BiomeFx™

FUNCTIONAL MICROBIOME ANALYSIS

SAMPLE REPORT

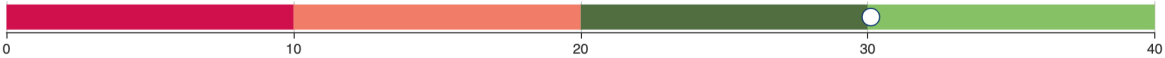
The results from this test kit are for informational purposes only and are not intended to be a substitute for professional medical advice, diagnosis, or treatment. Always seek the advice of your physician or qualified health provider with any questions you may have regarding a medical condition.

BiomeFx™
Functional Microbiome Analysis

POWERED BY COSMOSID® Unlocking The Microbiome

Date: 3/18/2020

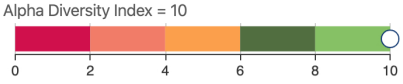
My Gut Microbiome Index (out of 40): 30.11

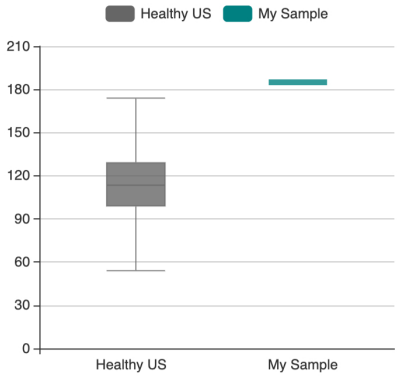


The Gut Microbiome Index (GMI) is an overall score for gut microbiome health. A score above 30 is considered excellent. It is calculated by assessing four key indicators of microbiome health for your gut microbiome and comparing them to the typical healthy gut microbiome. The four key indicators include Alpha Diversity (species richness), Beta Diversity (composition), Pathogen Occurrence (population of pathogens) and Resistome Occurrence (population of antibiotic resistance genes).

My Gut Microbiome Alpha- and Beta-Diversity

Alpha Diversity Index = 10



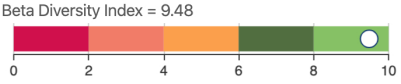


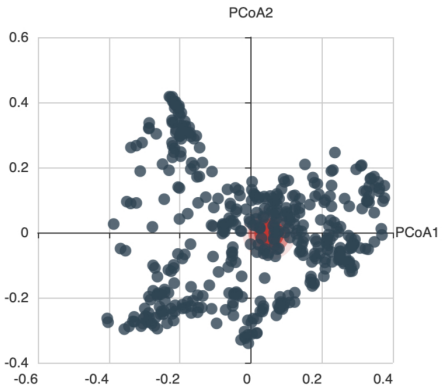
Number of species in gut microbiome: 185

In ecology, Alpha-Diversity refers to the average diversity, or the richness of species, in a particular ecosystem. This marker is looking at your own personal species richness within your gut microbiome.

A Low Alpha-Diversity Index suggests that your gut microbiome was recently damaged by antibiotics, environmental toxins, stress, diet, or other factors.

Beta Diversity Index = 9.48





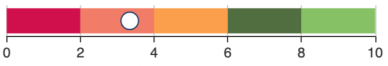
Beta-diversity is the variation of species when comparing the composition of two separate ecosystems. This marker compares the composition of your gut microbiome to healthy populations in order to illustrate notable differences. The red dot for your sample not falling within the clusters of grey dots (healthy) leads to a low Beta-Diversity Index suggesting that your gut microbiome composition is trending away from a healthy gut to an imbalanced, dysbiotic gut.

Recommendations:

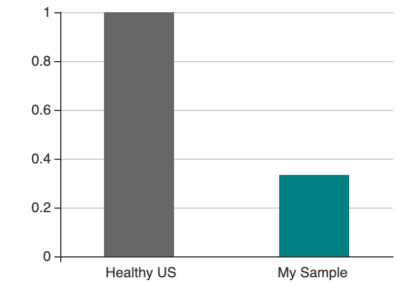
See the results of the report section on Functional Keystone Species in My Gut to learn how to increase your protective keystone bacteria and to improve your gut microbiome.

My Gut Stability and Uniformity

Resistome Occurrence Index = 3.34



Correlation between my sample and the average Healthy microbiome



This section explores the richness and stability of your gut microbiome by comparing the resilience of your gut microbiome to Healthy populations. A low index suggests that you have low richness and resilience in your gut.

