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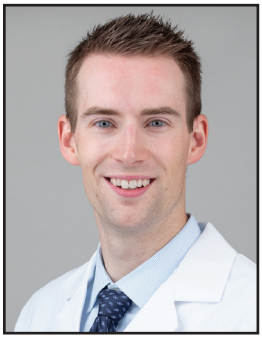
Fiber and Ileostomies: Does it Help or Hurt?



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Patients may receive an ileostomy as either destination therapy (such as in proctocolectomy) or as a temporary diversion prior to anastomosis. While the formation of an ileostomy is often quite beneficial for the patient, it can be complicated by dehydration, electrolyte losses, malnutrition, and undesirable stool consistency. To combat these issues, physicians and nutritionists alike employ a variety of measures. One of the more controversial strategies utilized is fiber supplementation with an intention to increase ileostomy effluent viscosity, slow transit time, and reduce water and micronutrient losses. Despite its commonality, there is surprisingly minimal literature on this topic. Nonetheless, the predicted physiologic benefits of fiber in patients with an ileostomy are not matched in both observational studies and randomized controlled clinical trials.

INTRODUCTION

Ileostomy is a common surgical procedure, with annual rates of about 20,800 in England[1] and 23,392 in the United States.[2] It may be destination therapy or used as a temporary diversion to allow mucosal healing prior to eventual takedown and anastomosis. Almost immediately, the ileostomy begins to work with initial production of 1200ml of watery output (effluent). The effluent gradually thickens and reduces in quantity over the next few months in normal individuals to around 500ml daily with some slight variation based on body size.[3] Several patient-modifiable and non-modifiable factors determine variation in effluent volume, including amount and type of oral intake, as well as the volume of intrinsic gastrointestinal secretions.[1]

Despite its frequency in clinical practice, ileostomy placement can be fraught with complications. Twenty to seventy percent of surgeries are complicated by perioperative and postoperative issues, including peristomal dermatitis, infections, hernia, stenosis, retraction, prolapse, and variceal formation.[4,5] Perhaps none is more vexing, however, than a high output stoma (HOS). HOS is variably defined in the literature as effluent volume exceeding 1000-2000ml daily, although a threshold of 2000ml is more commonly used given its association with clinically significant outcomes.[6] Up to 49% of patients with recent ileostomy placement are readmitted within 30 days; 44% of these readmissions are due to dehydration.[7] Severe volume depletion is often coupled with electrolyte disarray, renal dysfunction, and failure to thrive, representing significant morbidity and straining healthcare resources.[2,4,7] Given the financial impetus tied to penalties incurred

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by hospitals for excessive readmissions, much research has been conducted over the past several years to protocolize the treatment of HOS.[7]

General management strategies for HOS include starting intravenous fluids or oral rehydration solutions, electrolyte repletion, antidiarrheal medication use, nil per os trial to assess gastrointestinal secretion volume, proton pump inhibitor use to decrease gastric secretions, and codeine.[1] At our institution, tincture of opium is also an available option and can be used as an alternative to codeine, especially in the setting of codeine allergy.[8] However, it should be noted that cost, lack of insurance coverage, and scarcity in commercial pharmacies limits the use of tincture of opium. In more refractory cases, octreotide may be used.[1,4] In patients with short bowel syndrome (SBS) and intestinal failure (IF), a newer therapy is the glucagon-like peptide 2 (GLP-2) analog teduglutide (Gattex®). Teduglutide promotes intestinal crypt cell growth, thereby improving nutrient and fluid absorption. A recent systematic review of 14 studies (including 2 randomized, double-blind controlled trials) demonstrated that teduglutide decreased parenteral nutrition and fluid requirements in SBS-IF patients.[9] Although not approved for HOS, a small amount of literature also supports teduglutide use off-label.[10,11,12]

Types of Fiber

Fiber, whether contained within food or taken as a supplement, is classified as either soluble or insoluble. Soluble fiber (e.g. oat bran, barley, nuts, seeds, beans) tends to bind water and helps slow transit in patients with intact gastrointestinal tracts. Conversely, in patients with normal gastrointestinal continuity, insoluble fiber (e.g. wheat bran, whole grains, vegetables) bulks stool and may hasten transit.[13,14]

