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The Potential of Polysaccharides from Various Plants as Constipation Treatment

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Abstract

Constipation is one of the disorders of Irritable Bowel Syndrome (IBS) which can be caused by lack of consumption of water and food with fiber. Treatment for constipation patients can be solved by administering laxatives through drugs (pharmaceuticals) or using polysaccharide parts from plants. There are at least three types of laxatives: bulking agents, osmotic agents, and stimulants. Polysaccharides can be sourced from whole or some parts of the plants. Each type of plant has different polysaccharide components, and their effects on constipation treatment are also specific. This study aimed to review the mechanisms of polysaccharides from various plants parts and explain the misconception of polysaccharide intake as a laxative agent in treating constipation. This review is based on literature studies related to polysaccharides from plants materials and their effects as laxatives in experimental animals. The review found that these polysaccharides have a positive effect as a laxative or digestive aid. In general, polysaccharides from several plants were extracted and characterized to be used as anti-constipation test materials. These polysaccharides can help to increase the amount, weight, and water content of feces (bulk), increase peristalsis, speed up gastric emptying and transit time, as well as restore hormones that work in movement in the digestive tract, and improve the condition of the distal colon tissue. These studies are still limited to in-vivo treatments and thus have the potential to be further explored in clinical trials.

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Introduction

Laxative agents are commonly used in the treatment of constipation because they can speed up or induce defecation (Werth & Christopher, 2021). Constipation is a digestive problem affecting people of all ages, including children and seniors. Clinically, constipation is characterized by persistent difficulty in defecating, decreased frequency of defecation, hardened and dry feces, and painful defecation (Wang et al., 2017). The impact of constipation is not only physiological, such as hemorrhoids, anal fissures, irritable bowel syndrome, colon cancer, and the aggregate of intestinal toxins but also causes psychological stress, which can affect the quality of life (Belsey et al., 2010). Laxatives were classified into four types, including bulking agents (psyllium, wheat bran, and methylcellulose), osmotic agents (lactulose, sorbitol, polyethylene glycol), softeners and lubricants (sodium docusate), and stimulants (Epson salts and herbal tea) (Gélinas, 2013). Some of the main types of laxatives are presented in Table 1. The working principle of the laxative is to soften stool, trigger colonic movement, and reduce water absorption.

Many clinical studies have found that the structure of gut microbes differs between healthy people and constipation sufferers. An imbalance in intestinal bacteria results in constipation, and conversely, the formation of constipation indicates intestinal flora dysbiosis (Quigley, 2011; Dimidi et al., 2017; Mancabelli et al., 2017). Variations in intestinal microflora in constipated sufferers also affect intestinal peristalsis, thereby reducing colonic contractility and prolonging intestinal transit time (Huang et al., 2018; Lim et al., 2018; C. Zhang et al., 2020). Treatment for constipation sufferers using medication has recently become unpopular due to toxic side effects and low efficacy (J. Wang et al., 2021). In addition, laxatives containing sodium, magnesium, or phosphate can potentially disrupt electrolytes (Ramos et al., 2015). The challenges of adding laxatives to food include that the concentration of laxatives used must be sufficient to have an effect without reducing the sensory acceptability or quality of the food. Some laxatives have an off-taste, such as magnesium sulfate, and some food ingredients that have a high laxative ability can cause diarrhea, such as cellulose, sorbitol, and olestra (Gélinas, 2013).

Table 1. Classification of Laxative Types (Gélinas, 2013)

Laxatives Types	Mechanisms	Example	Notes
Bulking agents	Softens stools by binding it with water	Psyllium seed husk, methylcellulose, and calcium polycarbophil	It is thought to cause abdominal pain and bloating due to gas formation
Osmotic agents	Softens stool	Lactulose; sorbitol; mannitol; magnesium hydroxide (milk of magnesia); polyethylene glycol (PEG); sodium phosphate	Expected to produce excess gas; overly strong or nose-piercing taste (PEG)
Stimulant	Stimulates colonic movement and reduces water absorption	Epson salts (magnesium sulphate heptahydrate); bisacodyl, sodium sulphate; magnesium oxide; sodium picosulphate; phenolphthalein	The taste is too strong or piercing in the nose and does not produce much gas
		Herbal tea, including anthracenes derivatives (cascara, senna, aloe, Frangula bark)	The taste sensation is too intense, the action is fast, triggering laxative tolerance.

