

Gut Microbiome Restoration

Taking dysbiosis support to the next level using
prebiotics & foods



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THE FUNCTIONAL GUT HEALTH CLINIC

Outline of learnings, from me to you

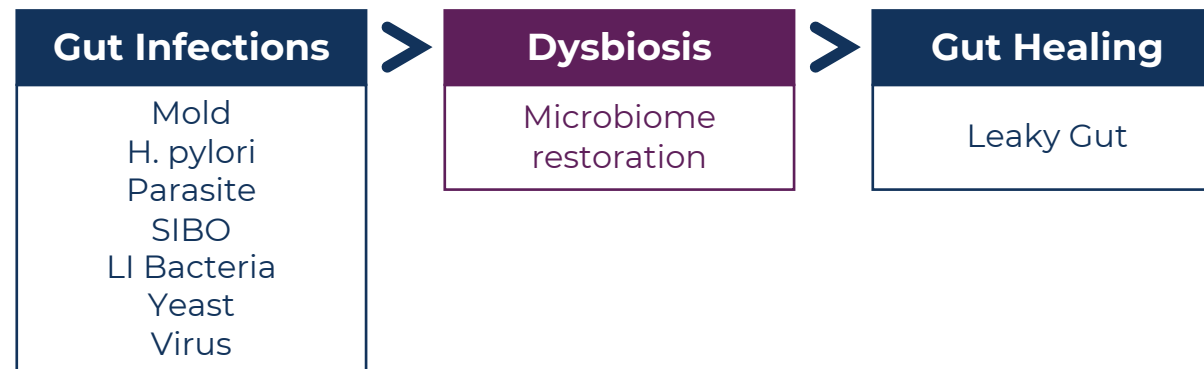
- Gut microbiome restoration & the FDN approach
- Introduce the gut microbiome
- How to support gut microbiome diversity
- Introduce phyla of the human gut microbiome
- Gut microbiome testing using the GI MAP
- Microbiome restoration using prebiotics & foods:
 1. Proteobacteria & Bacteroidetes phyla
 2. Lactobacillus species
 3. Bifidobacteria species
 4. Akkermansia muciniphila
 5. Faecalibacterium prausnitzii

FDN Approach & Microbiome Restoration



Microbiome restoration & the FDN framework

- Plant foods & fibers for microbiome restoration can cause symptoms & make clients feel worse if we start them too early
- Test, don't guess to work out the best time to start microbiome restoration
- **FDN framework:**



- Microbiome restoration work can start when mycotoxin test, organic acids test, stool test &/or SIBO breath test are clear of gut infections

The Gut Microbiome



What is the gut microbiome?

- 100 trillion living microorganisms mostly located in the colon
- Microorganisms come from 1000+ different species & have a mutually beneficial relationship when in balance
- Dysbiosis within the gut microbiome can lead to symptoms & eventually disease states
- Your gut microbiome is unique to you:
 - 160 known species
 - 30-40 species make up most of our personal gut microbiome
 - Differences in species contribute to who we are & the functioning of our human cells

What does our gut microbiome do for us?

- Regulates gut motility
- Colonization resistance against pathogenic organisms
- SCFA production
- Improves nutrition status
- Weight management
- Managing our mood
- Blood glucose control & insulin sensitivity
- Promotes an anti or pro-Inflammatory state
- Xenobiotic & drug metabolism
- Immune system modulation

Gut Microbiome Diversity



Microbiome diversity - the key to health!

- The biggest driver of a healthy gut microbiome is **diversity**
- Aiming for ideal diversity levels of greater than the 90th percentile
- Lack of diversity in the gut microbiome is associated with:
 - Allergies
 - Asthma
 - Obesity
 - Insulin resistance
 - Dyslipidemia
 - Body-wide inflammation

Factors that support gut microbiome diversity

- Diverse diet with a big variety of weekly plant-based foods (fruit, vegetables, legumes, nuts, seeds, herbs, spices, grains, pseudo-grains, etc)
- Prebiotic rich foods & supplements
- Natural birth or vaginal seeding
- Breastfeeding as a baby, especially within the first few days to help establish the gut microbiome
- Rural upbringing or urban upbringing with lots of time spent outside in natural environments

Restoring overall gut microbiome diversity

- Take **prebiotic supplements** daily (PHGG, Acacia, GOS, FOS, Lactulose, etc)
- Eat a wide variety of **multi-coloured plant foods** & plant fibers weekly
- Eat a variety of **resistant starches, polyphenols, prebiotic-rich foods, prebiotic-like foods, pectins, soluble & insoluble fibers**
- Aim for **40+ different plant foods** each week (fruit, vegetables, legumes, nuts, seeds, herbs, spices, grains, pseudo-grains, etc)
- **Organic gardening** to grow some of your own food
- Eat **raw** fruits, vegetables, nuts & seeds for soil-based organisms
- **Exercise moderately**
- **Probiotic supplements & fermented foods**

