

An Educational Resource from Diagnostic Solutions Laboratory

FUNCTIONAL FIBERS TO OPTIMIZE GUT HEALTH



FDA Definition of Fiber Characteristics:

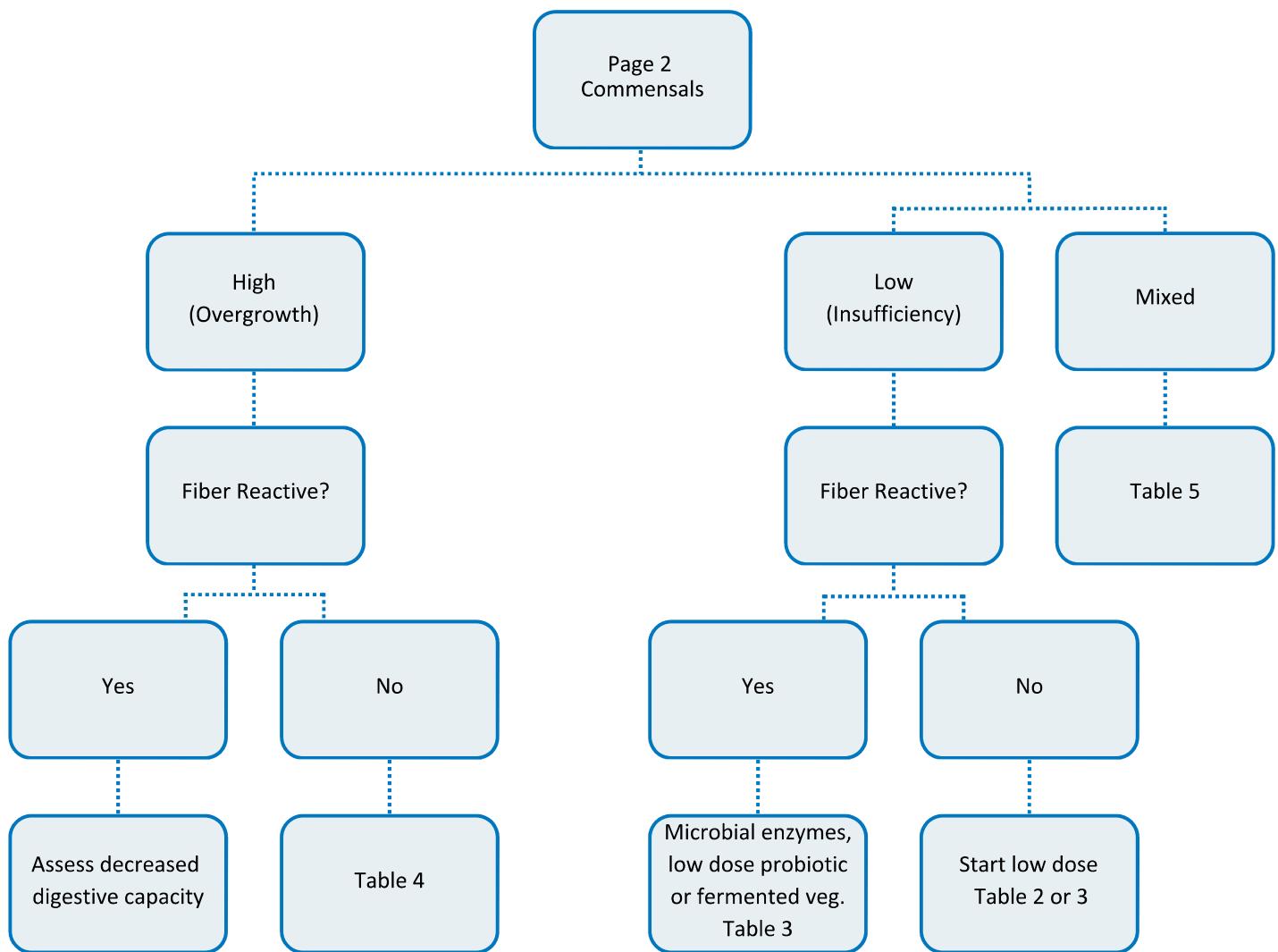
- Either intrinsic and intact in plants or can be synthetically made
- Non-digestible carbohydrate containing 3 or more monomeric units
- Non-digestible – cannot be broken down by human digestive enzymes
- Not absorbed in the small intestine
- Fermented by bacteria in the large intestine
- Promotes beneficial physiological effects to humans upon consumption

Table 1 – Physiochemical Characteristics of Fiber

Soluble	Readily dissolves in water. It is hydrophilic giving it the ability to absorb fluids. It has the ability to feed beneficial bacteria to improve microbial abundance and diversity.
	Non-Viscous – Does NOT form a gel when mixed with water, so it passes through the digestive system more quickly than viscous fibers. It contributes to digestion by feeding normal flora.
	Viscous – The ability of fiber to form a gel when mixed with water. This can assist in slowing down digestion and nutrient absorption and can help lower cholesterol, regulate blood sugar, promote satiety, and potentially support loose stools.
Insoluble	Does NOT dissolve in water. It is hydrophobic and remains fully intact in the digestive tract. It is either poorly fermented or not fermentable by gut bacteria. It helps add bulk to stool, increases water content in stool, and can improve constipation.
Fermentable	Can be metabolized by gut microbiota through saccharolytic fermentation. The rate of fermentation can vary depending on molecular weight/chain length. High Molecular Weight – (long chain) = slow fermentation Low Molecular Weight – (short chain) = fast fermentation
Non-Fermentable	Can NOT be metabolized by gut microbiota.