On the other hand, the trend of people wanting to consume natural ingredients, including herbal plants and medicinal foods, has led to increasing studies on using natural ingredients to prevent or treat constipation. Consequently, it has been demonstrated recently that polysaccharides generated from plants contain a variety of biological actions and lower cytotoxicity. Polysaccharides are supplementary therapeutic agents for treating constipation and are FDA-indexed (Luo et al., 2017; Cheng et al., 2023). As biomolecules, polysaccharides are important in regulating intestinal flora as immunosuppressants and antioxidants (Chen et al., 2019; Liu et al., 2020; Wu et al., 2021). Generally, polysaccharides are difficult for the GI tract to digest. When they enter the intestine, they are still in their original structural form or partially hydrolyzed because microorganisms have metabolized them to produce many short-chain fatty acids. SCFAs are very important in establishing mucosal immunity by increasing the barrier function of intestinal epithelial cells. In its development, polysaccharides can alter the gut microbiota's composition and promote the growth of advantageous bacteria like Lactobacillus and Bifidobacteria (Vogt et al., 2015; Xu et al., 2013). Polysaccharides may have laxative agents throughout the plants or be concentrated in some parts. Hence, this study aimed to review the mechanisms of polysaccharides from various plants parts and explained the misconception of polysaccharides intake as a laxative agent in treating constipation. Although this aspect has been reported by Gélinas (2013), this review focuses on polysaccharide intake towards curing constipation, not preventive measures.

Irritable Bowel Syndrome (IBS)

Irritable Bowel Syndrome (IBS) is a digestive disorder. The diagnosis of IBS is based on the Rome criteria, with the Rome IV criteria as the latest version since 2016. IBS is divided into several subs, including constipation (IBS-C), diarrhea (IBS-D), mixed (mixed) (IBS-M), or unclassified (IBS-U) (Defrees & Bailey, 2017). This review will be limited to discussing IBS with sub-constipation (IBS-C).

Constipation is a condition where the stool feels hard and difficult to expel (defecation), and the intensity is low (every 3-4 days or even lower) (Suares & Ford, 2011). Constipation comes in three different forms: slow-transit constipation, defecatory or rectal evacuation disorders, and normal-transit constipation (Zhang et al., 2018). Feces that remain long in the intestines can produce H_2S and amines, killing good bacteria. This condition will affect changes in the composition of microbiota diversity, where the number of harmful bacteria (such as Fusobacterium) will increase. In contrast, the number of good bacteria (such as Bifidobacterium, Bacteroides, and Lactobacillus) will decrease (Luan et al., 2019). Measuring the weight of wet feces per day is the indicator most often used to assess the presence or absence of constipation in individuals. Normal feces weigh around 150 g/day, and the bacteria in the feces are more diverse in normal mice (Cummings et al., 1992; Luan et al., 2019).

The prevalence of constipation in children and adolescents was around 0.7-29.6% and increased to 15-50% in seniors (elderly) (Suares & Ford, 2011). Based on location, the prevalence of constipation in Asia Pacific communities was lower (8.75%) compared to

European societies, which reached 27% (Suares & Ford, 2011). The causes of constipation include lifestyle influences: lack of water consumption, low-fiber foods, laxatives for long periods, drugs that trigger constipation (such as analgesics, antacids, anticholinergic agents, anticonvulsants, antidepressants, diuretics), etc. (Arnaud, 2003).

