Gut Health for the Primary Care Physician
Jennifer Pfleghaar, DO, FACEP
Gut Health for the Primary Care Physician

Objectives:

1. To understand the importance of gut health
2. To be able to recommend probiotic strains for specific medical conditions.
3. To identify the symptoms of leaky gut syndrome.
About me

- Medical School: Lake Erie College of Osteopathic Medicine
- Residency: St Vincent’s Toledo, OH
- Board Certified Emergency Medicine Physician
- Fellowship: Arizona College of Integrative Medicine
- Owner and Medical Director PflegMed: Center for Integrative Medicine
- Owner and certified yoga teacher at Perrysburg Yoga
Gut Health

- Gut microbiota’s weight can be up to 1-2 kg
- Estimated that 500–3000 different microbial species inhabit the gastrointestinal tract (4)
- 95% of our own bacteria in located in the GI tract
- The GI tract surface is as big as 2 tennis courts
- In our body microbes outnumber human cells by 10:1
Babies develop their gut microbiome starting at birth and over the next 2 - 4 years of their life.

They then develop their gut microbiome by their birth (passing through the vaginal canal), suckling at the breast and putting hands, etc. into their mouth.
Immune System

- The gut is the biggest immune organ of the human body.
- Immune cells in gut-associated lymphatic tissue (GALT) account for about 70 to 80% of the total immunologically active cells.
- Regulates the immune response (inflammatory cytokines [39]).
Neurotransmitters and the gut microbiota

- More than 90% of 5-HT (enterochromaffin cells and gut bacteria) and 50% of dopamine (DA) are synthesized in the gut [37]

- Regulates the concentration and activity of gut peptides/gut hormones, including insulin, glucagon, gastrin, cholecystokinin, and leptin [38]
Image: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6142822/#B43
Intestinal Permeability

- Damage to the integrity of the biofilm can result in alteration in intestinal permeability, now widely described as leaky gut.[13]

- Breakdown of the intercellular junction between the intestinal mucosal cells

- Diffusion of potentially immune-activating substances from the gut contents to have contact with the immune system on the interior surface of the intestinal mucosa [12]
Symptoms of “leaky gut”

- Autoimmune diseases [24]
- Allergies
- IBS
- Diarrhea, Constipation
- Mood disorders
Conditions that impair gut health

- Medications (NSAIDS, Chemo) [31, 32]
- PPIs and C.Difficile Infection- increased Enterococcaceae and Streptococcaceae taxa (8)
- Antibiotics (especially in early childhood) (6)
- Diet (alcohol) [33]
- Stress [30] and Exercise [28]
- Gastroenteritis [29]
Probiotics

Probiotics are nonpathogenic organisms (yeast or bacteria, especially lactic acid bacteria) in foods that can exert a positive influence on the host’s health. (1)
Mechanisms of action for probiotics in the gastrointestinal tract

- Nutritional Benefits
  - Assist in the breakdown of undigestible foods, to produce usable nutrients

- Block effects of pathogenic bacteria
  - Reduce pathogen binding
  - Decrease luminal pH
  - Produce antibacterial bacteriocins

- Neuronal effects
  - Induce mu-opioid and cannabionoid receptors on epithelial cells
  - Reduce visceral hypersensitivity and stress response

- Modulate intestinal immune function
  - Reduce pro-inflammatory cytokines
  - Promote tolerogenic cytokine profiles and regulatory pathways
  - Increase secretory IgA

- Promote epithelial cell homeostasis
  - Enhance barrier function
  - Promote cytoprotective responses, improve cell survival, and increase mucin production

Image: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3424311/
Dietary sources of probiotics

- Fermented and cultured foods

- Examples: yogurt, kefir, natto, tempeh, olives, miso soup, kimchee, sauerkraut, fermented vegetables, pickled ginger, raw pickles, hard cheeses, sourdough bread, kombucha, green tea, black tea, beer, and wine

- Fermented foods provide a rich source of probiotics, including Lactobacillus and Bifidobacteria, to inoculate the gut. (5)

- Fermentation makes foods more digestible, increases vitamin and enzyme activity, and extends shelf life.
Fresh vs Fermented

- Study: 180 G fresh vs fermented Kimchi per day for 8 weeks, colonic studies.