WHAT IS YOUR GOAL?

The status of the commensal bacteria, found on page 2 of the GI-MAP®, may inform clinical strategies. Use this flowchart to determine which fibers may be beneficial to include as part of a comprehensive protocol.



The flowcharts below may guide further use of specific fibers based on various treatment goals.

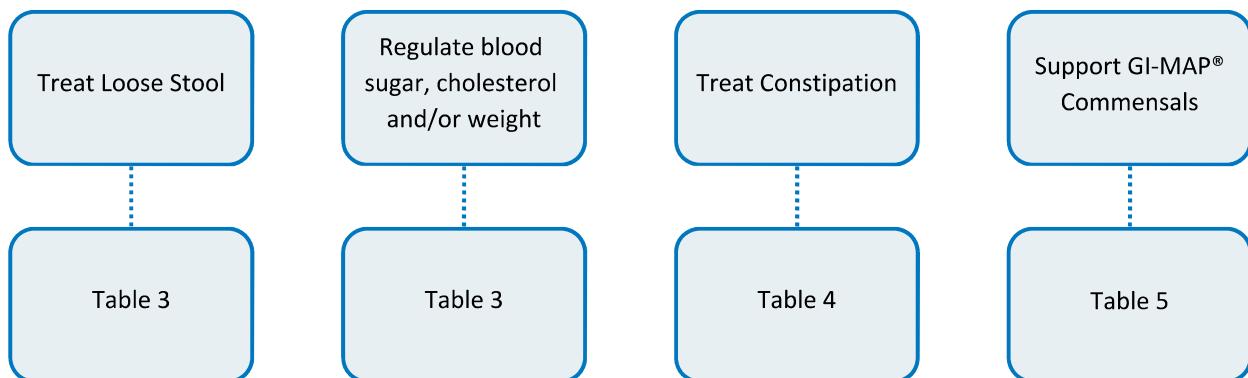


Table 2 – Soluble and Non-viscous Fiber

Examples	Inulin	FOS	GOS	XOS
Degree of Fermentation (Prebiotic)	✓✓	✓✓✓	✓✓✓	✓✓✓
Molecular Weight	Short chain	Short chain	Short chain	Short chain
Cholesterol-lowering				✓
Improved Glycemic Control	✓ (via butyrate)			✓
Constipation/Stool Softener	X			
Diarrhea/Stool Normalizer	✓			
FODMAP Safe	XX	XX	XX	XX
Foods	Chicory root, garlic, onions, leeks, green banana, raw asparagus, Jerusalem artichoke, agave, wheat* *contains gluten	Legumes (beans, peas, lentils), nuts (cashews, pistachios), dairy, added to infant nutrition & functional foods	Bamboo shoots, fruit, vegetables, milk, honey, added to functional foods and beverages	
Supplementation	Prebiotic formulas or standalone ingredient	Prebiotic formulas or standalone ingredient	Prebiotic formulas or standalone ingredient. Brand name: Bimuno®	Prebiotic formulas or synbiotic blends Brand name: PeticX®
Notes	Promotes rapid growth of flora	Improves gut barrier	Generally well tolerated at low dose, can support weight management	
Caution	In IBS + FODMAP sensitive individuals – most common S/E >10g are gas, bloating, abdominal discomfort, loose stools, and diarrhea. Avoid in IBD – may exacerbate inflammation and worsen symptoms.	FODMAP sensitive		

Key for Tables 2-4

✓ = mildly positive
 ✓✓ = moderately positive
 ✓✓✓ = highly positive
 X = is not or does not
 XX = strongly is not or does not

FOS = Fructooligosaccharide
 GOS = Galactooligosaccharide
 XOS = Xylooligosaccharide
 PHGG = Partially hydrolyzed guar gum
 RS = Resistant starch