Recommendations:

Low resilience can indicate an increased risk for antibiotic-resistant infections. Consult your doctor on appropriate antibiotic usage. Avoid consuming foods that contain antibiotics like low-quality meats and dairy, or drinking poorly purified water.

Probiotics containing *Bacillus* endospores, specifically *B. subtilis*, can help to support a healthy gut environment through competitive exclusion. Competitive exclusion is the process by which powerful protective bacteria, like *Bacillus* spores, can restore a favorable balance to the microbiome. Some strains of *Bacillus subtilis*, for example, can produce over 12 natural antimicrobials to support a more stable and resilient microbiome.

Pathobiome

Low levels of pathogens can be normal and characteristic of a healthy, diverse gut microbiome. Increased levels of pathogens however could indicate that a pathogen is playing a role in symptoms you are experiencing. This section compares the relative abundances (RA) of specific pathogens to normal levels present in the healthy gut and provides recommendations in case your pathogen levels are abnormally high.

Pathogen Control Index = 7.29

BiomeFX is NOT a diagnostic test. If your Pathogen levels are abnormally high consult your physician who can make a diagnosis and provide treatment if needed.

Pathogen Species	Healthy Relative Abundance IQR Range[%]	My Sample Relative Abundance[%]	Nutrition	Lifestyle	Supplements
Clostridium difficile	0.05 - 0.36	0.31	Avoid processed sugars. Increase consumption of prebiotic fibers and fermentable carbohydrates like green bananas, leeks, asparagus, onions, garlic, artichokes, chicory, and dandelion root.	C. diff infections are common after taking antibiotics. Wash hands thoroughly. Avoid taking antibiotics when possible (unless indicated otherwise by your physician), but taking a spore-based probiotic along with antibiotics can also protect the gut from a C. diff infection. Avoid smoking cigarettes, as this is associated with C. diff infections.	Probiotics containing Bacillus endospores can support a healthy balance of Clostridium difficile. Serum-derived bovine immunoglobulins (SBI) have been shown to support healthy detoxification.

Sample ID: [illegible] **Date:** 3/18/2020

Pathobiome ...continued

Pathogen Species	Healthy Relative Abundance IQR Range[%]	My Sample Relative Abundance[%]	Nutrition	Lifestyle	Supplements
Escherichia coli	0.04 - 0.27	0.01	Reduce intake of sugar, omega-6 fatty acids (eggs, canola oil, almonds, peanuts, sunflower seeds), animal protein, and saturated fats which can feed E. coli. Increase consumption of fruits and vegetables like bananas, kiwis, nectarines, onions, leeks, garlic, chicory and artichokes to help crowd out E. coli. Choose organic, antibiotic-free meats, as conventional foods can carry antibiotic-resistant strains of E. coli.	Cook food thoroughly, especially meat, and avoid potentially contaminated water sources. Avoid cross-contamination between raw meet and cooked foods.	Probiotics containing Bacillus endospores and Saccharomyces boulardii can support a healthy balance of E. coli.
Citrobacter freundii	0.04 - 0.17	1.22	Limit consumption of sugar, saturated fat, processed meats. Consume fibers like wheat bran, resistant starches from grains, nuts, seeds, legumes, raw potatoes, green bananas, and cooked and cooled rice and potatoes; or foods containing inulin, like bananas, sugar beets, leeks, asparagus, onions, garlic, dandelion root, Jerusalem artichoke, and chicory. Increase consumption of omega-3 containing foods, such as flax, chia, cold water fish and walnuts. Cranberry polyphenols can also reduce the abundance of C. freundii. Diets low in fiber can allow C. freundii to grow out of control.	Make sure to wash hands regularly, especially when coming into contact with potentially contaminated substances (soil, sewage, feces, and people infected with C. freundii). Practice relaxation techniques like yoga, meditation, massage, or deep breathing regularly.	Probiotics containing Bacillus endospores have been shown to support a healthy balance of gut bacteria. Omega-3 fatty acids EPA, DHA, and DPA can help support a healthy gut environment.