Despite the distinct physiologic properties of the two fibers above, there remains much confusion amongst clinicians regarding optimal utilization.[15] In addition, alterations in gastrointestinal anatomy may change expected clinical outcomes. It has been known for several decades that non-starch polysaccharides and dietary fiber are poorly digested and are near-completely recovered in ileostomy effluent.[16] It is also established that diets high in fiber are associated with lower body mass index and tend to be protective against weight gain.[17] Furthermore, complex (slowly digested) carbohydrates are known to reduce glucose and insulin responses, in addition to decreasing triglyceride and low-density lipoprotein levels.[18]

Efficacy of Increased Dietary Insoluble Fiber in Ileostomates

A strategy often utilized by medical providers when trying to thicken ileostomy output is the addition of dietary insoluble fiber. While this is common in clinical practice, small studies involving patients with quiescent inflammatory bowel disease (IBD) have not demonstrated benefit in patients with ileostomy (Table 1).

A cohort of 10 patients given a high-fiber diet (62 grams per day) for a week using brewer's spent grain (an insoluble fiber) excreted an identical amount of fiber as was ingested. However, the specific non-starch polysaccharides within the excreta were more consistent with residues typical of intestinal mucus, suggesting that the excessive fiber intake was promoting increased gastrointestinal secretions and not net water absorption.[16] Two other studies involving 10 patients each also used a high-fiber diet (52 grams per day) with rye bread (another insoluble fiber) as the principal carbohydrate source. Patients consuming the high-fiber diet were found to have decreased insulin secretion and increased energy excretion.[18] Furthermore, a high-fiber diet was associated with lower reported hunger rating and post-meal satiety (up to eight hours after breakfast). This led to a 50-kilocalorie deficit in nutrient absorption on a daily basis for patients consuming a high-fiber diet (again versus a low-fiber diet). The principal hormones involved in promoting this satiety were identified as glucagon-like peptide 1, oxyntomodulin, and PYY.[17]

Given the high excretion of insoluble fiber through ileostomy effluent and its apparent weight stabilizing effects, its addition to the diet of patients with ileostomies may in fact be counterproductive in situations where there is excessive output, dehydration, or malnutrition.

Efficacy of Soluble Fiber Supplementation in Ileostomates

As agents designed to bind water and slow digestion, several forms of soluble fiber supplements have

Table 1. Trials of Dietary Insoluble Fiber Use in Ileostomies

Author	Year	n	Patient Population	Fiber Source (amount)	Effect(s) on Ileal Effluent	Effect on Water Excretion	Metabolic Effect(s)
Åman et al.	1994	10	Quiescent IBD Ileostomies >1y	Brewer's yeast (62g/day)	Fiber volume of excreta identical to volume ingested Excreted fiber more consistent with intestinal contents	Increased (indirectly measured)	-
Lundin et al.	2004	10	Quiescent IBD Ileostomies >1y	Rye bread (52g/day)	-	-	Decreased insulin secretion Increased energy excretion
Isaksson et al.	2013	10	Quiescent IBD Ileostomies >1y	Rye bread (52g/day)	-	-	Increased post-meal satiety 50 kcal daily decrease in daily nutrient absorption

been tried to increase effluent viscosity and potentially decrease water losses (Table 2).

One of the oldest studies looked at adding 15 grams of sterculia bulk (in the form of Inolaxol®) to the diet of 12 patients with quiescent IBD and an ileostomy. The effluent viscosity increased while water concentration decreased, which 75% (8 patients) felt was beneficial given it led to a decrease in required ileostomy appliance changes.[19]

Guar gum has also been investigated, but surprisingly had fewer desirable effects on ileostomy effluent. In a study of 5 quiescent IBD patients, the addition of 15 grams to a typical diet led to a mean decrease in intestinal transit time of greater than three hours. In addition, there was increased ileal excretion of fat, protein, sodium, and potassium.[20] While the study period was short (five days), these findings reaffirmed the inherent complexity of intestinal physiology.