Mechanisms of polysaccharides in the treatment of constipation

Polysaccharides as laxative agents

Polysaccharides can be obtained from various parts of plants. Each type of plants has different polysaccharides components, and their capabilities on the body's health are also specific. Although, in general, there are similarities in the mechanism of polysaccharides in treating constipation, as shown in Table 2. Polysaccharides from *Cistanche deserticola* provide a laxative effect, mainly due to metabolic energy and amino acid synthesis (Liu et al., 2022). Indications of laxatives were also found in rats given *Amorphophallus muelleri* Blume konjac flour when they experienced constipation due to loperamide. The dietary fiber with a high glucomannan concentration has the potential to raise the water content and weight of fecal pellets because it can absorb and retain water in the gut. The water-holding capacity ratio of insoluble solids, such as dietary fiber, influences stool consistency. When solids bind adequately or slightly to water, the stool will become thick or formed. Otherwise, solids that bind to too little water will cause the consistency of the stool to become loose, even like water (Saito et al., 2002). The formation of SCFA can increase feces' mass and weight, increase feces' water-holding capacity, and help laxation, which stimulates contractions in the proximal colon to the transverse and distal colon. SCFA in mice intestinal isolation leads to increased 5-HT (5-hydroxytryptamine) luminal concentrations, essential in regulating colonic motility (Fukumoto et al., 2003). In this study, konjac flour was better than bisacodyl because although it produced a higher gastrointestinal transit ratio, the water content and stool weight were lower.

The same results were shown in polysaccharide administration in mice by Zhang et al. (2016) and Lee et al. (2012) using *Dendrobium officinale* and fig, respectively. The weight, number, and water content of feces increase compared to controls, so the flow of substances through the intestine speeds up their movement and excretion from the colon (Hu et al., 2012). The increase in water content in rat feces is thought to be the result of the breakdown of polysaccharides, thereby increasing the amount of water that passes through the intestines. The increase in fecal water content, which aligns with the increase in fecal bulk, positively impacts the reduction of carcinogenic compounds (Zhang et al., 2016). Polysaccharides from *Dendrobium officinale* also increases the production and accumulation of Short-Chain Fatty Acids as the dose of polysaccharides increases (40-160 mg/kg). In addition, mice given *Dendrobium officinale* polysaccharide (DOP) at 160 mg/kg experienced increased colon length. Likewise, cellulose in fig can also increase the length of the intestine as peristalsis occurs (Lee et al., 2012).

Stem-derived polysaccharide of the *Dendrobium officinale* plant (Figure 1a) was known to successfully increase the gastrointestinal transit ratio in normal experimental animals as the dose used increases (29, 57, and 114 mg/kg). These polysaccharides can also speed up the time to expel feces and the amount and weight of feces produced (Figure 2) (Luo et al., 2017). Accelerating the excretion of wastes was essential because it can reduce the accumulation of ammonia and thus improve colon health (Zhang et al., 2016). A similar trend in results was also found in mice induced to experience constipation with diphenoxylate and reduced water intake and then given DOP intake. Serum levels of the hormones gastrin, motilin, acetylcholine, and substance P (SP), which manage regulation in the digestive tract and constipation, have increased. This result showed that DOP acts as a laxative component and can improve digestive conditions in constipated mice. The increased water content in mice feces proved that polysaccharides were water soluble and have viscous characteristics, so they acted as a laxative (Luo et al., 2017).

Figure 1. The morphology of (a) *Dendrobium officinale* Kimura et Migo, (b) *A. asphodeloides* Bunge, and (c) flaxseed (Tang et al., 2017; Naik et al., 2021; Lee et al., 2023).