Full List of Pathogen Species Tested

Helicobacter pylori	Clostridium difficile
Escherichia coli	Campylobacter
Salmonella enterica	Vibrio cholerae
Yersinia enterocolitica	Klebsiella pneumoniae
Citrobacter freundii	Hafnia alvei
Raoultella ornithinolytica	Candida
Blastocystis hominis	Giardia lamblia
Cryptosporidium	Entamoeba histolytica
Adenovirus	Cytomegalovirus
Epstein Barr Virus	

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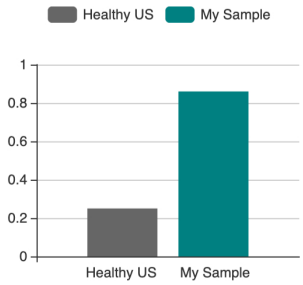
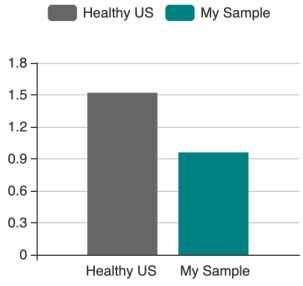
Dysbiosis Ratios

This section compares the abundances of important groups of gut bacteria between your gut and the typical healthy gut microbiome. Elevated dysbiosis ratios for these bacterial phyla or genera point to disbalances in abundance (dysbiosis) which are associated with a range of health conditions. Check the recommendations for maintaining healthy ratios or to counteract cases of dysbiosis.

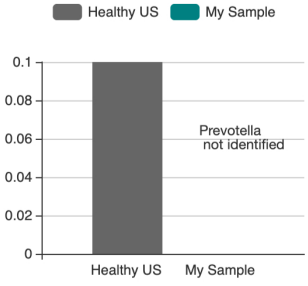
Description	Healthy Ratio	My Ratio	Recommendations if High
Firmicutes:Bacteroidetes (F/B) Ratio In adults, Firmicutes and Bacteroidetes are the most abundant bacterial phyla in the gut. The Firmicutes to Bacteroidetes (F/B) abundance ratio was shown to increase from infancy to adulthood and subsequently to decrease again in the elderly. Elevated F/B ratios have been linked to obesity though the evidence is not conclusive. Healthy F/B ratios differ significantly between studies and can exceed 0.25 (shown here), in some studies even 1.	~ 0.25	0.86	**Nutrition:** Consume more green bananas, apples, pears, guavas, plums, citrus fruits, barley, oats, whole grains, psyllium, flaxseed, leeks, Brussels sprouts, cabbage, cauliflower, broccoli, asparagus, onions, garlic, seaweed, algae, and reishi, maitake, and shiitake mushrooms. Reduce excessive fat and animal protein consumption. **Lifestyle:** Engage in moderate exercise 30-60 minutes per day, get outdoors as often as possible, and reduce sleep disturbances by practicing relaxation techniques and avoiding screen time before bed. **Supplements:** Supplements that contain beta-glucans, resistant starches, arabinoxylan, pectin, cellulose, or inulin can improve F/B ratios.



Description	Healthy Ratio	My Ratio	Recommendations if High
Proteobacteria:Actinobacteria (P/A) Ratio Together these phyla comprise about 10% of total gut microbes. Healthy adults tend to have no more than 4.5% Proteobacteria. Proteobacteria:Actinobacteria (P/A) ratios less than 1.0 are associated with healthy metabolism and cell turnover. Increasing Actinobacteria can be accomplished by consuming plant-derived carbohydrate starch and polysaccharides, such as FOS, GOS, XOS, inulin or arabinoxylan.	~ 1.52	0.96	**Nutrition:** Consume more plant-derived carbohydrates and fibers from bananas, kiwis, mangos, pears, onions, garlic, legumes, beets, artichokes, bamboo shoots, oats, cashews, and pistachios. Limit your intake of saturated fats and sugar, as these increase the abundance of Proteobacteria. **Lifestyle:** Enjoy moderately intense exercise 30-60 minutes per day, avoid exposure to toxic chemicals such as glyphosate, and consider taking a spore-based probiotic when traveling to high altitudes. **Supplements:** Supplements that contain FOS, GOS, XOS, inulin, or arabinoxylan can improve P/A ratios.