- Women who consumed the fermented Kimchi had influence on the expression of human genes related to metabolism by alternating gut microbial composition (7)
A triple blinded RCT study- results show improvement in body composition and blood pressure

Patients were given 2 probiotic capsules per day (or placebo)

Study suggest that the gut microbiome differs between healthy individuals and those with metabolic syndrome and that dysbiosis correlates with obesity

Imbalance in the gut microbiota can promote the transfer of endotoxins across the intestinal barrier, driving systemic inflammation, oxidation, and metabolic disease.[9]

Healthy microbiota help to suppress the appetite, increase energy expenditure, and regulate lipid metabolism.[10]
Effect of Lactobacillus gasseri BNR17 on Overweight and Obese Adults: A Randomized, Double-Blind Clinical Trial

- This microbe is native to the human gut and vaginal tracts of healthy women.
- Helps keep Clostridium, Listeria and Enterococcus in check.
- Adults showing with supplementation of L. gasseri there was a reduced weight and waist circumference. [25]
Akkermansia muciniphila

- Low levels higher risk of leaky gut
- High levels inversely associated with inflammatory markers, lipid synthesis, and several plasma markers of insulin resistance, cardiovascular risk and adiposity
- Study: mice fed a high fat diet- decrease in commensal Akkermansia [2]
- Inversely correlates with the onset of inflammation, altered adipose tissue metabolism and metabolic disorders during obesity in mice [14]
- How to increase? Dietary inulin and butyrate [13]
Probiotics in disease

- Prevention of Traveler’s diarrhea: Saccharomyces boulardii [20]
- Prevention of antibiotic associated diarrhea: Lactobacillus rhamnosus (LGG) and S. boulardii [20]
- Treatment of infant colic: L. reuteri [20]
- Depression: reduction of depression score scale [26]
- Treatment of atopic dermatitis [27]
- ASD: improved symptoms and GI complaints [17]
- Vaginitis [36] and UTIs
- NAFLD-NASH: pro and probiotics, animal and pilot studies underway [19]
Specific probiotic strains

- Lactobacillus: IBS, recurrent UTIs [22]
- Bifidobacterium: IBS (and depression scores) [21]
- VSL #3: Ulcerative Colitis (combination of Lactobacillus and Bifidobacterium) [18]
- Lactobacillus casei: reduces inflammation in RA (improves inflammatory cytokines) [23]
- Lactobacillus rhamnosus GG: acute diarrhea in children [15], Post part depression and anxiety [16], Pregnancy and infancy for eczema [17]
- L plantarum: ASD, improved symptoms and GI complaints
Prebiotics

- Encourage growth and modify activity of beneficial bacteria
- The starches that provide a fermentable food source for intestinal Lactobacilli and Bifidobacteria to thrive
SCFAs

❖ Short Chain Fatty Acids

❖ Bacterial digestion of prebiotic foods also produces short-chain fatty acids (eg, butyric acid), which colonocytes use for health, maintenance, and repair.

❖ Butyrate, a SCFA, may reduce intestinal permeability
Examples of prebiotics: Dietary

- Chicory Root
- Dandelion Greens
- Jerusalem artichokes
- Garlic
- Onions
- Leeks
- Asparagus
- Bananas
- Apples
- Konjac Root
- Cocoa
- Flaxseeds
- Burdock Root
- Yacon Root
- Jicama Root
- Seaweed
Examples of prebiotics: supplements

- Acacia
- Green banana flour
- Inulin
- Resistance starch
- Larch wood (Arabinogalactan)
Polyphenols

- Found in fruits and vegetables act in a similar way as prebiotics increasing populations of beneficial bacteria (3).
- Promote the growth of Lactobacilli and Bifidobacteria by serving as a food source
- Inhibits growth of pathogens
- Metabolites exert antioxidant and anti-inflammatory actions supporting gut health
- Examples of polyphenol-rich foods include apples, onions, chocolate, green tea, and red wine
Effects of dietary polyphenols on modulation of intestinal ecology

- Phenolic compounds alter gut microbiota and, consequently, alter the Bacteroides/Firmicutes balance.