Alternatively, other studies in patients with ileostomies have evaluated the effect of psyllium (derived from the Plantago ovata plant), a commonly used soluble fiber, on ileostomy output. A small study (n = 5) looked at the difference between husk (Metamucil®) versus seed formulations of psyllium. While effluent dry weight increased with husk use, wet weight remained unchanged, suggesting that the additional fiber did not promote fluid retention. Seed use had neutral effects on effluent volume.[21] A more recent, slightly larger non-randomized prospective trial of 38 patients demonstrated benefit with psyllium husk, showing a decrease in daily ileostomy output of 322ml after the 90-day trial period; however, this could also be attributed to gut adaptation over time. This was correlated to an estimated cost savings of 120 euros per patient given decreased ileostomy bag requirements.[22]

Interestingly, psyllium husk (also known as ispaghula husk) has been used in an antidiarrheal capacity, but when directly compared to codeine and diphenoxylate, it actually was found to increase water and electrolyte losses while also having an unpalatable taste.[23]

One of the other theoretical concerns that exists with the use of soluble fiber is decreased medication absorption. Unfortunately, there is minimal literature to guide clinicians on this topic, with the small amount available confined to levothyroxine (exogenous thyroid hormone) use. One study demonstrated that high dietary fiber was associated with decreased absorption (thus requiring patients to use higher doses), whereas another small study utilizing calcium polycarbophil (FiberCon®) had no effect on levothyroxine absorption.[24,25]

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Table 2. Trials of Soluble Fiber Supplementation in Ileostomies

Author	Year	n	Patient Population	Bulking Agent (amount)	Effect on Ileal Effluent	Effect on Water Excretion	Metabolic Effect
Dalhamn et al.	1978	12	Quiescent IBD Ileostomies >1y	Sterculia (15g/day)	Viscosity increased	Decreased	-
Higham et al.	1991	5	Quiescent IBD Ileostomies >1y	Guar gum (15g/day)	Decreased transit time	-	Increased excretion of fat, protein, electrolytes
Gelissen et al.	1994	5	Quiescent IBD Ileostomies >1y	Psyllium husk vs. seeds	Increased dry weight with husk	Decreased with husk	-
Crocetti et al.	2014	38	Unspecified	Psyllium husk	Decreased effluent volume	-	-

In summary, while the evidence for soluble fiber is greatly limited by small sample sizes, selection biases, and significant methodologic and statistical heterogeneity, the effects appear to be mixed and dependent on the specific agent. Psyllium husk, in particular, may be worth further investigation. Whether fiber ingestion alters medication absorption remains an interesting, but unknown question.

Efficacy of Specific Carbohydrates

Another potential way to modify ileostomy consistency or output is to alter the primary carbohydrate source for patients. Two studies have directly looked at these outcomes, albeit with only a small number of patients (Table 3).

Similar to the aforementioned investigations into fiber intake, patients with quiescent IBD and ileostomy were administered different carbohydrates with measurement of effluent output and water concentration. Three patients were given eight different carbohydrates (each with varying degrees of protein, fat, fiber, and caloric density), including white bread, pumpernickel bread, Minute Rice, Kellogg's Crispix, pearl barley, red lentils, amylopectin bread, and amylose bread, for standardized three-day time periods over the course of the study. The source of carbohydrate had minimal and non-statistically significant effects on daily ileostomy effluent volume. While the concentration of water within the effluent likewise was consistent between carbohydrate sources, it varied inversely with fiber intake, although the low effect size (in a very small sample size) makes the clinical significance unclear.[26]

Another metabolic area of interest in patients with ileostomies has been bile acid and cholesterol absorption. Humans are dependent on bacterial degradation of sterol rings within the colon and thus the presence of an ileostomy creates an absence of surface area to facilitate degradation, thus promoting increased absorption. Prior research has shown that various foods including oat bran can reduce serum cholesterol concentration by promoting small bowel excretion of both bile acids and cholesterol. A study involving 9 patients with quiescent IBD looked at the metabolic effects of native versus hydrolyzed β-glucans in oat bran. Ileostomy effluent was more viscous with native β-glucans, but more importantly, there was increased ileal excretion of both bile acids and cholesterol.[27] Fat and fat-soluble vitamin absorption was not studied.

Thus, the use of specific carbohydrates in patients with ileostomies needs to be tailored to specific patient needs. Effluent viscosity may be improved with native β-glucans, however its anti-sterol absorptive properties may not be ideal in patients underweight or malnourished. In regards to ileostomy output and water concentration, no definitive conclusion can be reach from the available literature.

Fiber and FODMAPs

Besides being classified by their solubility, fiber can either be fermentable or non-fermentable (Table 4).

