched-chain amino acids), control of markers of disease, proper levels of carbohydrates to fuel high-performance exercise, and sufficient energy intake. We want to do this, all while not impairing exercise by feeling too bloated.

STATISTICALLY SPEAKING OUT OF THE 13,000 ATHLETES WHO COMPETE AT THE SUMMER AND WINTER OLYMPIC GAMES, ABOUT 8,840 OF THEM WOULD HAVE VARYING DEGREES OF GASTROINTESTINAL PROBLEMS DURING THEIR TRAINING AND EVEN WHILE COMPETING FOR A MEDAL IF THEY CONSUME DAIRY.

Unfortunately, dietary recommendations for elite athletes are primarily based on a high-protein, low-fiber diet, which is associated with reduced microbiota diversity and functionality[1] (e.g., less synthesis of by-products such as short-chain fatty acids which play a pivotal role in skeletal muscle function). Since many elite athletes suffer from gastrointestinal conditions,[2] coaches should focus on making recommendations that meet the criteria at the macronutrient level, but also contribute to healthy digestion and microbiome diversity. As a gastroenterologist who specializes in gut health and fitness, I'm always surprised to see athletes who consume foods that may diminish their performance. The dairy industry heavily advertises cow's milk as the beverage of choice for athletes, but many coaches who promote chocolate milk and whey protein never review the actual science. Here is what the science has taught us.

Lactose Causes GI Upset and Fatigue

Lactose (milk sugar) is the main source of carbohydrates in breast milk (of any species) and is suited for infants who are uniquely adapted to lactose-based nutrition. Cow's milk contains approximately 12.5 g lactose in a typical serving size of 250mL (or one cup).[3] Digestion and absorption of lactose takes place in the small intestine by an enzyme along the brush border of villi in the small bowel, called lactase.[4] Diminished expression of this enzyme is common and known as lactase deficiency.[5] When a person who is lactase deficient consumes lactose, it will lead to lactose malabsorption which manifests as abdominal pain, bloating, constipation, or diarrhea.[4,5] The activity of lactase in the small intestine reaches a peak at the time of birth but is reduced in most populations during early childhood. The undigested lactose in the small intestine leads to trapping of water in the colon, causing significant diarrhea.[6]

Worldwide, most individuals have lactose intolerance.[4] A recent meta-analysis estimated the prevalence of lactose malabsorption worldwide at 68%.[7] Therefore, if they consume dairy, then statistically speaking out of the 13,000 athletes who compete at the Summer and Winter Olympic Games, about 8,840 of them would have varying degrees of gastrointestinal problems during their training and even while competing for a medal.

Many individuals develop symptoms of intolerance rather than malabsorption. These symptoms may include abdominal pain, borborygmi (rumbling tummy), and significant gas and bloating after lactose intake. The onset of these symptoms is strongly correlated to the appearance of hydrogen gas during breath tests which is seen in a condition called small intestinal bacterial overgrowth (SIBO) and IBS. So perhaps drinking cow's milk could be involved in the overgrowth of small intestinal bacteria seen in SIBO. Products of lactose fermentation by the colonic organisms may also trigger fatigue and neurological symptoms. A recent review of results from over 2,000 patients reported a high frequency of neurological symptoms such as tiredness and headache after lactose ingestion,[8] posing a significant problem for athletes in the face of completing or winning a competition.

Lactose Intolerance May Lead to Microbiome Dysbiosis and Irritable Bowel Syndrome

Undigested lactose travels through the gastrointestinal tract and is fermented in the colon, producing carbon dioxide, hydrogen gas, and methane by gas-producing microbes. However, does it lead to dysbiosis (a microbial imbalance) and/or irritable bowel syndrome?

The relationship of lactose intolerance and irritable bowel syndrome has been extensively studied in a South Chinese population with near 100 percent lactose intolerance based on genetic testing. A double-blind,

randomized, cross-over comparison of lactose tolerance at 10, 20, and 40g lactose was performed in IBS patients with diarrhea (IBS-D) and healthy controls. This study demonstrated a very strong correlation between the appearance of hydrogen gas in the breath and reports of bloating, pain, and other symptoms in patients with lactose intolerance. Symptoms of intestinal gas production were increased in patients with IBS-D.[9] Further research has demonstrated that pain of the inner organs and high levels of gas production on breath tests all increased the severity of abdominal symptoms after ingestion of 20g lactose,[10] an amount that may be found in about one and a half servings of milk.

Moreover, biopsies from the small intestine and colon have shown increased numbers of inflammatory cells in lactose-sensitive patients. The type of inflammatory cells shown to increase include mast cells (increase in response to allergies) and lymphocytes (white cells in response to infection and inflammation) in lactose-sensitive patients. Furthermore, studies have shown that lactose ingestion spurs the release of substances known as inflammatory cytokines, which are triggered by inflammation and used to recruit other inflammatory white cells.[11] The cause of irritable bowel syndrome remains elusive, but dairy products should be considered as a potential underlying promoter of IBS.