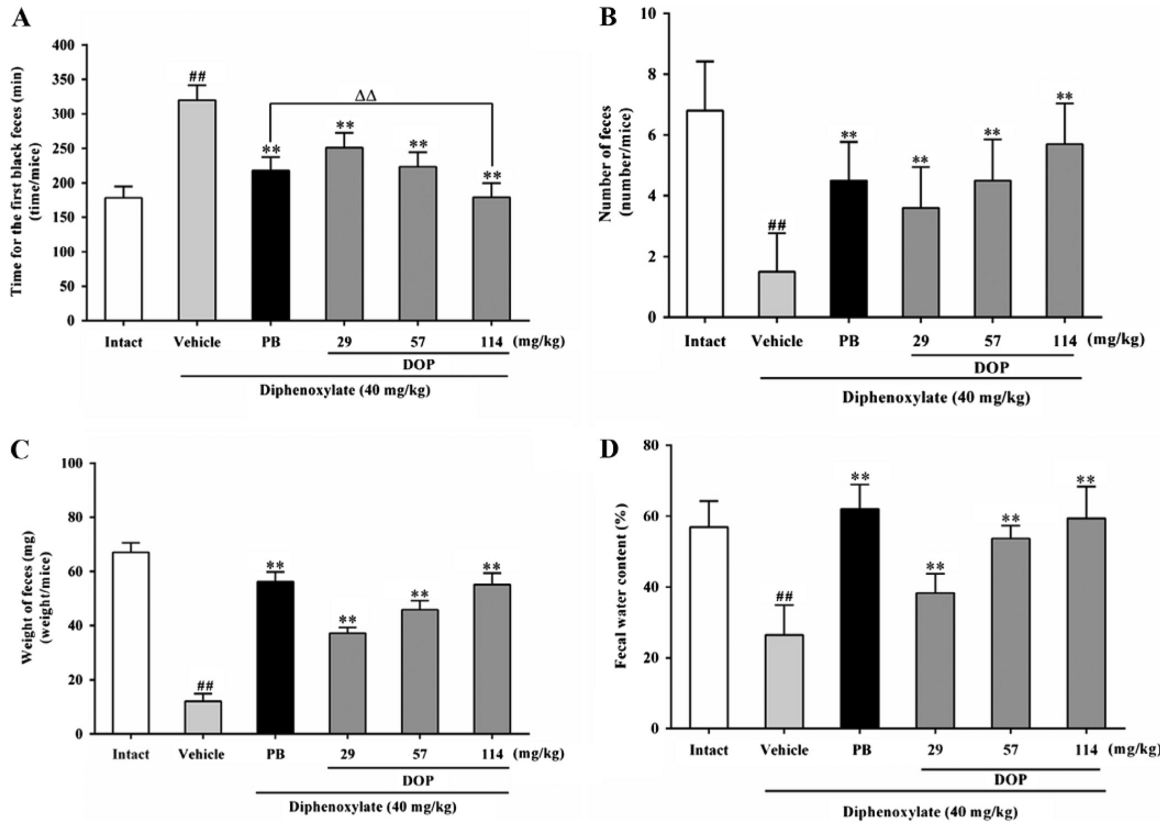

Figure 2. Characteristics of feces in rats induced by diphenoxylate (40 mg/kg) and given the addition of *D. officinale* polysaccharides (DOP) (29, 57, and 114 mg/kg). (A) time of first fecal expulsion; (B) number of feces; (C) stool weight; (D) water content of feces. Data were presented as mean+SD and analyzed using one-way ANOVA with Duncan's multiple range tests (n=10). ##p<0.01 versus intact group. **p<0.01 versus vehicle group. ΔΔp<0.01 versus PB (pyridostigmine bromide) (positive control) (Luo et al., 2017).

McRorie & Chey (2016) stated that the requirements for fiber to be a laxative were (1) it must be resistant to fermentation and (2) it has the potential to significantly raise the water content and weight of feces. The mechanism of fiber can increase water content through insoluble crude fiber irritating the gut mucosa and the ability of gel-forming fiber to bind water (water holding capacity) (McRorie & McKeown, 2017). Soluble and fermentable fibers such as inulin have no significant effect on the water content and consistency of feces and transit time in the colon. This statement was also supported by Gélinas (2013), who stated that inulin was included in the group of laxatives with low potency. Xu et al. (2012) revealed that flaxseeds that have undergone partial fat reduction (partially defatted flax meal or PDFM) were known to have laxative potential. Feed supplemented with PDFM with a concentration of 2.5, 5, and 10% can speed up defecation time and increase the amount and weight of feces in normal and constipation mice. The mechanism of PDFM as a laxative is that the insoluble fiber from PDFM is not fermented in the large intestine but can act like a "sponge" so that it becomes bulk and softens the digest (Xu et al., 2012). Insoluble fiber can reduce transit time in the upper digestive tract (small intestine) due to a reduced digestion rate. Lowering transit time also increases the frequency of defecation (Brownlee, 2011). The swelling nature of insoluble fiber causes the chime to become more extensive in the intestines. The use of dietary fiber from natural ingredients as a laxative agent result from the various types of fiber contained therein (J. Xu et al., 2012).