Table 3. Trials of Varying Primary Carbohydrate Source in Ileostomies

Author	Year	n	Patient Population	Carbohydrate Source	Effect on Ileal Effluent	Effect on Water Excretion	Metabolic Effect
Steinhart et al.	1992	3	Quiescent IBD Ileostomies >1y	Various	None	None (but inversely related to fiber intake)	-
Ellegård et al.	2007	9	Quiescent IBD Ileostomies >1y	Native vs. hydrolyzed β-glucans	Increased viscosity with native β-glucans	-	Increased excretion of bile acids and cholesterol

In recent years, fermentable oligosaccharides, disaccharides, monosaccharides, and polyols (FODMAPs) have been of great clinical interest, in particular as an identified dietary trigger for gastrointestinal symptoms in patients with irritable bowel syndrome. These short-chain carbohydrates are rapidly fermented by intestinal bacteria, leading to gas production and resulting abdominal discomfort (due to intestinal stretch receptors), bloating, and flatulence. Patients often report feeling full or develop early satiety, leading to decreased oral intake.[28] Therefore, if a specific fiber is used without regard to its proclivity to undergo fermentation, there is risk of inadvertently causing gastrointestinal upset and decreased oral intake. In patients with ileostomies struggling with dehydration or malnutrition, this is particularly detrimental.

The majority of our understanding of FODMAP effects on digestive function is derived from patients with irritable bowel syndrome (who have an intact colon). However, a study of 12 patients with ileostomy demonstrated that the beneficial effects of a low FODMAP diet might also extend to patients with foreshortened intestinal tracts. In crossover fashion, patients were given either a high or low FODMAP containing diet for four days. While on the high FODMAP diet, patients experienced increased ileal effluent weight (wet and dry), water content, and output volume. Furthermore, patients also tended to perceive their effluent consistency as being thicker on the low FODMAP diet.[28] In patients with intact colons, this additional bulk and water delivery distal to the proximal colon may be beneficial in the setting of underlying constipation. However, in the setting of an ileostomy, this output is simply excreted. Thus, fiber supplements (or liquid medications [sugar alcohols]) with high FODMAP concentration may actually promote dehydration. All too often we see patients on these agents referred to our institution with failure to thrive; fortunately, patients quickly improve with discontinuation of the fiber or a change from liquid medications containing sugar alcohols (FODMAPS) to tablets.

SUMMARY

Ileostomies provide relief from underlying mucosal disease; however, the disruption of normal GI tract physiology may lead to complications. Most prominent for physicians, wound and ileostomy nurses, and registered dietitian nutritionists alike is the notoriously difficult to manage HOS and dehydration. However, a recent review article in this journal provides an excellent overview of this condition, complete with optimal management strategies.[29] Soluble fiber, insoluble fiber, and specific carbohydrate sources may be efficacious in selected patients, yet there remain misconceptions about the clinical benefits of fiber supplementation in patients with ileostomy.

Patients with an intact colon may benefit from additional dietary fiber in the setting of constipation. However, careful review of the literature shows that in patients with ileostomies, there may actually be a net loss of fat, protein, and electrolytes with fiber use. Furthermore, fiber may promote weight stability to even a loss, possibly related to decreased absorption of nutrients, decreased oral intake, or both. In cases of malnutrition, excessive fiber may in fact be antithetical to the desired patient outcome. Additionally, data are not consistent supporting its use to prevent dehydration and it

Table 4. Common Fiber Supplement Properties

Fiber	Brand Name	Soluble?	Fermentable?	FODMAP Content
Psyllium	Metamucil®	Mostly (70/30)	Intermediate	Intermediate
Methylcellulose	Citrucel®	Yes	No	Low
Calcium Polycarbophil	FiberCon®	Yes	No	Low
Inulin	Fiber Choice®	Yes	Yes	High
Wheat Dextrin	Benefiber®	Yes	Yes	Low
Wheat Bran	N/A	No	Yes	High

seems that in particular, fiber sources with high FODMAP content promote excessive water losses.

Given that the studies in this review are mostly derived from older, smaller, and non-randomized cohorts, firm conclusions cannot be drawn given the large potential for methodologic bias. Large, randomized clinical trials are needed to determine the ideal treatment of patients with ileostomies who are suffering from malnutrition, dehydration, and/or excessive ileostomy output. ■

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