Description	Healthy Ratio	My Ratio	Recommendations if High
Prevotella:Bacteroides (P/B) Ratio High Prevotella:Bacteroides ratios are associated with lower BMI and reduced incidence of chronic, inflammatory disease. Low Prevotella:Bacteroides ratios (smaller numbers) are associated with metabolic imbalances and are positively correlated with high intake of protein and animal fat as typical for a Western diet. Higher abundance of Prevotella is observed in individuals that consume diets rich in carbohydrates and fiber. Bacteroides is increased by sugar and saturated fat intake, while Prevotella generally thrives on fiber rich foods, like fruit, vegetables, beans and whole grains. Levels of Prevotella tend to decrease with age, particularly among centenarian populations.	~ 0.1	0	**Nutrition:** Consume more pears, apples, bananas, guavas, plums, oranges and other citrus fruits, onions, garlic, chicory root, barley, oats, sorghum, leeks, seaweed, and mushrooms such as reishi. Limit consumption of animal fat and protein as well as sugar. **Lifestyle:** This ratio can be improved by limiting cigarette smoking, practicing stress reduction techniques, especially before bed, spending time in nature with animals (when possible), and avoiding excessive sterilization of the home. Spending time outdoors can enhance exposure to beneficial microbes in the environment, time with animals or on farms is also recommended, particularly in childhood. **Supplements:** Supplements that contain fructooligosaccharides (FOS), xylooligosaccharides (XOS), beta-glucans, or pectins can improve the ratio of Prevotella:Bacteroides.

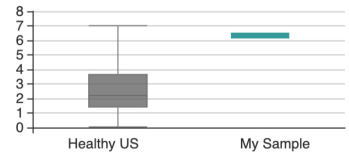


Date: 3/18/2020

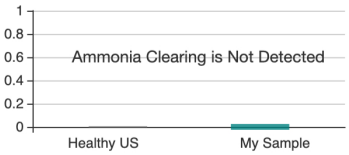
Biologically Important Bacteria in My Gut

This section explores the abundance of bacterial groups known to contribute important metabolic functions. The abundance levels are compared between your gut and the typical Healthy microbiome and recommendations in case of abnormal levels are provided.

Ammonia Producing

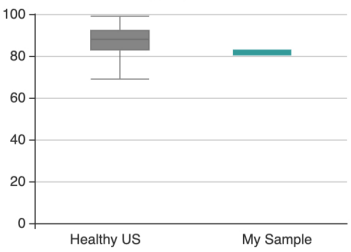


Ammonia Clearing



Description	Recommendations
Ammonia is a normal by-product of amino acid fermentation by gut microbes. Ammonia is also produced in the small intestine through the bacterial degradation of glutamine. Healthy liver and kidneys can filter and excrete ammonia through the urine. Reducing ammonia production in the gut may be accomplished by following a low protein diet, increasing healthy, omega-3 fatty acids, and feeding beneficial ammonia clearing bacteria that can metabolize ammonia in the gut.	**If Ammonia Production is HIGH and Ammonia Clearing is LOW** **Nutrition:** Follow a low-protein diet by limiting consumption of meat, poultry, nuts, legumes, and dairy. **Lifestyle:** No action needed **Supplements:** Probiotics that contain Bacillus subtilis can support healthy blood ammonia levels.

Estrobolome

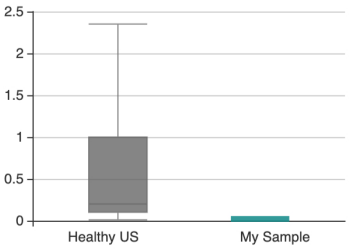


The estrobolome is a network of over 60 genera of bacteria that can deconjugate excreted estrogens for reabsorption into circulation by producing very powerful enzymes. This deconjugation process is handled by gut bacteria with β-glucuronidase and β-glucosidase activity.

When the deconjugation of estrogens (estrobolome) is too high, this can lead to excess estrogen in the body, and ultimately to estrogen dominance. On the other hand, if estrogen deconjugation (estrobolome) is too low, then this may lead to insufficient levels of estrogen in circulation.

If Estrobolome is HIGH
Nutrition: Limit intake of phytoestrogens like soy (tofu, tempeh, miso, soymilk), coffee, legumes, and oranges, in addition to sugar, red meat, and alcohol. Vegetarian diets have been shown to clear estrogens 3 times more efficiently.
Lifestyle: Avoid cosmetics with phthalates and parabens, plastics containing bisphenol A (BPA), cigarette smoke, car exhaust, forest fire smoke, fabric softeners, nail polish, perfumes, and non-stick cooking pans.
Supplements: Supplement: Probiotics that contain Bacillus endospores combined with prebiotic fibers like FOS, GOS, and XOS can work together to increase microbial diversity in the gut.

