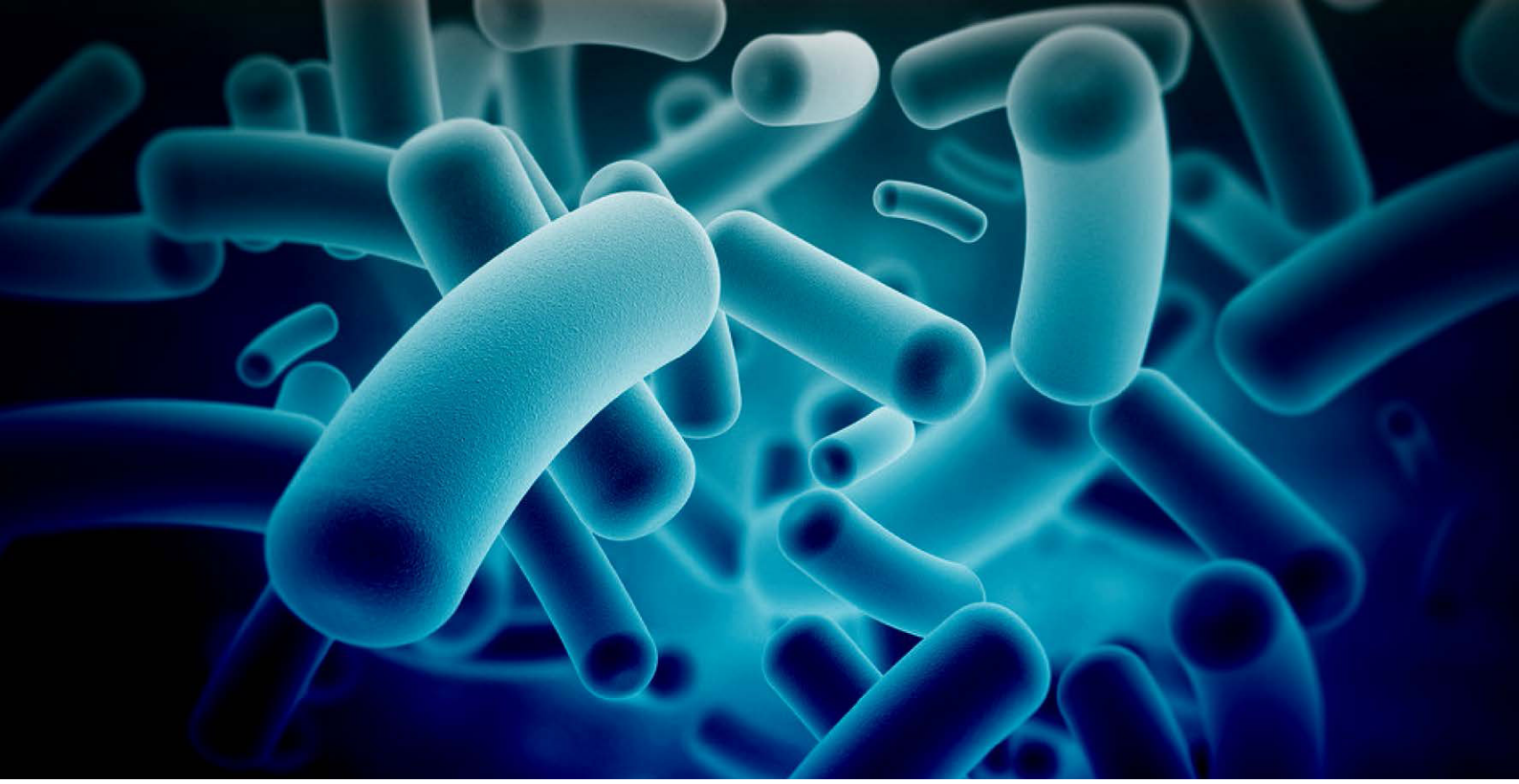


Generated on 03/03/2019

Microbiome Report

רינת אישק

Client ID 8617

DAY TWO

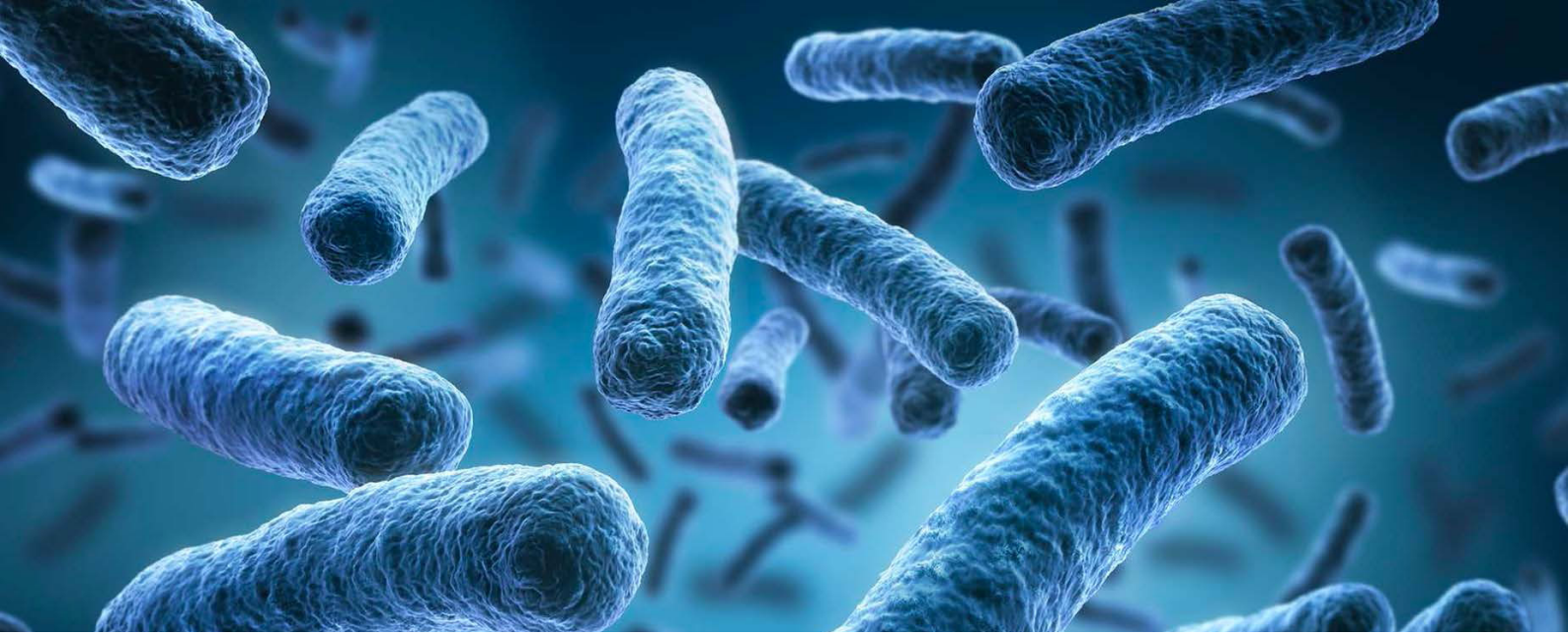
Overview

DayTwo™ provides solutions based on the DayTwoTM Microbiome Platform aiming to prevent and treat metabolic diseases, primarily diabetes and obesity. The DayTwo™ App provides personally tailored nutrition guidelines aimed at balancing blood sugar levels post meal. As high blood sugar is linked to energy dips, excessive hunger, weight gain, and increased risk for metabolic diseases like obesity and diabetes, balancing blood sugar levels presents a significant health benefit. Users provide personal and clinical information, a stool sample (we use full shotgun next generation sequencing technology to sequence the DNA of the gut microbiome), blood tests etc. - all this data is used to create for each user their personalized cloud-based DayTwo predictor. Users get a personalized report that includes details of their better and worse foods and complex meals; the ability to search and receive a prediction for various foods and meals; and a detailed report on their microbiome.