- Growth of certain pathogenic bacteria (Clostridium perfringens, C. difficile and Bacteroides spp.) was repressed by tea phenolics.

- Commensal anaerobes like Bifidobacterium spp. and probiotics such as Lactobacillus sp. were less severely affected. (4)
Functional/Integrative approach

- Remove
- Replace
- Restrain
- Re-feed
- Relieve
- Reinoculate
- Repair
- Rebalance
- Reconnecting Social Connection
- Reconsider alternatives
Remove

- Bad bugs, allergens - these tend to promote inflammation and break down barrier defenses
- Stool studies can help differentiate between beneficial or pathological bacteria
Replace

- Digestive enzymes
- Digestive Bitters

- Deficiency of hydrochloric acid and/or digestive enzymes allows colonization of pathogenic gut bacteria and promotes malabsorption of nutrients
Restrain

- Restrain from inflammation
- Stress
- Standard American Diet
Re-feed

- Whole foods
- Anti-inflammatory foods
- Prebiotics
Reinoculate

- Probiotics
- Fermented food
- Support a healthy gut environment
Relieve

- Relief from symptoms
- Nutraceutical and herbal supplements can often times help break the vicious cycle of pain and discomfort
- Ex: ginger, DGL
Repair

- Barrier defense (supplements)
- Promote integrity of the and prevent leakage of toxins from the digestive tract into the body
Rebalance

- Stress management
- Allows proper digestion function and motility (parasympathetics)
Reconnecting Social Connections

- Brings calmness which can help lower stress and improve digestion function
Reconsider Alternative Modalities

- Energy medicine
- Hypnosis
- EMDR therapy [34]
Treatment examples

- Whole 30 diet, climate gluten, or ketogenic
- Prebiotics
- Probiotics
- l-glutamine at dosages of 500-10,000 mg daily
- Quercetin (1000-4000 mg)
- Slippery elm (500-2000 mg)
- DGL licorice (chews as needed)
- Zinc-Carnosine (75 mg)
## Probiotics Rx

<table>
<thead>
<tr>
<th>Brand:</th>
<th>Condition:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Align (Bifidobacterium infantis)</td>
<td>IBS</td>
</tr>
<tr>
<td>BioGaia (L. reuteri protectis)</td>
<td>IBS/ Acute Infectious Diarrhea</td>
</tr>
<tr>
<td>Bio-K+ (L. acidophilus, L casei)</td>
<td>AAD and CDAD prevention</td>
</tr>
<tr>
<td>Culturelle (L. rhamnosus GG)</td>
<td>AAD and CDAD prevention, Infectious diarrhea prevention/tx</td>
</tr>
<tr>
<td>Florastor (Saccharomyces Boulardii)</td>
<td>AAD and CDAD prevention, Infectious diarrhea prevention/tx and Crohns</td>
</tr>
<tr>
<td>VSL#3 (combination probiotic)</td>
<td>IBS, UC</td>
</tr>
</tbody>
</table>