Common causes of damage to the gut microbiome

- **Medications:** antibiotics, chemotherapy, radiation, PPI's, NSAID's
- **Medical conditions caused by dysbiosis:** allergies, asthma, obesity, insulin resistance, dyslipidemia, & body-wide inflammation
- **Stress:** long-term chronic stress or recent acute stress
- **Dietary risk factors:** low fiber/plant foods diet such as long-term use of Keto, low-FODMAP, high protein/fat & low carb diets; standard Western diet or diets low in plant food diversity

Gut Microbiome Phyla



Phyla of the human gut microbiome

Phylum	Genus	Species
1. Firmicutes		
2. Bacteroidetes		
3. Proteobacteria		
4. Actinobacteria		
5. Verrucomicrobia		
6. Fusobacteria		
7. Euryarchaeota (archaea)		

Genera of the human gut microbiome

Phylum	Genus	Species
1. Firmicutes	Faecalibacterium, Bacillus, Clostridium, Lactobacillus, Enterococcus, Staphylococcus, Streptococcus, Roseburia	
2. Bacteroidetes	Bacteroides, Prevotella, Alistipes	
3. Proteobacteria	Helicobacter, Escherichia, Pseudomonas, Klebsiella, Campylobacter, Salmonella, Oxalobacter, Desulfovibrio	
4. Actinobacteria	Bifidobacterium, Actinomyces	
5. Verrucomicrobia	Akkermansia	
6. Fusobacteria	Fusobacterium	
7. Euryarchaeota (archaea)	Methanobrevibacter	

Species of the human gut microbiome

Phylum	Genus	Species
1. Firmicutes	Faecalibacterium, Bacillus, Clostridium, Lactobacillus, Enterococcus, Staphylococcus, Streptococcus, Roseburia	Faecalibacterium prausnitzii Lactobacillus plantarum
2. Bacteroidetes	Bacteroides, Prevotella, Alistipes	Bacteroides fragilis
3. Proteobacteria	Helicobacter, Escherichia, Pseudomonas, Klebsiella, Campylobacter, Salmonella, Oxalobacter, Desulfovibrio	Helicobacter pylori
4. Actinobacteria	Bifidobacterium, Actinomyces	Bifidobacterium lactis
5. Verrucomicrobia	Akkermansia	Akkermansia muciphila
6. Fusobacteria	Fusobacterium	Fusobacterium nucleatum
7. Euryarchaeota (archaea)	Methanobrevibacter	Methanobrevibacter smithii

Gram-positive vs gram-negative phyla

Phylum	Genus	Species
1. Firmicutes	Faecalibacterium, Bacillus, Clostridium, Lactobacillus, Enterococcus, Staphylococcus, Streptococcus, Roseburia	Faecalibacterium prausnitzii Lactobacillus plantarum
2. Bacteroidetes	Bacteroides, Prevotella, Alistipes	Bacteroides fragilis
3. Proteobacteria	Helicobacter, Escherichia, Pseudomonas, Klebsiella, Campylobacter, Salmonella, Oxalobacter, Desulfovibrio	Helicobacter pylori
4. Actinobacteria	Bifidobacterium, Actinomyces	Bifidobacterium lactis
5. Verrucomicrobia	Akkermansia	Akkermansia muciniphila
6. Fusobacteria	Fusobacterium	Fusobacterium nucleatum
7. Euryarchaeota (archaea)	Methanobrevibacter	Methanobrevibacter smithii



Gram-positive

Gram-negative

Gram-negative bacteria & LPS

- Gram-negative bacteria contain LPS. LPS are endotoxins
- Endotoxins inside gram-negative bacterial cell membranes can be shed into the gut lumen of both the SI & LI when the bacteria dies
- **Lots of LPS in the gut can lead to symptoms of endotoxemia:** leaky gut, inflammation, mood changes – depression, anxiety, cognition changes - brain fog, memory issues, fatigue
- Diets higher in fat like Keto, & other low-carb / high fat diets can increase LPS in the gut (LPS binds to dietary fats for absorption) & might not work for some clients when on bacteria eradication protocols that address gram-negative bacteria

Gut Microbiome Testing



Microbiome testing: test don't guess!