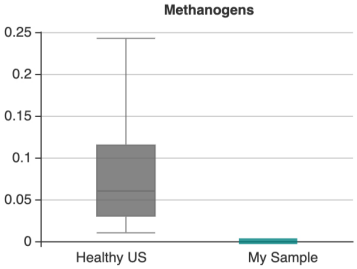
Sulfate Reduction



Sulfate-reducing bacteria (SRB) convert dietary sulfur to H2S, or hydrogen sulfide, which can cause gas that smells like rotten eggs.
Sulfate-reducing bacteria are found in 50% of the population and are also associated with high-protein, low-fiber diets. Foods that contain sulfur will increase the abundance of SRB and therefore H2S production. Sulfate-reducing bacteria compete with methane-producers and acetate-producers for the same H2S substrate; and as a result, it is important to maintain a delicate balance.
Sulfate-reducing bacteria can be kept in healthy range by consuming more foods that contain prebiotic fibers like FOS, GOS, and XOS that increase the abundance of acetateproducers.

If Sulfate Reduction is HIGH
Nutrition: Limit consumption of sulfate-containing foods like red meat, seafood, eggs, cheddar and parmesan cheese, dried apricots, peaches, onions, leeks, garlic, cabbage, brussels sprouts, broccoli, bok choy, asparagus, spinach, kale, peanuts, brazil nuts, walnuts, almonds, cocoa, or tea.
Lifestyle: No action needed
Supplements: Supplements that contain prebiotic fibers like FOS, GOS, or XOS can increase the abundance of acetate-producers and limit the abundance of SRB.

Methanogens



Methanogens may contribute to weight gain by increasing polysaccharide fermentation and nutrient production. Methane gas also slows the intestinal transit and affects gut motility, which may also allow increased time for nutrient absorption.
Furthermore, methane producers compete with acetate producers for substrate utilization, which may explain why methanogens are indirectly associated with digestive issues.

If Methane Production is HIGH
Nutrition: Consume more sulfur-containing foods like red meat, seafood, eggs, cheddar and parmesan cheese, dried apricots, peaches, onions, leeks, garlic, cabbage, brussels sprouts, broccoli, bok choy, asparagus, spinach, kale, peanuts, brazil nuts, walnuts, almonds, cocoa, and tea.
Lifestyle: No action needed
Supplements: Supplements containing licorice flavonoids or ginger extract can help support healthy gastrointestinal transit time.

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Functional Keystone Species in My Gut

Keystone species are beneficial bacteria that have a disproportionately large effect on both their habitat and the status of other microbial communities of the gut. Keystone species create an environment that is unfriendly to pathogens yet allows good gut microbes (commensal) to thrive. This section compares relative abundances between your gut and the healthy gut microbiome and offers recommendations in case abundance levels are low.