Implications for Athletes

As far as athletes are concerned, drinking cow's milk may create several problems:

1. Cow's milk consumption could cause a vicious cycle of inflammation, which could interfere with athletic performance.
2. Athletes who use cow's milk as a sports nutrition beverage risk abdominal discomfort, bloating/distension, gas, diarrhea, and/or constipation.
3. Athletes commonly report symptoms consistent with IBS[12] and dairy consumption can worsen such symptoms.[9,10]

Excessive Intake of Sulfate-producing Foods Can Potentially Damage the Gut

Significant amounts of sulfur-containing amino acids are found in cow's milk and cheese.[13] Consumption of large amounts of these foods may significantly increase sulfide production in the colon by the colonic bacteria.[14] Most of the bacteria live inside the colon in a symbiotic relationship with us humans as the host. Sulfate-producing bacteria are members of the normal colonic flora and they ferment the amino acids from dairy to produce hydrogen sulfide, which is toxic to human cells.[15]

Research found the elimination of milk and cheese from the diet of sufferers of ulcerative colitis (an inflammatory bowel disease which manifests as ulcers in the colon) results in substantial therapeutic benefit, suggesting that reducing the intake of sulfur-containing amino acids decreases colonic production of sulfide.[16] Indeed, sulfur-containing foods were positively associated with ulcerative colitis relapse in a 2015 review.[17]

A High-protein Beverage is Not Necessarily Healthy

Drinking milk for protein (or calcium) is like drinking soda for potassium. The studies show that athletes need to consume about 1.2 to 2.0 grams of protein per kilogram of lean body weight per day.[18-20] This is important regarding muscle regeneration and recovery. However, in excess, protein may cause harm. When a person eats more dietary protein than they are able to digest, some of it may escape digestion in the small bowel and enter the colon largely intact, where it is fermented by the colonic microflora. The resulting end products include branched-chain fatty acids (e.g., isovalerate, isobutyrate, and 2-methylbutyrate) and potentially harmful metabolites (ammonia, amines, phenols, sulfide, and indoles).[21-23] Ammonia reduces the lifespan of intestinal cells and is considered to be toxic to healthy cells—potentially promoting cancer growth.[24] The production of these toxic compounds is directly related to dietary protein intake,[24] a reduction of which can decrease the production of harmful by-products. In comparison to diets high in overall protein, diets high in animal protein have specific effects on intestinal microflora.[25-27] Ingestion of large amounts of animal protein does increase the activity of certain bacterial enzymes, which may result in increased release of potentially toxic metabolites in the bowel.[28]

The Fatigued Athlete

Fatigue management in an athlete's training is important for performance because adequate recovery allows athletes to train harder and more vigorously while avoiding injuries, and it all starts in the gut. Most coaches design their athletes' nutrition around how quickly they can recover, because effective nutrition and hydration are key strategies for optimizing recovery. The gastrointestinal tract plays an important role in the absorption of nutrients, but the normal absorptive capacity of healthy nutrients could be interrupted which negates their health benefits.

Research has shown that drinks such as beetroot juice—which is a rich source of antioxidants and high in nitrates—can improve athletic performance.[29] Nitrate is a chemical naturally occurring in certain foods, which our bodies convert to nitric oxide. Nitric oxide is a potent molecule that increases blood flow, improves lung function, and strengthens muscle contraction. Furthermore, beetroot juice aids in recovery by preserving muscle function and improving cardiorespiratory fitness.[29] In addition to its nitrates, beetroot contains antioxidants which may further benefit recovery by reducing oxidative stress and inflammation.[30]

There are other types of antioxidants including vitamin C, vitamin E, and beta-carotene—which like polyphenols[31] help repair cellular damage.[32] Polyphenols (of which 8,000 have been identified) are a class of phytonutrients that are found only in plant-based foods. Consumption of these foods is key in improving and expediting recovery in athletes.

On the other hand, studies have shown that cow's milk reduces the health benefits of antioxidant-rich foods by reducing the absorption of polyphenols and blocking the antioxidant effects.[33-35] In a study of cocoa and milk, the addition of milk reduced the antioxidant capacity of cocoa products by 30%.[35]

In another study where researchers tested antioxidant activity of blueberries in association with milk, when milk and blueberries were ingested together, there was a reduction in the antioxidant properties of blueberries and reduced nutrient absorption.[34] Research finds that the alpha-casein protein in milk binds to antioxidants and prevents their absorption.[35]

In conclusion, when it comes to optimizing nutrition for athletes, a milk beverage may have to take the back seat in favor of nutritious, antioxidant-rich food and drinks which can facilitate faster recovery.

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