- **Labs that map the human gut microbiome:** can be useful for detailed analysis, often don't share or report on the information we need
- **PCR/molecular testing:** decent lists of organisms, measure abundance & diversity, offer enough information to help our clients
 - Genova Diagnostics, GI Effects
 - Doctor's Data, GI 360
 - Vibrant Wellness, Gut Zoomer
 - Diagnostic Solutions Laboratory, GI MAP

GI MAP: Bacterial pathogens, page 1

PATHOGENS			
BACTERIAL PATHOGENS	Phyla	Result	Reference
<i>Campylobacter</i>	Proteobacteria	<dl	< 1.00e3
<i>C. difficile</i> Toxin A	Firmicutes	<dl	< 1.00e3
<i>C. difficile</i> Toxin B	Firmicutes	<dl	< 1.00e3
<i>Enterohemorrhagic E. coli</i>	Proteobacteria	2.14e3 High ↑	< 1.00e3
<i>E. coli</i> O157	Proteobacteria	<dl	< 1.00e3
Enteroinvasive <i>E. coli/Shigella</i>	Proteobacteria	<dl	< 1.00e3
Enterotoxigenic <i>E. coli</i> LT/ST	Proteobacteria	<dl	< 1.00e3
Shiga-like Toxin <i>E. coli</i> stx1	Proteobacteria	<dl	< 1.00e3
Shiga-like Toxin <i>E. coli</i> stx2	Proteobacteria	<dl	< 1.00e3
<i>Salmonella</i>	Proteobacteria	<dl	< 1.00e4
<i>Vibrio cholerae</i>	Proteobacteria	<dl	< 1.00e5
<i>Yersinia enterocolitica</i>	Proteobacteria	<dl	< 1.00e5

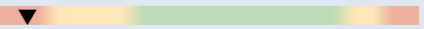
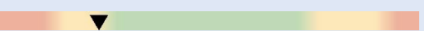
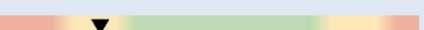
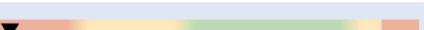
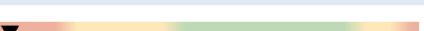
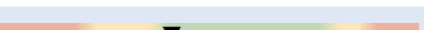
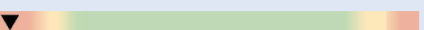
GI MAP: Helicobacter pylori, page 2

HELICOBACTER PYLORI				
H. PYLORI & VIRULENCE FACTORS	Phyla	Result		Reference
<i>Helicobacter pylori</i>	Proteobacteria	1.59e3	High ↑	< 1.00e3
Virulence Factor, babA		Negative		Negative
Virulence Factor, cagA		Negative		Negative
Virulence Factor, dupA		Negative		Negative
Virulence Factor, iceA		Negative		Negative
Virulence Factor, oipA		Negative		Negative
Virulence Factor, vacA		Negative		Negative
Virulence Factor, virB		Negative		Negative
Virulence Factor, virD		Negative		Negative

GI MAP: Opportunistic/overgrowth microbes, page 3

OPPORTUNISTIC/OVERGROWTH MICROBES			
DYSBIOTIC & OVERGROWTH BACTERIA	Phyla	Result	Reference
<i>Bacillus</i> spp.	Firmicutes	5.00e5	< 1.76e6
<i>Enterococcus faecalis</i>	Firmicutes	<dl	< 1.00e4
<i>Enterococcus faecium</i>	Firmicutes	<dl	< 1.00e4
<i>Morganella</i> spp.	Proteobacteria	<dl	< 1.00e3
<i>Pseudomonas</i> spp.	Proteobacteria	6.65e6 High ↑	< 1.00e4
<i>Pseudomonas aeruginosa</i>	Proteobacteria	2.58e4 High ↑	< 5.00e2
<i>Staphylococcus</i> spp.	Firmicutes	<dl	< 1.00e4
<i>Staphylococcus aureus</i>	Firmicutes	4.35e3 High ↑	< 5.00e2
<i>Streptococcus</i> spp.	Firmicutes	2.57e3 High ↑	< 1.00e3
COMMENSAL OVERGROWTH MICROBES			
<i>Desulfovibrio</i> spp.	Proteobacteria	2.05e7	< 7.98e8
<i>Methanobacteriaceae</i> (family)	Euryarchaeota	2.52e8	< 3.38e8
INFLAMMATORY & AUTOIMMUNE-RELATED BACTERIA			
<i>Citrobacter</i> spp.	Proteobacteria	<dl	< 5.00e6
<i>Citrobacter freundii</i>	Proteobacteria	<dl	< 5.00e5
<i>Klebsiella</i> spp.	Proteobacteria	<dl	< 5.00e3
<i>Klebsiella pneumoniae</i>	Proteobacteria	<dl	< 5.00e4
<i>M. avium</i> subsp. <i>paratuberculosis</i>	Actinobacteria	<dl	< 5.00e3
<i>Proteus</i> spp.	Proteobacteria	<dl	< 5.00e4
<i>Proteus mirabilis</i>	Proteobacteria	<dl	< 1.00e3
COMMENSAL INFLAMMATORY & AUTOIMMUNE-RELATED BACTERIA			
<i>Enterobacter</i> spp.	Proteobacteria	2.78e6	< 5.00e7
<i>Escherichia</i> spp.	Proteobacteria	9.64e7	< 3.80e9
<i>Fusobacterium</i> spp.	Fusobacteria	1.58e5	< 1.00e8
<i>Prevotella</i> spp.	Bacteroidetes	5.84e6	< 1.00e8