Keystone Species	Function	Healthy Relative Abundance IQR Range[%]	My Sample Relative Abundance	My Sample Percentile	Recommendations if levels are LOW
Akkermansia muciniphila	metabolism and SCFA	0.06 - 0.85	2.5	93.93	**Nutrition:** Reduce intake of sugar and consume more sources of fructooligosaccharides (FOS) like mangos, bananas, kiwis, watermelon, pears, raspberries, nectarines, onions, garlic, chicory root, asparagus, leeks, and jicama. Cranberry polyphenols have also been shown to significantly increase the abundance of Akkermansia. SCFAs like butyrate can be used as signaling molecules for blood sugar control. Limiting your intake of sugar can spare your butyrate resources and reallocate them toward reducing inflammation and repairing the intestinal mucosal barrier. **Lifestyle:** Consider intermittent fasting. Engage in moderate exercise 2-3 times a week to increase the abundance of Akkermansia. Avoid prolonged exposure to cold temperatures. **Supplements:** Supplements containing FOS or cranberry polyphenols can increase the abundance of Akkermansia.
Faecalibacterium prausnitzii	inflammation and SCFA	1.21 - 5.79	4.62	67.84	**Nutrition:** Diets that are high in animal meat, saturated fat, sugar, and/or processed foods and deficient in fiber can reduce the abundance of F. prausnitzii. Consuming more whole fruits and vegetables and limiting the consumption of animal meats and fats can increase the abundance of F. prausnitzii. SCFAs like butyrate can be used as signaling molecules for blood sugar control. Limiting your intake of sugar can spare your butyrate resources and reallocate them toward reducing inflammation and repairing the intestinal mucosal barrier. **Lifestyle:** Participate in moderate exercise 2-3 times a week to increase the abundance of Faecalibacterium prausnitzii. **Supplements:** Supplements containing FOS can increase the abundance of Faecalibacterium prausnitzii.
Ruminococcus bromii	cellulose degrader	0.15 - 1.07	0.01	3.11	**Nutrition:** Consume more resistant starches from grains, nuts, seeds, legumes, raw potatoes, green bananas, and rice and potatoes that have been cooked and then cooled. Cellulose from Brussels sprouts, broccoli, collard greens, cauliflower, and leafy green vegetables like kale and spinach can also increase the abundance of this keystone strain. Ruminococcus is a cellulose degrader, which means that it prefers sources of cellulose and resistant starch. **Lifestyle:** No action needed **Supplements:** Supplements containing resistant starches or cellulose can increase the abundance of Ruminococcus bromii.
Ruminococcus flavefaciens	cellulose degrader	0.02 - 0.11	Not Detected	Not Detected	**Nutrition:** Consume more navy beans, black beans, bamboo shoots, Brussels sprouts, broccoli, collard greens, cauliflower, and leafy green vegetables like kale and spinach. This keystone species feeds on cellulose and xylooligosaccharides (XOS). **Lifestyle:** No action needed **Supplements:** Supplements containing cellulose or XOS can increase the abundance of Ruminococcus flavefaciens.

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Functional Keystone Species in My Gut

Keystone species are beneficial bacteria that have a disproportionately large effect on both their habitat and the status of other microbial communities of the gut. Keystone species create an environment that is unfriendly to pathogens yet allows good gut microbes (commensal) to thrive. This section compares relative abundances between your gut and the healthy gut microbiome and offers recommendations in case abundance levels are low.

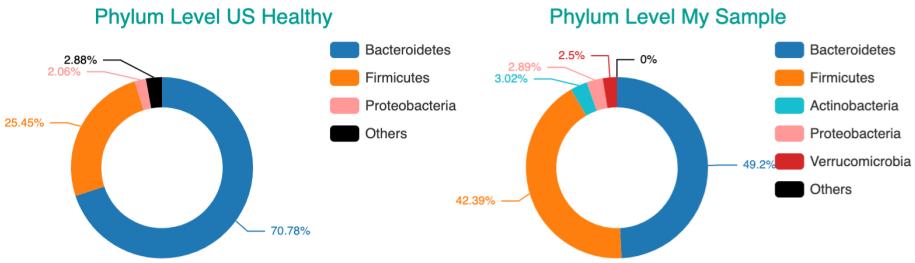
Keystone Species	Function	Healthy Relative Abundance IQR Range[%]	My Sample Relative Abundance	My Sample Percentile	Recommendations if levels are LOW
Roseburia intestinalis	beta-mannan degrader, butyrate producer	0.04 - 0.67	0.62	73.93	**Nutrition:** Consume more spirulina, nuts, seeds, legumes, coffee beans, coconut palm, tomato, raw potatoes, and green bananas. Limit consumption of protein, specifically whey and beef protein. This keystone species feeds on beta-mannan and resistant starch. **Lifestyle:** Minimize psychological stressors and participate in 30-60 minutes of aerobic exercise 3 times a week to increase the abundance of Roseburia intestinalis. Psychological stress can reduce the abundance of this keystone species. **Supplements:** Supplements containing spirulina, beta-mannan, or resistant starch can increase the abundance of Roseburia intestinalis.
Eubacterium rectale	butyrate producer	0.59 - 2.67	0.16	13.33	**Nutrition:** Resistant starches from nuts, seeds, grains, legumes, raw potatoes, and green bananas, as well as antioxidants from red wine, apples, coffee, cocoa, and berries, can increase the abundance of this keystone species. **Lifestyle:** Participate in moderate exercise 2-3 times a week to increase the abundance of Eubacterium rectale. **Supplements:** Supplements containing resistant starches, resveratrol, or anthocyanins can increase the abundance of E. rectale.
Bifidobacterium longum	acetate	0.06 - 0.68	Not Detected	Not Detected	**Nutrition:** Consume more bananas, sugar beets, leeks, asparagus, onions, garlic, dandelion root, Jerusalem artichoke, chicory, potatoes, and green tea. **Lifestyle:** Moderate exercise can increase the abundance of Bifidobacterium. **Supplements:** Supplements containing green tea extracts or fructo-oligosaccharides (FOS) from green kiwifruit can increase the abundance of Bifidobacterium longum.
Lactobacillus species	lactate producer	0.03 - 0.18	0.13	59.38	**Nutrition:** Consume more spirulina, pea and whey protein, bananas, legumes, cashews, pistachios, hummus, oat milk, beets, leeks, asparagus, onions, garlic, dandelion root, and artichokes. Inulin and GOS can increase the abundance of Lactobacillus. **Lifestyle:** Moderate exercise can increase the abundance of Lactobacillus. **Supplements:** Supplements containing inulin, GOS, or FOS from kiwifruit and GOS can increase the abundance of Lactobacillus species.

