



## “Dairy-Free” Dietary Substitute, Abdominal Pain, and Weight Loss

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### Abstract

**Introduction:** Patients are showing increased awareness of the need to choose healthier foods to promote health. In efforts to reduce saturated fat intake, minimize ingestion of potential toxins added to animal diets, and/or avoid lactose, many individuals are selecting organic “dairy-free” foods. Additives to these milk product substitutes may pose other risks.

**Case:** A 62 year-old Caucasian female experienced cramping abdominal pain of two months’ duration associated with 12 pound unintentional weight loss. Laboratory workup, computed tomography scan of abdomen and pelvis and colonoscopy revealed no etiology. Elimination of carrageenan-containing almond milk from her diet which she had substituted for cow’s milk several months prior resulted in stabilization of weight and resolution of symptoms.

**Conclusion:** Certain food substitutions for dairy products may expose patients to additives like carrageenan, for which there is early evidence of its contribution to gastrointestinal disturbances. Considering an etiology for gastrointestinal symptoms brought on by dietary additives in the diagnostic differential gives the practitioner avenues to pursue prior to ordering expensive testing and treatments.

### Keywords

Abdominal pain, Weight loss, Decreased appetite, Bloating, Carrageenan, Food additives, Dairy-free, Almond milk

### Introduction

Abdominal pain, cramps, and spasms are common complaints in emergency and primary care outpatient office visit settings [1,2]. In as many as half the cases, the etiology of the pain is not discovered [3,4], suggesting that causes for abdominal pain are missing from the current list of differential diagnoses. Unintentional weight loss associated with abdominal pain also warrants investigation, usually with costly endoscopic procedures and abdominal/pelvic computed tomography (CT) studies. Discomfort and anxiety may cause significant social impact resulting in missed work and reduced quality of life. Increased awareness of food sensitivities has led to more frequent diagnoses of lactose intolerance and celiac disease. The effects of other dietary elements that cause gastrointestinal irritation are infrequently reported. In the list of digestive diseases

associated with abdominal pain in the National Digestive Diseases Information Clearinghouse (NDDIC), lactose intolerance and gluten sensitivity are the only dietary etiologies that are acknowledged [5]. The differential diagnosis of diffuse abdominal pain includes mesenteric ischemia, ruptured aneurysm, peritonitis, and intestinal obstruction, most of which present as acute, rather than chronic pain. The differential for abdominal pain for patient categories such as “older adults”, “rare causes”, and even “other”, do not reference a dietary etiology for abdominal pain except for lactose intolerance [6]. In addition, individuals with unexplained abdominal pain may be treated for irritable bowel syndrome, the cause of which remains unknown, resulting in symptomatic non-curative treatment with medications such as antispasmodics or probiotics to alter flora composition.

Another dietary cause of gastrointestinal symptoms may be related to ingredients other than gluten or lactose. The increasing substitution of dairy-free milk for dairy milk exposes patients to dairy-free products that contain additives to which individuals may be sensitive. For example, some brands of dairy-free milks contain an added thickener called carrageenan, a seaweed extract. According to a 2014 review of *in vivo* safety studies, carrageenan lacked carcinogenic, tumor promoter, genotoxic, developmental or reproductive effects in animals [7]. However, the same review reported that carrageenan can cause soft stools and diarrhea. Other reports have suggested that carrageenan is not without potential toxicity. A 2001 review describes how carrageenan ingestion has been associated with gastrointestinal inflammation in animal studies. Oral intake of carrageenan in concentrations ranging from 0.1-5% caused gastrointestinal pathology including microscopic inflammation, ulcerations and even neoplasms (depending on the concentration and duration of exposure) in the intestines of rats, guinea pigs, monkeys and others [8]. A 2007 study found that carrageenan contributes to inflammation of the gastrointestinal tract by upregulating the production of Interleukin-8 (IL-8) in human intestinal epithelial cells. IL-8 is an inflammatory cytokine that is made after activation of an intracellular signaling cascade that involves Bcl-10 activation and NF- $\kappa$ B nuclear translocation [9]. A double-blind placebo study of a single individual established that a patient experienced carrageenan-induced anaphylaxis from a barium enema. The same individual reported cessation of chronic nausea, vomiting, bloating, and diarrhea after exclusion of foods with carrageenan [10].

## Case

A 62 year-old Caucasian female experienced cramping abdominal pain of two months' duration associated with 12-pound unintentional weight loss. The pain was 7/10 in intensity and worse after eating. The patient denied any associated vomiting, diarrhea, constipation, melena, fever, chills or change in bowels. She complained of bloating, intermittent nausea and loss of appetite. Past medical history was significant for allergy to penicillin and latex, allergic rhinitis, osteopenia, and spinal stenosis. The patient had tried over the counter remedies of 14 days of omeprazole and bismuth subsalicylate with no relief. When the treatment regimen brought no improvement, she presented to her physician.