GI MAP: Commensal/keystone bacteria, page 2

COMMENSAL/KEYSTONE BACTERIA				
COMMENSAL BACTERIA	Phyla	Result		Reference
<i>Bacteroides fragilis</i>	Bacteroidetes	1.21e9 L		1.6e9 - 2.5e11
<i>Bifidobacterium</i> spp.	Actinobacteria	8.29e8		> 6.7e7
<i>Enterococcus</i> spp.	Firmicutes	5.29e5		1.9e5 - 2.0e8
<i>Escherichia</i> spp.	Proteobacteria	7.73e4 L		3.7e6 - 3.8e9
<i>Lactobacillus</i> spp.	Firmicutes	2.09e6		8.6e5 - 6.2e8
<i>Enterobacter</i> spp.	Proteobacteria	1.56e6		1.0e6 - 5.0e7
<i>Akkermansia muciniphila</i>	Verrucomicrobia	<dl L		1.0e1 - 8.2e6
<i>Faecalibacterium prausnitzii</i>	Firmicutes	<dl L		1.0e3 - 5.0e8
<i>Roseburia</i> spp.	Firmicutes	3.23e8		5.0e7 - 2.0e10
BACTERIAL PHyla				
<i>Bacteroidetes</i>	Bacteroidetes	3.67e11 L		8.6e11 - 3.3e12
<i>Firmicutes</i>	Firmicutes	1.55e10 L		5.7e10 - 3.0e11
<i>Firmicutes:Bacteroidetes Ratio</i>		0.04		< 1.0

Microbiome Restoration



Microbiome restoration using prebiotics & foods

- **5 imbalances to address using prebiotics & foods:**

1. Reduce gram-negative Proteobacteria phyla & balance gram-negative Bacteroidetes phyla
2. Support Lactobacillus species
3. Support Bifidobacterium species
4. Support Akkermansia municipihila
5. Support Faecalibacterium prausnitzii