Polysaccharides enhance gut protection

The polysaccharide-rich aqueous extract from *Cistanche deserticola* used in the study (Jia et al., 2012) effectively prevented colorectal cancer and intestinal inflammation in model mice. The active immune system can be stimulated, reducing the inflammation of mucosal hyperplasia and intestinal helicobacter infection. In other findings from Lee et al. (2012), intake of polysaccharides from *Ficus carica* in rats with loperamide-induced constipation based on the results of histological observations showed the average group had thick distal colon tissue and high levels of mucin acid in the crypt cells (blue) (Figure 3). Mucin itself was responsible for the physical and chemical properties of the mucus that covers the colonic mucosa. Meanwhile, the opposite happened in mice that experienced constipation triggered by loperamide, resulting in decreased mucosal layer thickness and mucin release.

Table 2. Sources of polysaccharides and their mechanisms in the treatment of constipation.

Part of The Plant	Plant Name	Laxative Agent	Mechanism of Action	Reference
Flower	*Dendrobium officinale*	Polysaccharides, mainly composed of glucose and mannose	The water content in feces can be significantly increased	(Luo et al., 2017)
	Chrysanthemum morifolium	Water soluble polysaccharides contained arabinogalactan (arabinose, galactose, glucose)	Recovering colon tissue pathological state, increasing the water content of stool pellets, and support peristalsis in the gastrointestinal tract	(Liang et al., 2014; J. Wang et al., 2021)
	Camellia sinensis	Polysaccharides composed of arabinose, rhamnose, galactose, galacturonic acid	Enhancing the expression of intestinal mucosal integrity genes and promoting the production of short-chain fatty acids	(Chen et al., 2019)
Rhizome	*Anemarrhena asphodeloides* Bge.	Polysaccharides included D-mannose, L-rhamnose, D-glucose, D-galactose, D-galacturgalactose, and L-arabinose	Increasing intestinal fluids and repairing the damage to mucosal	(Li et al., 2019)
	Atractylodes macrocephala	Crude polysaccharide		(Yang et al., 2023)
Stem	*Cistanche deserticola*	Soluble polysaccharides composed of arabinose, rhamnose, mannose, galactose, and glucose	Restoring gut microbial homeostasis and synthesizing metabolic energy and amino acid	(Cheng et al., 2023)
Fruit	*Actinidia arguta* (kiwi berry)	Insoluble polysaccharides	Alleviate constipation by increasing the fecal number, water content, and GI transit rate, shortening the time to first dark stool and changing the intestinal flora.	(J. Zhang et al., 2022)
	Ficus carica (fig)	Cellulose	Increasing feces' number, weight, water content, and thickness of the mucosa layer to prevent constipation	(H.-Y. Lee et al., 2012)
Seed	Flaxseed	Insoluble fiber	lowering transit time also increases the frequency of defecation	(Singh et al., 2011; Xu et al., 2012; Soltanian & Janghorbani, 2018)
	Wheat germ	Polysaccharides contained mainly glucose, glucuronic acid, ribose, and small number of galactose, arabinose, fucose	Regulating gut microbiota composition, increasing the contents of SCFAs, and improving gastrointestinal function, such as tissue protection, regulatory peptide levels, and motility	(Guan et al., 2023)
Seed husk	Psyllium	Insoluble fiber, xylose, arabinose	Gel from unfermented psyllium provides lubrication which allows colon contents to propulsion, thus producing stools that are more moist and bulkier.	(Marlett et al., 2000)
Rind	*Durio zibethinus* (durian)	Crude polysaccharides	Increasing the intestinal transit rate, motilin, gastrin, substance P levels and concentration of short-chain fatty acids (SCFAs) reduce the somatostatin levels and improves the gastrointestinal peristalsis	(Jiang et al., 2020)
Cob	Corn	Xylooligosaccharides	Decreasing the time for defecation, enhances the rate of gastrointestinal transit, returns the balance of gastrointestinal neurotransmitters, preserves against oxidative stress, and reverses constipation-induced colonic inflammation.	(Song et al., 2023)
Tuber	*Amorphophallus paeoniifolius* (*suweg*)	Glucomannan	Increasing peristaltic movement in digestion, gastric emptying, and transit time, enhancing stool volume and bulk	(Dey et al., 2016)
Root	Chicory	Inulin, oligofructose	Increasing in stool weight and fecal frequency	(Den Hond et al., 2000)