IBS: Irritable Bowel Syndrome  
AAA: Antibiotic Associated Diarrhea  
CDAD: Clostridium Difficile Associated Diarrhea
<table>
<thead>
<tr>
<th>Clinical condition</th>
<th>Strained probiotic species</th>
<th>Studied products*</th>
<th>Third-party tested products</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Atopic dermatitis</em></td>
<td><em>Bifidobacterium</em> animals subsp. lactis</td>
<td>Align, Bo-Ku, Cultyre, DanActive, Faunus, HolmOne, Rinkin, NIKJAI-3551, VS1</td>
<td>Garden of Life, Ruff Products, Ultimate Care, howtousp, Probiotic-1C, Renew Life, Ultimate Flora, SedaLabs, Lactobacillus reuteri, Probiotics</td>
<td>Broad-spectrum antibiotic treatment, products likely to have the most benefit consider <em>Bifidobacterium</em> species per day of each organism</td>
</tr>
<tr>
<td><em>Helicobacter pylori</em></td>
<td><em>Bifidobacterium</em> animals, breve, <em>Lactobacillus</em> animalis, <em>Lactobacillus</em> casei, <em>Lactobacillus</em> rhamnosus, <em>Streptococcus thermophiles</em></td>
<td>Biod, Cultyre, Lactisen</td>
<td>Garden of Life, Ruff Products, Ultimate Care, howtousp, Probiotic-1C, Renew Life, Ultimate Flora, SedaLabs, Lactobacillus reuteri, Probiotics</td>
<td>Adjunct to antibiotics</td>
</tr>
<tr>
<td><em>Hepatitis</em></td>
<td><em>Bifidobacterium</em> animals, breve, <em>E. coli</em>, <em>Lactobacillus</em> animalis, <em>Lactobacillus</em> casei, <em>Lactobacillus</em> rhamnosus, <em>Peptostreptococcus</em></td>
<td>Align, Moraden, VS1</td>
<td>Garden of Life, Ruff Products, Ultimate Care, howtousp, Probiotic-1C, Renew Life, Ultimate Flora, SedaLabs, Lactobacillus reuteri, Probiotics</td>
<td></td>
</tr>
<tr>
<td><em>Ulcerative colitis</em></td>
<td><em>Bifidobacterium</em> animals subsp. lactis, breve, <em>E. coli</em>, <em>Lactobacillus</em> animalis, <em>Lactobacillus</em> casei, <em>Lactobacillus</em> rhamnosus, <em>Peptostreptococcus</em></td>
<td>Align, Biod, Cultyre, Moraden, VS1</td>
<td>Garden of Life, Ruff Products, Ultimate Care, howtousp, Probiotic-1C, Renew Life, Ultimate Flora, SedaLabs, Lactobacillus reuteri, Probiotics</td>
<td>IPS-9 and similar high-dose multispecies products with several <em>Bifidobacterium</em> species are preferred</td>
</tr>
</tbody>
</table>

CFU = colony-forming unit

*—Not available by this name in the United States
Information from references 9 through 10, and 12 through 27
Table 1. Summary of Gastrointestinal Conditions That May Benefit from Probiotic Use (continued)

<table>
<thead>
<tr>
<th>Chronic Condition</th>
<th>Probiotic species</th>
<th>Studied probiotic strain(s)</th>
<th>Third-party branded product</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irritable bowel syndrome</td>
<td><em>Eubacterium</em> rectale, <em>Lactobacillus</em> acidophilus, <em>Bifidobacterium</em> bifidum</td>
<td>Alginate, Alg 01, Beedi, Biorn</td>
<td>—</td>
<td><em>Double arm study showing clinical efficacy</em></td>
</tr>
<tr>
<td><em>E. coli</em> O157-H7 enteritis</td>
<td><em>E. coli</em> O157-H7</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

*CTU*: chronic treating unit

1. A meta-analysis of 33 RCTs with 11,811 children and adults that compared probiotics with placebo or no treatment reported a significant reduction in the risk of antibiotic-associated diarrhea (NNT = 13). A meta-analysis of adult patients showed a reduction in antibiotic-associated diarrhea (15 RCTs in 2,295 patients; NNT = 11) and a reduction in *C. difficile* infection (nine RCTs, 1,399 patients; NNT = 30) among patients randomly assigned to probiotics vs. placebo. A Cochrane review of 38 RCTs reported that probiotics significantly reduced the risk of *C. difficile*-associated diarrhea vs. placebo (ARR = 0.23; 95% CI 0.14 to 0.39). This review did not find a significant difference in *C. difficile* infection with probiotics compared with placebo. A meta-analysis of 70 RCTs with 5,384 adults and children demonstrated a significantly decreased rate of *C. difficile*-associated diarrhea (NNT = 50). A meta-analysis of two low-quality RCTs including 49 children and adults found no significant effect of yogurt vs. placebo to prevent antibiotic-associated diarrhea.