Table 3 – Soluble and Viscous Fiber

Examples	Glucomannan (most viscous)	Beta-glucan (highly viscous)	Apple Pectin (highly viscous)	PHGG (low viscosity)	Acacia (low viscosity)
Degree of Fermentation (Prebiotic)	✓ Long chain	✓ Long chain	✓ Depends on type of pectin	✓ Slow fermentation	✓ Slow fermentation
Cholesterol-lowering	✓✓	✓✓	✓✓	✓	
Improved Glycemic Control	✓✓	✓✓	✓✓	✓	
Constipation/Stool Softener	✓✓ 3-4g per day	✓ Adds bulk	✓ Increases frequency of bowel movements	✓	✓
Diarrhea/Stool Normalizer			✓	✓	
FODMAP Safe	Moderate amounts	✓	Moderate amounts	✓	✓
Foods	Shirataki noodles, vegan gelatin substitute	Grains (oats, barley*, wheat*, rye*), mushrooms, yeast, seaweed <small>*contains gluten</small>	Skin, peels and core of apples, pear, citrus fruits, plums, apricots, sour cherries, quince, sugar beets	N/A	Not found in whole foods, but used to fortify products such as soups, cereals, nutritional bars, etc.
Supplementation	Available in powder, capsule, or tablet form May be referred to as: Konjac, Konjac mannon, Konjac extract, Propolmannan	Available in powder, capsule, or cream form Supplements sources from oats, barley, yeast or mushrooms	Fiber-based supplements	Prebiotic formulas or standalone ingredient Brand name: Sunfiber®	Available in powder or capsule form Brand name: Fibregum™
Notes	Highest viscosity of any fiber – can absorb up to 50 times its weight in water (good for weight loss – promotes fullness) Must take with sufficient water			Tasteless, colorless, odorless Well tolerated – minimal gas and bloating	Well tolerated – minimal gas and bloating

Table 4 – Insoluble Fiber

Examples	Cellulose	Psyllium (soluble but acts insoluble)	Resistant Starch
Viscous	X	✓✓	X
Degree of Fermentation (Non-prebiotic)	X	X	RS 1: Non-fermentable RS 2: Slowly
Cholesterol-lowering	X	✓✓	Potentially
Improved Glycemic Control	X	✓✓	Potentially
Constipation/Stool Softener	✓✓	✓✓	X
Diarrhea/Stool Normalizer	X	✓✓	X
FODMAP Safe	✓	✓	Many tolerate
Foods	Fruit (skin of apples, pears, berries, citrus fruit), vegetables (broccoli, green beans, carrots, cabbage family, leafy greens, corn, celery) whole grains (wheat*, oat, barley*, brown rice), nuts and seeds (almonds, pistachios, chia seeds, flax seeds, hemp seeds), legumes (navy bean, split peas, lentils) *contains gluten	Psyllium husk	RS 1: oats, green peas, white beans, lentils RS 2: raw potato, green banana, high amylose corn RS 3: cooked and cooled potato/rice/pasta RS 4: synthesized in a lab; added to processed foods such as crackers, bread, cereals, and supplements
Supplementation	Cellulose is often is component of fiber supplements	Psyllium husk products – available in powder or capsules Brand name: Metamucil®	
Notes	Promotes satiety, appetite control, and reduces calorie intake	This is actually a soluble fiber but acts like an insoluble one	May support appetite control, cardiovascular health
Caution	Not recommended for managing diarrhea or IBS-D	High doses can worsen IBS-D	

Other insoluble fibers to consider: some pectins, some beta-glucans

Table 5 – Fibers to Support Specific Commensals/Keystones on GI-MAP®

Commensal/Keystone Bacteria	Fibers to Feeds/Benefit
<i>Bacteroides fragilis</i>	XOS, Soluble fiber
<i>Bifidobacterium</i> spp.	Inulin/FOS, GOS, XOS, Glucomannan, Beta-glucan, PHGG, Acacia, RS 2, RS 3
<i>Enterococcus</i> spp.	General soluble fibers
<i>Escherichia</i> spp.	General soluble fibers
<i>Lactobacillus</i> spp.	Inulin/FOS, GOS, PHGG, Glucomannan, Beta-glucan, PHGG, Acacia
<i>Enterobacter</i> spp.	General soluble fibers
<i>Akkermansia muciniphila</i>	Inulin/FOS, RS 2
<i>Faecalibacterium prausnitzii</i>	Inulin/FOS, Apple Pectin, PHGG, Acacia, RS 2, RS 3
<i>Roseburia</i> spp.	Inulin/FOS, Glucomannan, RS 2, RS 3
<i>Bacteroidetes</i> (phylum)	Inulin/FOS, GOS, XOS, Beta-glucan, Apple Pectin, PHGG, RS 2, RS 3, RS 4
<i>Firmicutes</i> (phylum)	Inulin/FOS, XOS, Apple Pectin, PHGG, RS 4 Mediterranean diet (plant forward, fiber-rich diversity, limited refined sugars)

Dietary Approaches to Support Microbial Diversity and Commensal Bacteria

- Mediterranean diet
- Fiber-rich diet with an emphasis on plant diversity (30 plants per week)
- Polyphenol-rich foods: olive oil, fruits, vegetables, nuts, herbs/spices, red wine (low-moderate, with meal)
- Fermented foods such as sauerkraut, kimchi, and kefir
- Avoidance of ultra-processed foods, excess sugar, and unhealthy fats



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