Microbiome restoration using prebiotics & foods

COMMENSAL/KEYSTONE BACTERIA					OPPORTUNISTIC/OVERGROWTH MICROBES				
COMMENSAL BACTERIA		Phyla	Result	Reference	DYSBIOTIC & OVERGROWTH BACTERIA		Phyla	Result	Reference
3	<i>Bacteroides fragilis</i>	Bacteroidetes	1.21e9 L		1.6e9 - 2.5e11	<i>Bacillus</i> spp.	Firmicutes	5.00e5	< 1.76e6
	<i>Bifidobacterium</i> spp.	Actinobacteria	8.29e8		> 6.7e7	<i>Enterococcus faecalis</i>	Firmicutes	<dl	< 1.00e4
	<i>Enterococcus</i> spp.	Firmicutes	5.29e5		1.9e5 - 2.0e8	<i>Enterococcus faecium</i>	Firmicutes	<dl	< 1.00e4
	<i>Escherichia</i> spp.	Proteobacteria	7.73e4 L		3.7e6 - 3.8e9	<i>Morganella</i> spp.	Proteobacteria	<dl	< 1.00e3
	<i>Lactobacillus</i> spp.	Firmicutes	2.09e6		8.6e5 - 6.2e8	<i>Pseudomonas</i> spp.	Proteobacteria	6.65e6 High ↑	< 1.00e4
2	<i>Enterobacter</i> spp.	Proteobacteria	1.56e6		1.0e6 - 5.0e7	<i>Pseudomonas aeruginosa</i>	Proteobacteria	2.58e4 High ↑	< 5.00e2
	<i>Akkermansia muciniphila</i>	Verrucomicrobia	<dl L		1.0e1 - 8.2e6	<i>Staphylococcus</i> spp.	Firmicutes	<dl	< 1.00e4
4	<i>Faecalibacterium prausnitzii</i>	Firmicutes	<dl L		1.0e3 - 5.0e8	<i>Staphylococcus aureus</i>	Firmicutes	4.35e3 High ↑	< 5.00e2
	<i>Roseburia</i> spp.	Firmicutes	3.23e8		5.0e7 - 2.0e10	<i>Streptococcus</i> spp.	Firmicutes	2.57e3 High ↑	< 1.00e3
BACTERIAL PHyla					COMMENSAL OVERGROWTH MICROBES				
1	<i>Bacteroidetes</i>	Bacteroidetes	3.67e11 L		8.6e11 - 3.3e12	<i>Desulfovibrio</i> spp.	Proteobacteria	2.05e7	< 7.98e8
	<i>Firmicutes</i>	Firmicutes	1.55e10 L		5.7e10 - 3.0e11	<i>Methanobacteriaceae</i> (family)	Euryarchaeota	2.52e8	< 3.38e8
	<i>Firmicutes:Bacteroidetes</i> Ratio		0.04		< 1.0	INFLAMMATORY & AUTOIMMUNE-RELATED BACTERIA			
1	<i>Citrobacter</i> spp.	Proteobacteria	<dl		< 5.00e6	<i>Citrobacter freundii</i>	Proteobacteria	<dl	< 5.00e5
	<i>Klebsiella</i> spp.	Proteobacteria	<dl		< 5.00e3	<i>Klebsiella pneumoniae</i>	Proteobacteria	<dl	< 5.00e4
	<i>M. avium</i> subsp. <i>paratuberculosis</i>	Actinobacteria	<dl		< 5.00e3	<i>Proteus</i> spp.	Proteobacteria	<dl	< 5.00e4
	<i>Proteus mirabilis</i>	Proteobacteria	<dl		< 1.00e3	COMMENSAL INFLAMMATORY & AUTOIMMUNE-RELATED BACTERIA			
1	<i>Enterobacter</i> spp.	Proteobacteria	2.78e6		< 5.00e7	<i>Escherichia</i> spp.	Proteobacteria	9.64e7	< 3.80e9
	<i>Fusobacterium</i> spp.	Fusobacteria	1.58e5		< 1.00e8	<i>Prevotella</i> spp.	Bacteroidetes	5.84e6	< 1.00e8

Prebiotics: a brief introduction

- **Prebiotics:** non-digestible foods that promote the growth of beneficial microorganisms in the gut (probiotics are live microorganisms)
- Best way to take prebiotics in therapeutic quantities is to supplement them
 - Take with meals: mixed into water directly before a meal or sprinkled onto a meal
 - Titrate slowly!
 - Supplement later in the day to avoid discomfort during waking hours
- Allow up to 3 months to titrate in full recommended doses of prebiotics
- It can take 6-12 months - 2 years of prebiotic supplementation & diet diversity to eliminate the last of a client's lingering GI symptoms

1. Reduce Proteobacteria & balance Bacteroidetes

- **Ideal levels:** Bacteroidetes phyla: < 35%, Proteobacteria phyla: < 4%
- Improving the terrain of the gut microbiome rather than following a 'kill only' approach to balance these phyla
- This approach is not recommended to bring down lots of bacterial pathogens or lots of opportunistic or overgrowth bacteria. It is for balancing commensal bacteria & small populations of opportunistic or overgrowth bacteria on lab testing

Prebiotics: Proteobacteria & Bacteroidetes

- **Galactooligosaccharides or GOS**

- All supplemental forms of GOS (that I know of) are dairy-derived
- Not all clients are going to tolerate this prebiotic supplement due to dairy so you may need to focus on foods for this prebiotic
- The recommended supplement dosing for GOS is 3 grams per day

Prebiotics: Proteobacteria & Bacteroidetes

- **Galactooligosaccharides or GOS products:**
 - Bimuno, Daily sachets: 1 sachet per day
 - Ariya Purity, GOS Powder: 3g per day
 - Klaire Labs, Galactomune Powder: blend of GOS (2.5g) & beta-glucans, 1 scoop per day
 - Microbiome Labs, MegaPre: 4g blend of GOS, FOS & XOS, 1-2 scoops per day

Prebiotics: Proteobacteria & Bacteroidetes

- **Fructooligosaccharides or FOS**

- Derived from chicory root
- Hardest prebiotic to tolerate, try to titrate FOS in last
- FOS & inulin are different - FOS has a shorter fermentation time so use this instead of inulin where possible
- The recommended supplement dosing for FOS is 3 grams per day