# H. pylori Infection

There are inconsistent results on the effectiveness of probiotics in an adjunct to antibiotic therapy to improve *Helicobacter pylori* eradication rates. A meta-analysis of nine RCTs involving 1,163 children and adults found

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https://www.aafp.org/afp/2017/0801/p170.html
Stool study example
### Digestion and Absorption

<table>
<thead>
<tr>
<th>Test</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
<th>Reference Range</th>
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</thead>
<tbody>
<tr>
<td>Pancreatic Elastase ↑</td>
<td>50C</td>
<td></td>
<td></td>
<td></td>
<td>200</td>
<td>&gt;200 mcg/g</td>
</tr>
<tr>
<td>Products of Protein Breakdown (Total)†</td>
<td>5.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.8-9.3 micromol/g</td>
</tr>
<tr>
<td>Fecal Fat (Total)†</td>
<td>&gt;105.1</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td>3.2-38.6 mg/g</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>13.8</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td>3.3-2.3 mg/g</td>
</tr>
<tr>
<td>Long Chain Fatty Acids</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.2-25.1 mg/g</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>2.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.4-4.5 mg/l</td>
</tr>
<tr>
<td>Phospholipids</td>
<td>&gt;24.0</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td>3.2-6.3 mg/l</td>
</tr>
</tbody>
</table>

### Inflammation and Immunology

<table>
<thead>
<tr>
<th>Test</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
<th>Reference Range</th>
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<tbody>
<tr>
<td>Calprotectin ↑</td>
<td>&lt;17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt;=50 mcg/g</td>
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<tr>
<td>Eosinophil Protein X (EPOX)†</td>
<td>&lt;DL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt;=4.6 mcg/g</td>
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<tr>
<td>Fecal secretory IgA</td>
<td></td>
<td>129</td>
<td></td>
<td></td>
<td></td>
<td>&lt;=885 ng/ml</td>
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</table>

### Metabolic

<table>
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<th>5th</th>
<th>Reference Range</th>
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</thead>
<tbody>
<tr>
<td>Short Chain Fatty Acids (SCFA) (Total)†</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&gt;=23.3 micromol/g</td>
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<tr>
<td>n-Butyrate Concentration</td>
<td>15.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&gt;=3.6 micromol/g</td>
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<tr>
<td>n-Butyrate %</td>
<td>42.5</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td>11.8-23.3 %</td>
</tr>
<tr>
<td>Acetate %</td>
<td>38.0</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
<td>48.1-60.2 %</td>
</tr>
<tr>
<td>Propionate %</td>
<td>15.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt;=29.3 %</td>
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<tr>
<td>Beta-glucuronidase</td>
<td>1.27</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>368-6,266 U/g</td>
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</tbody>
</table>

*Total value is equal to the sum of all measurable parts.
†These results are not represented by quintile values.
A L. Taubman-Brooks, PhD, DURAM: (L. L. B. Rounds). C1A: (CA): #1400555021; Medtronic I/R: #34-4575.
\*Tests were developed and their performance characteristics determined by Genova Diagnostics. Unless otherwise noted with *, the assays have not been cleared by the U.S. Food and Drug Administration.
## Gastrointestinal Microbiome