Soluble and insoluble dietary fiber diets can reduce mucinase activity, which inhibits mucin formation. Mice epithelial tissue, which was thinned due to loperamide, then improved after administration of fig polysaccharide for 5 weeks and mucus can be released into the lumen. Thus, figs also have therapeutic potential and prevent constipation (Lee et al., 2012).

Different results were found in the Wang et al. (2021) study stated that *Chrysanthemum morifolium* polysaccharides significantly increase the expression of the FABP1 protein. It plays a role in lipid metabolism and enterocyte proliferation, responsible for intestinal homeostasis (Sawicki et al., 2017). Apart from that, there was also an increase in SLC1A5 (solute carrier 1 family member 5), which is a neutral amino acid transporter through peripheral cell membranes and the primary glutamine transporter which provides carbon and nitrogen sources for biosynthesis, energy metabolism, and cellular homeostasis (Kanai et al., 2013; Wang et al., 2015; Mayers & Heiden, 2015). Meanwhile, a significant decrease occurred in RAS, an oncogene involved in various cancer responses mediated by colon cancer cells (Drosopoulos et al., 2005; Calleros et al., 2009).

Anemarrhena asphodeloides Bge. (Figure 1b) polysaccharides also decrease the expression of PCNA, which is closely related to colon cancer. In addition, increases the regulation of ICAM-1, thereby slowing down leukocyte inflammation (Li et al., 2019). *Anemarrhena asphodeloides* Bge., *Chrysanthemum morifolium*, and kiwi berry polysaccharides showed an increase in gastrointestinal hormones, namely gastrin (Gas), motilin (MTL), substance P (SP), and 5-hydroxytryptamine (5-HT) which can improve constipation (Li et al., 2019; Wang et al., 2021; Zhang et al., 2022). MTL receptors are expressed in the duodenum and colon neurons, where they act agonistically and antagonistically to treat various gastrointestinal motility disorders. GAS is secreted by the gastric sinus, duodenum, and small intestinal mucosa to stimulate gastric acid secretion and increase gastrointestinal motility. SP is an endogenous peptide that plays a role in cell proliferation, migration, and immune regulation, while SS inhibits smooth muscle contraction and GAS secretion. Polysaccharides' intake is expected to increase MTI, GAS, and SP to inhibit the development of intestinal damage, reduce inflammation, and improve intestinal structure. On the other hand, SS levels can decrease so that digestive muscle contractions increase in constipation treatment.

Polysaccharides improve the intestinal microflora

The effects of *Cistanche deserticola* polysaccharides were discovered through the study of Fu et al. (2020), particularly low molecular polysaccharides, which found an increase in the beneficial bacteria *Prevotella* spp. and predominantly produces acetate. In addition, polysaccharides can regulate the diversity of intestinal microflora, increase echinacoside absorption and SCFA production, and improve disturbed intestinal microbiota. A similar trend also happened in experiments using old mice, showing a significant increase in beneficial bacteria while pathogenic bacteria decreased. Additionally, a low molecular weight polysaccharide, namely D-galactose, in *Cistanche deserticola* can improve low cognitive levels in mice by restoring intestinal microbial homeostasis (Gao et al., 2021). Fermentation of dietary fiber by microflora also occurs when consuming *Amorphophallus muelleri* Blume konjac glucomannan flour, xylooligosaccharides from corn cobs, and polysaccharide from *durian* rind producing SCFA, which lowers colonic pH (Slavin et al., 2009).