Prebiotics: Proteobacteria & Bacteroidetes

- **Fructooligosaccharides or FOS products:**
 - Ariya Purity Synergy, Inulin/FOS Powder: 3g per day
 - Jarrow Formulas, Inulin/FOS Powder: 3g per day
 - Microbiome Labs, MegaPre: 4g blend of GOS, FOS & XOS, 1-2 scoops per day

Prebiotics: Proteobacteria & Bacteroidetes

- **Lactulose**

- Derived from lactose, may not be tolerated by clients who have a dairy allergy or lactose intolerance
- Hard to source in the USA – need a Doctor's prescription
- Acidifies the colon, makes it inhospitable for Proteobacteria
- Titrate very slowly!
- The recommended supplement dosing for Lactulose is 5mL per day

Prebiotics: Proteobacteria & Bacteroidetes

- **Lactulose products:**

- USA/CAN: prescription only, check for fillers or added sugars, 5mL per day
- AUS/NZ: Actilax: 5mL per day
- UK/EU: Boots Lactulose: 5mL per day

Foods: Proteobacteria & Bacteroidetes

- **High fiber, whole foods diet with prebiotic-rich foods:**
 - **GOS:** legumes, brassica family vegetables, fresh beans, beets, sunflower seeds, pumpkin seeds & LSA mix
 - **FOS:** Jerusalem artichokes (sunchokes or sun artichokes), yacon tubers, burdock roots, chicory root, dandelion roots, garlic, onion, leek, asparagus & globe artichoke
- **Decrease dietary fat intake** for clients who are following a high-fat diet
 - Many Bacteroidetes & some Proteobacteria are bile acid consumers

2. Supporting Lactobacillus species

- **Ideal levels:** 0.01 - 1% (very small amount!)
- Lactobacillus strains important for vagina health - 70-90% of the vaginal microbiome
- **Benefits of Lactobacillus as a part of the gut microbiome:** Colonization resistance against Proteobacteria, SCFA & lactate production, acidifies the colon, can produce GABA, supports the activity of many medicinal herbs, aids absorption of dietary polyphenols
- You can have too much lactobacillus but very rarely occurs. People who have a short bowel are at higher risk of negative consequences of high levels of lactobacillus in their gut (D-lactate acidosis)

Prebiotics to restore Lactobacillus

- **Konjac glucomannan**
 - Derived from the root vegetable konjac
 - Well tolerated prebiotic
 - Best choice for feeding Lactobacillus species
 - The recommended supplement dosing for Konjac glucomannan is 1.5 grams 3x per day

Prebiotics to restore Lactobacillus

- **Konjac glucomannan products:**
 - Now Foods, Glucomannan powder or capsules: ½ tsp 3x daily or 3 caps 3x daily
 - Powdered product: take it with water since it can absorb up to 100x its own weight in liquid & can be hard to get down

Prebiotics to restore Lactobacillus

- **Lactulose**

- The recommended supplement dosing for Lactulose is 5 - 15+ mL per day
- Doses higher than 5mL may cause bloating, gas & stool changes
- Titrate very slowly!

- **Lactulose products:**

- USA/CAN: prescription only, check for fillers or added sugars, 5-15mL per day
- AUS/NZ: Actilax: 5-15mL per day
- UK/EU: Boots Lactulose: 5-15mL per day

Prebiotics to restore Lactobacillus

- **Partially hydrolysed guar gum or PHGG**
 - Derived from the guar bean
 - Most tolerated prebiotic overall
 - Best choice if you can't access konjac glucomannan or lactulose
 - The recommended supplement dosing for PHGG is 5 grams per day

Prebiotics to restore Lactobacillus

- **Partially hydrolysed guar gum or PHGG products:**
 - BioMedica, GI Restore: contains PHGG (5g) & Acacia Fiber (2.5g), 7.5g per day
 - Tomorrow's Nutrition, Sun Fiber: 5g per day
 - Healthy Origins, Natural Healthy Fiber: 5g per day

Foods to restore Lactobacillus

- **Specific prebiotic-like & polyphenol-rich foods:** black currant powder, almonds, green tea & dark cacao powder
- **Konjac root:** contains konjac glucomannan. Whole konjac root or noodles/rice/pasta made from konjac
- **Fermented foods:** contain live lactobacillus species. Start with sauerkraut or other fermented vegetable juice & build up to a variety of fermented foods each week, including kimchi, kefir, kvass, tamari, miso & tempeh