### Commensal Bacteria (PCR)

<table>
<thead>
<tr>
<th>Bacteria/Phylum</th>
<th>Result</th>
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<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
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</thead>
<tbody>
<tr>
<td><strong>Bacteroides Phylum</strong></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Bacteroides Prevotella group</td>
<td>8.6E8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.4E8-1.5E9</td>
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<tr>
<td>Bacteroides vulgatus</td>
<td>9.3E8</td>
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<td></td>
<td></td>
<td></td>
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<td>&lt;=2.2E9</td>
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<tr>
<td>Gemmatales spp.</td>
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<td></td>
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<td>&lt;=1.6E8</td>
</tr>
<tr>
<td>Oscillospora spp.</td>
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<td>&lt;=8.1E7</td>
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<td>Peptostreptococcus</td>
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<td></td>
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<td>1.4E8-1.4E7</td>
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<tr>
<td><strong>Firmicutes Phylum</strong></td>
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<tr>
<td>Anaerococcus colitidios</td>
<td>2.4E7</td>
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<td>Bacillus coagulans</td>
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<td>1.7E8-1.5E10</td>
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<tr>
<td>Coprococcus acclavus</td>
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<tr>
<td>Mucispirillum hamatum</td>
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<td>5.5E7-4.1E9</td>
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<tr>
<td>Lachnospirales spp.</td>
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<td>5.3E8-5.2E8</td>
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<td>Peptostreptococcus candidatus</td>
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<tr>
<td>Ruminococcus spp.</td>
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<td>9.9E7-1.6E8</td>
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<tr>
<td>Veillonella spp.</td>
<td>1.2E6</td>
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<td>1.2E6-6.6E7</td>
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<tr>
<td><strong>Actinobacteria Phylum</strong></td>
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<tr>
<td>Bifidobacterium spp.</td>
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The gray shaded portion of a line indicates the proportion of the reference population with results below detection limit.

Commensal strains' and reference sample values are displayed in a color-coded version of scientific notation, where the capital letter "E" indicates the exponent value [eg. 7.1E3 indicates 7.1 x 10^3].

The Firmicutes/Firmicutes ratio (F/F Ratio) is estimated by utilizing the lowest and highest values of the reference range for individual organisms when patient results are reported as "OL" or "<=".

©GenicaDiagnostics Robert H. David, Ph.D. Lab Director - C.M.L. Lab-ID: 1002923461 - Medicare L1, F5-4915. Georgia Lab Code: K1777047
**Microbiology Legend**

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**Bacteriology (Culture)**

- *Lactobacillus spp.*
  - 1+ NP
  - 2+ NP
  - 3+ NP
  - 4+ NP

- *E. coli*
  - 3+ NP

- *Bifidobacterium*

**Additional Bacteria**

- *Bacillus species*
  - 1+ NP

- *gamma haemolytic Streptococcus*
  - 4+ NP

**Mycology (Culture)**

- NG

---

Human microflora is influenced by environmental factors and the competitive ecosystem of the organisms in the GI tract. Pathogenic significance should be based upon clinical symptoms.

**Additional Bacteria**

**Non-Pathogen**: Organisms that fall under this category are those that constitute normal, commensal flora, or have not been recognized as etiological agents of disease.

**Potential Pathogen**: Organisms that fall under this category are considered potential or opportunistic pathogens when present in heavy growth.

**Pathogen**: The organisms that fall under this category have a well-recognized mechanism of pathogenicity in clinical literature and are considered significant regardless of the quantity that appears in the culture.
Plan

- Probiotics - improve commensal bacteria (crowd out bad)

- Prebiotics - low SCFA, use Acacia fiber

- High IgA - food allergies? Intestinal permeability? l-glutamine and quercetin, consider elimination diet

- High fecal fats - Slow down when eating, digestive enzymes, bitters

- Consider SIBO, testing if symptomatic (breath test)
Gut Health

Start talking about it with patients!

Recommend:
Eating fresh, healthy foods (think perimeter of the grocery store)
Eat SLOW- take your time, cook meals
Digestive Enzymes or bitters with meals
Probiotics- fermented foods and supplements
Prebiotics- diet and supplements
Mindfulness/Meditation/Decrease Stress
Antibiotics- only when necessary!

Consider GI testing or referral to Integrative Physician.
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Thank you!

Questions?
References


4. Effect of tea phenolics and their aromatic fecal bacterial metabolites on intestinal microbiota. Hui ChengLeeaAndrew M.JennerbChin SengLowaYuan KunLeea


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