Flaxseed (Figure 1c) is one of the plants known to be rich in dietary fiber (36.7-46.8%), consisting of soluble and insoluble fiber, with the insoluble fiber being higher. It has been used to treat constipation (Singh et al., 2011). Most of the soluble fiber and a small portion of insoluble fiber are fermented by the colonic microflora so that substrates for microbial growth become available and increase the number of bacteria in the digestion. These fermentation products also produce short-chain fatty acids such as acetic, butyric, and propionic acids, which can also be healthy for the colon (Xu et al., 2012). A study conducted by Yang et al. (2023) produced a significant increase in the specific bacteria *Lachnospiraceae_bacterium_A4*, *Bact-oides_vulgatus*, and *Prevotella_sp_CAG:891*, indicating that *Atractylodes macrocephala* polysaccharide can modulate target strains effectively to improve gut microbiota dysbiosis. Administration of *Durian* rind polysaccharides can enhance the bacterial composition of gut microbiota by raising the proportion of beneficial bacteria (*Lachnospiraceae group-K4A136*) and decreasing the number of pathogenic bacteria (*Desulfovibrio*) (Jiang et al., 2020).

The study conducted by Chen et al. (2019) showed that SCFA production in *Camellia sinensis* L. tea flower polysaccharide intake is closely related to the activity of *Lactobacillaceae*, *Ruminococcaceae*, *Bacteroidaceae,* and *Prevotellaceae*. Although enriched *Lachnospiraceae* and *Lactobacillaceae* were found to be detrimental, enriched *Bacteroidaceae* and *Prevotellaceae* correlated positively with total SCFA and *n*-butyric acid. *N*-butyric acid can accelerate mucin production by stimulating intestinal epithelial cells, thereby changing bacterial adhesion and tight junction integrity for the better (Xu et al., 2013). Cy treatment, a known chemotherapeutic agent, has immunosuppressive and immunomodulatory effects that can alter bacterial genera. The finding in this study was that tea flower polysaccharide treatment can change the functional pathways of bacteria due to Cy in a dose-dependent manner (Chen et al., 2019).