3. Supporting Bifidobacteria species

- **Ideal levels:** > 2.5 - 5.0%
- Some species are fragile, can get extinct from poor diet or antibiotic use
- **Benefits of Bifidobacteria as a part of the gut microbiome:** Colonization resistance against Proteobacteria, acidifies the colon, supports the activity of medicinal herbs, aids absorption of dietary polyphenols, protects from & heals GI damage, modulates the immune system, protects from viral infections & helps produce B vitamins - B1, 2, 3, 6, 7, 9 & 12
- **Boosting levels of Bifidobacteria:** decreases endotoxin levels, improves leaky gut, improves mood disorders, protective against insulin resistance, some strains can produce GABA

Prebiotics to restore Bifidobacteria

- **Acacia Fiber**
 - Derived from acacia trees
 - Well tolerated prebiotic
 - Best choice for feeding Bifidobacteria species
 - The recommended supplement dosing for acacia fiber is 10 grams per day

Prebiotics to restore Bifidobacteria

- **Acacia Fiber products:**

- Protocol for Life Balance, Organic Acacia Fiber powder: 10g per day
- Now Foods, Organic Acacia Fiber powder: 10g per day
- BioMedica, GI Restore: contains PHGG (5g) & Acacia Fiber (2.5g), 7.5g per day can be added to one of the above products if needing to supplement PHGG & Acacia

Prebiotics to restore Bifidobacteria

- **Lactulose**
 - The recommended supplement dosing for Lactulose is 5 mL per day
- **Lactulose products:**
 - USA/CAN: prescription only, check for fillers or added sugars, 5mL per day
 - AUS/NZ: Actilax: 5mL per day
 - UK/EU: Boots Lactulose: 5mL per day

Prebiotics to restore Bifidobacteria

- **GOS & FOS**

- The recommended supplement dosing for GOS is 3 grams per day
- The recommended supplement dosing for FOS is 3 grams per day

- **GOS & FOS products:**

- Microbiome Labs, MegaPre: 4g blend of GOS, FOS & XOS, 2 scoops / day
- Bimuno, Daily sachets (GOS): 1 sachet per day
- Ariya Purity, GOS Powder: 3g per day
- Klaire Labs, Galactomune Powder: GOS (2.5g) & beta-glucans, 1 scoop/day
- Ariya Purity Synergy or Jarrow Formulas, Inulin/FOS Powder: 3g per day

Foods to restore Bifidobacteria

- **Wholefoods diet with lots of plant-foods & fiber:** daily consumption of polyphenol-rich foods, prebiotic-rich foods & prebiotic-like foods
- **Polyphenol-rich foods:** dark black/blue fruits (elderberries, black currants, blueberries, cherry, strawberry, blackberry, plum, raspberry, red apple, black grapes), nuts & seeds (flax, chestnuts, hazelnuts, pecans, black tahini), vegetables (purple & red carrot, purple & red potato, red cabbage, spinach, red onion, broccoli, carrot, red lettuce), grains (red & black rice, red & black quinoa), black olives & olive oil

Foods to restore Bifidobacteria

- **Prebiotic-rich foods:**
 - **GOS:** legumes, brassica family vegetables, fresh beans, beets, sunflower seeds, pumpkin seeds & LSA mix
 - **FOS:** Jerusalem artichokes (sunchokes or sun artichokes), yacon tubers, burdock roots, chicory root, dandelion roots, garlic, onion, leek, asparagus & globe artichoke
- **Prebiotic-like foods:** brown rice, carrots, black currants, dark cacao powder, almonds, green tea

4. Supporting *Akkermansia muciniphila*

- **Ideal levels:** 1 - 3%
- Gram-negative bacteria, supports the gut lining to maintain integrity by producing mucin & helps to metabolize excess mucin in the gut
- **Benefits of *Akkermansia* as a part of the gut microbiome:** supports metabolic health, blood sugar regulation, inflammation management & weight loss interventions. Associated with having a more diverse & healthy gut microbiome, low levels are associated with leaky gut
- **Elevated *Akkermansia*:** over 5 - 7% is a clue for severe inflammation & common to have mucus in the stool as a result. *Akkermansia* levels will normalize as inflammation & excess mucin levels go down

Prebiotics to restore Akkermansia

- **Fructooligosaccharides or FOS**
 - Best choice for feeding Akkermansia
 - The recommended supplement dosing for FOS is 3-6 grams per day
- **Fructooligosaccharides or FOS products:**
 - Ariya Purity Synergy, Inulin/FOS Powder: 3-6g per day
 - Jarrow Formulas, Inulin/FOS Powder: 3-6g per day
 - Microbiome Labs, MegaPre: 4g blend of GOS, FOS & XOS, 3 scoops per day – not the best choice