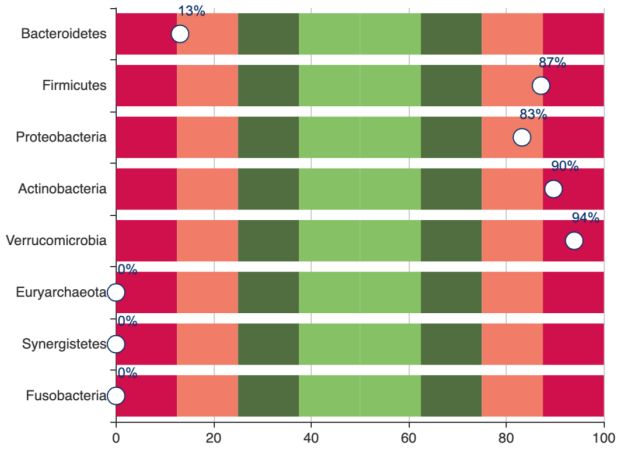
Date: 3/18/2020

Appendix

My Gut Microbiome Composition (Phylum level)

This section explores the composition of your gut microbiome at phylum level resolution.





The Donut Charts to the left visualizes the most abundant bacterial phyla in your gut.

The Percentile Chart to the right compares the relative abundance (RA) for each bacterial phylum between your gut microbiome and the microbiomes typical for healthy populations. Percentile values between around 25% – 75% are typical, low values for a certain phylum suggest that in your case relative abundances are on the low side, high values suggest that your abundances are on the high side.

Phylum	Healthy Population Relative Abundance IQR Range [%]	My Sample Relative Abundance [%]	My Sample Percentile
Bacteroidetes	64.04 - 84.54	49.2	13.11
Firmicutes	13.04 - 31.67	42.39	87.12
Proteobacteria	0.61 - 2.31	2.89	83.22
Actinobacteria	0.1 - 1.26	3.02	89.69
Verrucomicrobia	0.06 - 0.85	2.5	93.93
Euryarchaeota	0.07 - 0.47	0	0
Synergistetes	0.02 - 0.07	0	0
Fusobacteria	0.02 - 0.25	0	0

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Appendix

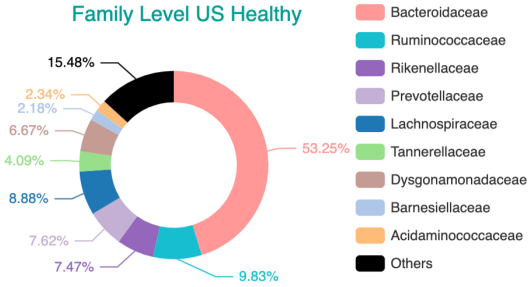
My Gut Microbiome Composition (Family level)

This section explores the composition of your gut microbiome at family level resolution.

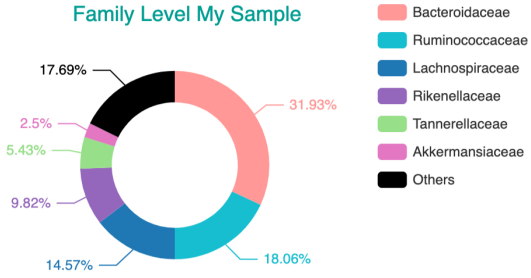
The Donut Charts visualize the most abundant bacterial genera in your gut.