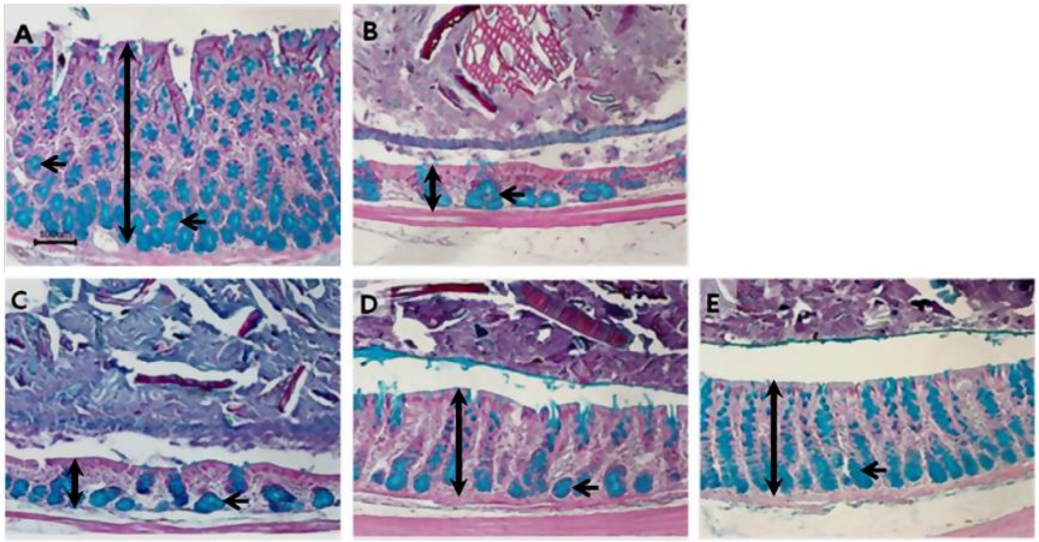

Figure 3. Effect of fig extract on histology in the loperamide-induced constipation model. Cross-section of the distal colon of control mice containing fecal pellets (A) and the treatment group with 0 g/kg figs (B); 1 g/kg (C); 6 g/kg (D) or 30 g/kg (E) for 4 weeks in loperamide-induced rats. Samples are marked with Alcian blue at pH 2.5 (100x magnification); the top arrow shows colon thickness, and the side arrow shows colonic crypt (Lee et al., 2012).

Polysaccharides as lubricants

There is a different mechanism for psyllium polysaccharides than other polysaccharides. Non-fermented psyllium creates a soluble gel with a high water-holding capacity and resists dehydration in the large intestine, resulting in soft and bulky stools (McRorie & McKeown, 2017). A study conducted by Marlett (2000) has proposed psyllium seed husk as an emollient and lubricant, considering that psyllium gel does not ferment because increasing the water content of the stool makes it gentle, soft, and easier to defecate. Due to the soluble gel from psyllium seed husk, a new laxative mechanism for dietary fiber provides additional hydration and lubrication to facilitate colon movement, resulting in a cohesive, soft, and bulky stool. The lubrication effect can be seen from the shiny appearance of the stool and the slippery feeling when defecating.

Misconceptions about polysaccharide intake in the treatment of constipation

A comparison of studies on wheat bran and psyllium conducted by McRorie (2019) regarding their effect on stool moisture content shows that psyllium, predominantly soluble non-fermented gel-forming fiber, produces 3.4 times more stool than wheat bran. Meanwhile, a direct comparison study between the effects of coarse wheat bran and fine wheat bran on stool water content shows that coarse wheat bran increases stool water content (+2.6% and +1.0%; the stool becomes softer). Fine wheat bran reduces stool water content (-1.1% and -2.0%, harder stools). All studies found different results for psyllium wheat bran (mean dose 14.8 g/day), which showed an increase in fecal water content (mean + 5.4%), indicating a stool-softening effect. Although wheat bran and psyllium both increase stool output and fecal water content, they both have different mechanisms: 1) coarse, water-insoluble wheat bran particles can irritate the intestinal mucosa mechanically, thereby stimulating the secretion of water and mucus, which then becomes a defense mechanism for protects the mucosa and 2) The non-fermented gel produced by psyllium can retain water/prevent dehydration throughout the large intestine (McRorie & McKeown, 2017). A study conducted by them showed that large/coarse wheat bran had a significant influence on stool output, while particles that were too small/fine did not. The secretion of water and mucus cannot be stimulated by finely ground wheat bran particles. Instead, it increases the stool's dry mass, reducing its water content and causes constipation (McRorie & McKeown, 2017). Even though no label states the degree of insoluble fiber milling, it may worsen chronic idiopathic constipation. These results may also be relevant to other fiber supplements that initially aim to increase but decrease feces' water content, making them more rigid (e.g., wheat dextrin; Benefiber) (Heuvel et al., 2004).

Conclusion

Polysaccharides in various forms, such as glucomannan, mucilage, cellulose, fiber, etc., from specific sources of plant parts are known to have laxative abilities. These polysaccharides were important for reducing and treating constipation. In general, polysaccharides can help increase the amount, weight, and water content of feces (bulk), increase peristalsis, speed up gastric emptying and transit time, restore hormones that work in movement in the digestive tract, and improve the condition of the distal colon tissue. However, the polysaccharide mechanism as a lubricant was discovered because only part of it was fermented. Polysaccharide intake in curing constipation also requires attention to its properties, dosage, and size.

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