Prebiotics to restore Akkermansia

- **Lactulose**
 - The recommended supplement dosing for Lactulose is 5 mL per day
- **Lactulose products:**
 - USA/CAN: prescription only, check for fillers or added sugars, 5mL per day
 - AUS/NZ: Actilax: 5mL per day
 - UK/EU: Boots Lactulose: 5mL per day

Foods to restore Akkermansia

- **Foods high in omega-3 fats:** oily fish (salmon, mackerel, sardines, herring), cod liver or fish oil, flax seeds or oil, chia seeds, walnuts
- **Fasting:** for 12+ hours can help to boost populations
- **Red polyphenol-rich foods:** red rice, red quinoa, cranberry, red apple skin, red grapes, lingonberries, pomegranate & red dragon fruit
- Other options since Akkermansia can be hard to support:
 - Pendulum, Akkermansia probiotic supplement: 1 capsule 2x daily
 - If populations don't recover after 1-2 years of prebiotics & foods, consider FMT (fecal microbial transplantation)

5. Supporting *Faecalibacterium prausnitzii*

- **Ideal levels:** 10 - 15% & up to 25%
- Most abundant bacteria in the gut & the biggest butyrate producer
- Considered important indicator for overall gut health, higher levels indicates a more diverse & healthy gut microbiome
- **Benefits of *Faecalibacterium* as a part of the gut microbiome:** produces butyrate, supports gut lining integrity, anti-inflammatory support, reduces risk of GI conditions & cancers, improves insulin sensitivity, can help with sleep & mood
- Can be killed off by chemotherapy, Chron's & Coeliac disease. GF & low-FODMAP diets can significantly reduce numbers

Prebiotics to restore Faecalibacterium

- **Fructooligosaccharides or FOS**
 - Best choice for restoring Faecalibacterium
 - The recommended supplement dosing for FOS is 3-6 grams per day
 - 10 grams per day recommended in the literature but not well tolerated
- **Fructooligosaccharides or FOS products:**
 - Ariya Purity Synergy, Inulin/FOS Powder: 3-6g per day
 - Jarrow Formulas, Inulin/FOS Powder: 3-6g per day
 - Microbiome Labs, MegaPre: 4g blend of GOS, FOS & XOS, 3 scoops per day – not the best choice

Prebiotics to restore Faecalibacterium

- **Galactooligosaccharides or GOS**
 - All supplemental forms of GOS (that I know of) are dairy-derived
 - The recommended supplement dosing for GOS is 3 grams per day
- **Galactooligosaccharides or GOS products:**
 - Bimuno, Daily sachets: 1 sachet per day
 - Ariya Purity, GOS Powder: 3g per day
 - Klaire Labs, Galactomune Powder: blend of GOS (2.5g) & beta-glucans, 1 scoop per day
 - Microbiome Labs, MegaPre: 4g blend of GOS, FOS & XOS, 1-2 scoops / day

Prebiotics to restore Faecalibacterium

- **Lactulose**
 - The recommended supplement dosing for Lactulose is 5 mL per day
- **Lactulose products:**
 - USA/CAN: prescription only, check for fillers or added sugars, 5mL per day
 - AUS/NZ: Actilax: 5mL per day
 - UK/EU: Boots Lactulose: 5mL per day

Foods to restore Faecalibacterium

- **Prebiotic-rich foods:**
 - **GOS:** legumes, brassica family vegetables, fresh beans, beets, sunflower seeds, pumpkin seeds & LSA mix
 - **FOS:** Jerusalem artichokes (sunchokes or sun artichokes), yacon tubers, burdock roots, chicory root, dandelion roots, garlic, onion, leek, asparagus & globe artichoke
- **Apple pectin:** red or green apples, pectin comes from the pulp (or apple pectin powder as a supplement)
- **Starches in general:** starchy vegetables, legumes, grains
- **Grape polyphenols:** higher quantities in red grapes, including red wine

Final thoughts...

- Long-term use of prebiotics & a diverse diet (1-2 years) consistently shows gut microbiome diversity being greatly improved & correlates with overall improvements in both gut & general health markers
- **If you want to learn more:** I mentor practitioners who want to upskill in SIBO & microbiome restoration work. If you want to learn more you can review my website: <https://bellalindemann.com/practitioner-education>
- **Questions, thoughts or feedback?**



THE FUNCTIONAL

Gut Health Clinic

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