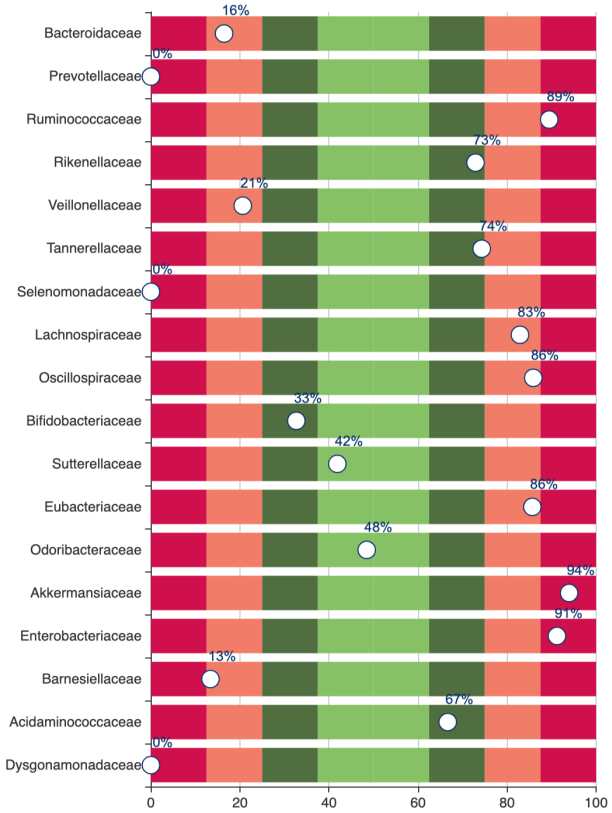
The Percentile Chart below compares the relative abundance (RA) for each bacterial genera between your gut microbiome and the microbiomes typical for healthy populations. Percentile values between around 25% – 75% are typical, low values for a certain family suggest that in your case relative abundances are on the low side, high values suggest that your abundances are on the high side.

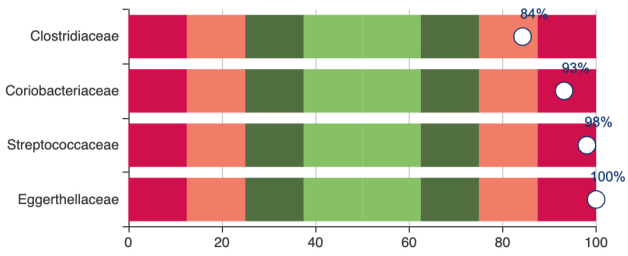
Family Level US Healthy



Family Level My Sample







Family	Healthy Population Relative Abundance IQR Range [%]	My Sample Relative Abundance [%]	My Sample Percentile
Bacteroidaceae	37.67 - 68.32	31.93	16.43
Prevotellaceae	0.05 - 7.36	0	0
Ruminococcaceae	3.63 - 12.22	18.06	89.46
Rikenellaceae	3.81 - 10.63	9.82	72.91
Veillonellaceae	0.14 - 1.57	0.06	20.62
Tannerellaceae	2.5 - 5.49	5.43	74.31
Selenomonadaceae	0.07 - 1.42	0	0
Lachnospiraceae	3.46 - 11.52	14.57	82.9
Oscillospiraceae	0.33 - 1.17	1.54	85.89
Bifidobacteriaceae	0.11 - 1.35	0.16	32.66
Sutterellaceae	0.19 - 1.23	0.38	41.87
Eubacteriaceae	0.26 - 1.32	1.83	85.68
Odoribacteraceae	0.52 - 1.55	0.96	48.47
Akkermansiaceae	0.06 - 0.86	2.5	93.93
Enterobacteriaceae	0.04 - 0.36	1.94	91.2
Barnesiellaceae	0.92 - 3.17	0.44	13.37
Acidaminococcaceae	0.7 - 2.33	2	66.67
Dysgonamonadaceae	2.25 - 8.76	0	0
Clostridiaceae	0.01 - 7.64	0.78	84.27
Coriobacteriaceae	0.0 - 2.82	1.04	93.16
Streptococcaceae	0.0 - 4.11	1.05	98.03
Eggerthellaceae	0.0 - 0.89	1.62	100