The patient denied any history of lactose or gluten intolerance. Upon further questioning about her diet and weight loss, she admitted to having recently made "healthier" food choices. Coincident to the time of symptom onset in the previous two months, she had made daily substitutions of olive oil for butter and almond milk [11] for cow's milk. Physical exam was normal except for diffuse abdominal tenderness with no rebound or guarding to deep palpation. Workup included a normal CT of abdomen and pelvis and normal colonoscopy. A lipid panel (Total cholesterol 176 mg/dL, HDL 85 mg/dL, LDL 76 mg/dL), complete blood count (WBC 5.5 thousand/uL, Hemoglobin 14.1 g/dL, Hematocrit 42%, platelets 176,000, normal differential), renal function (glomerular filtration rate 75ml/min/1.73m<sup>2</sup>) and liver enzymes (alkaline phosphatase 108 U/L, AST 18 U/L, ALT 16 U/L) were within normal limits.

After discussion of diet with her physician, the patient stopped drinking almond milk. Over the next several months, she noticed steady improvement.

The ingredients in the almond milk product [11] she had been consuming were listed as: almond milk (filtered water, almonds), calcium carbonate, natural vanilla flavor with other natural flavors, sea salt, potassium citrate, carrageenan, sunflower lecithin, vitamin A palmitate, vitamin D2 and D-alpha-tocopherol (natural Vitamin E). She had previously consumed on a nearly daily basis, without problem, breakfast cereals and dairy products containing vitamin A palmitate. She had also consumed on a nearly daily basis, without problem, fortified pasteurized milk to which Vitamin D2 is commonly added. She had never experienced problems with frequently-used vegetable oils to which D-alpha-tocopherol is a common additive. Problems with lecithin are most often encountered as allergies to the product from which the lecithin is derived (commonly soy or sunflower). The patient consumed sunflower seeds regularly without problem. The patient denied any problems with the occasional ingestion of almonds or soy products.

After eliminating almond milk [11] from her diet, but not excluding almonds, soy and sunflower seeds or foods containing the other additives, her weight stabilized and pain symptoms resolved. Notably, she was able to consume other brands of almond milk not containing carrageenan with no symptoms. She also checked the ingredients of labeled foods and common carrageenan-containing products, such as yogurt, ice cream, and creamers to ensure there were no other sources of the additive in her diet. The cause of her weight loss and abdominal pain was presumed to be due to sensitivity to carrageenan. The patient was not willing to do a food challenge with almond milk or carrageenan-containing food to establish a stronger link to carrageenan as the cause. Based on her diet history and the improbability that other ingredients in the almond milk were the cause of gastrointestinal toxicity, her clinical improvement was attributed to avoidance of carrageenan. The patient did eliminate all foods labelled as containing carrageenan from her diet.

Of interest also is that the authors received reports from two other patients who were experiencing unexplained gastrointestinal symptoms. In both individuals, cessation of carrageenan-containing coffee creamer in their diet resolved gastrointestinal symptoms.

## Discussion

Both practitioner and population awareness of how food sensitivities may affect overall health is evident by the increased availability of products that are gluten-free and/or dairy-free. Of note, consumption of dairy-free milks, such as almond milk, soy milk, and coconut milk has increased dramatically in recent years [12]. This substitution of dairy-free milks for cow's milk may be occurring for multiple health-related reasons: the high prevalence of lactose intolerance, less saturated fat content in dairy-free milks, and growing concern about the presence of hormones, pesticides or antibiotics in cow's milk.

In the case reported here, the patient decided to make a "healthy choice" by selecting almond milk over cow's milk for regular ingestion. When her onset of symptoms was found to be correlated with the timing of ingestion of almond milk, the patient's dietary intake of all of the additives included in the brand of almond milk she was consuming were explored. The authors were able to elicit a history of dietary tolerance to calcium carbonate, natural vanilla flavor, sea salt, potassium citrate, sunflower lecithin, vitamin A palmitate, vitamin D2 and D-alpha-tocopherol (natural Vitamin E). Lack of sensitivity to "other natural flavors" (which can include up to 50 to 100 unspecified ingredients) was more difficult to substantiate. In fact, "natural flavor" is listed in more than a fifth of the roster of 80,000 foods included in database of the Environmental Working Group's Food Scores [13]. However, the very ubiquity of "natural flavors" in foods, including many food products ingested by the patient, made "natural flavors" less likely to be the cause of this patient's symptoms. Also, the fact that the patient's symptoms resolved on a diet that included foods that had "natural flavors" but eliminated the brand of almond milk containing carrageenan as well as all carrageenan-containing food products, supports the conclusion that carrageenan was the likely cause of her symptoms.

## Conclusion

Many individuals are increasingly selecting "dairy-free" foods as "healthier" food choices. However, certain substitutions may expose patients to additives like carrageenan, for which there is early evidence of its contribution to gastrointestinal disturbances. Considering an etiology brought on by food additives in the diagnostic differential gives the practitioner dietary interventions to pursue prior to ordering expensive testing and treatment of irritable bowel syndrome. Importantly, modifying dietary intake to avoid certain additives may resolve symptoms without unnecessary testing or medications and alleviate anxiety in patients and their families. Patients may be well advised to create their own non-dairy beverages, guaranteeing that the ingredients do not include carrageenan, other additives, or the commonly added "natural flavors" to which a patient may be sensitive.

More research is needed into understanding the roles of food additives, including carrageenan, into their contribution to chronic gastrointestinal symptoms in individuals.

## Ethical Statement

Both authors have contributed significantly to the research and writing of the manuscript. Neither author has any affiliations or financial arrangements with any company making a product referred to in the article. No commercial entity has provided financial support or writing assistance in this manuscript. There are no conflicts of interest. The patient has provided full permission to use the case.

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