Introduction to the Microbiome Report

Intro

Microbes are everywhere, they live in and on all animals and plants and they fill our oceans. Right now, they are on your phone, your hands (even if you wash them), in your drinking water (about a million per one milliliter!), in aerosols around you and present at any moment in time. In fact, the ecosystem of planet earth, which is composed of a multitude of habitats, contains different sets of microbes that are essential for proper ecosystem functioning. As the ecosystems of planet Earth have a series of habitats with specific organisms that are essential for a proper ecosystem functioning, so does the human body. On a smaller scale, the human body is also an ecosystem, with different body sites providing different habitats for microbial communities. The microbial communities living in and on our body are collectively called the microbiome and we have distinct microbiomes at each of our body sites.



What is the Gut Microbiome?

The gut microbiome is a collective name for the 40 trillion cells and up to 1000 microbial species that include bacteria, viruses, fungi, parasites and archaea and reside in our gut. The number of gut bacterial cells is approximately equal to the total number of human cells in our body, so if we consider only cell counts, we are only about half human. In terms of gene counts, the microbiome contains about 200 times more genes than the human genome, making bacterial genes responsible for over 99% of our bodies' gene content! Of all the microbial communities in the human body, the gut microbiome is by far the most dense, diverse and physiologically important ecosystem to our overall health.

The importance of your Gut Microbiome

Our body lives in a symbiotic relationship with the microbes within us, which are significant contributors to our health and overall wellness.

Health: In recent years science has discovered various associations between the microbiome and various health conditions including obesity(1), allergies and autoimmune conditions(2-4), vascular diseases(5), gastrointestinal diseases and disorders (IBS, IBD, Crohn's, colitis)(6-8) and even neurodegenerative disorders and mental conditions(9-10).

Energy: Bacterial breakdown of food provides approximately 10-20% of our energy supplies(11). The extent of energy extracted from foods depends on the microbiome, and it can differ dramatically between people(12).

Essential Nutrients: The human body cannot produce all the nutrients required for its proper functioning, so some nutrients must be either acquired from diet, or produced by the gut microbiome. For example, the gut microbiome is a key producer of essential vitamins, like vitamin K and many vitamin B derivatives(13-14). Additionally, while many food components are absorbed early in our digestive tract (i.e the small intestine), some kinds of dietary fiber can only be broken down in the large intestines by specific members of the gut microbiome. Important products of this process include short chain fatty acids (SCFA) that are important for energizing colon cells, have anti-inflammatory properties and are even associated with hunger levels and the release of the hunger hormone, Leptin(15-16).

Immunity: There is growing evidence that the microbiome is regulating our immune system(17). Our microbiome is important in developing our immune system, helps by making our body tolerate food molecules and harmless substances, helps in recognizing invaders and protects against pathogens by constantly communicating with the immune system in the intestines(18).

Taxonomic Classification

Taxonomy is the science of organisms classification into groups based on shared characteristics or evolutionary relatedness. All living organisms are classified using taxonomic classifications.

Ranks or Levels of Microbial Taxonomy:

Taxonomic classification is a hierarchical grouping of organisms in ranks of decreasing similarity. Organism groups can be aggregated with other relatively similar groups of the same rank, to create a super-group of higher rank. In bacterial taxonomy, the most commonly used ranks or levels in their ascending order are: strains, species, genera, families, orders, classes, phyla and domain (see table).

Species is the basic taxonomic group in bacterial taxonomy. Groups of species are then collected into genera. Groups of genera are collected into families (sing. family), families into orders, orders into classes, classes into phyla (sing., phylum), and phyla into domain (the highest rank or level). Groups of bacteria at each rank or level have names with endings or suffixes characteristic to that rank or level.

Taxonomic Hierarchy

Taxonomic Hierarchy

	Homo sapiens	*Bacteroides fragilis*
KINGDOM	Animalia	Bacteria
PHYLUM	Chordata	Bacteroidetes
CLASS	Mammalia	Bacteroidia
ORDER	Primates	Bacteroidales
FAMILY	Hominidae	Bacteroidaceae
GENUS	*Homo*	*Bacteroides*
SPECIES	*H. sapiens*	*B. fragilis*
STRAIN		gcf_000297735

Interpretation of your Results

The results in this report are based of identification and quantification of microbial DNA sequences from your stool sample. In some cases, your results are compared to microbiome compositions of others in DayTwo's cohort. Therefore, some of the analyses provide relative scores with respect to the entire DayTwo cohort (for example, diversity score of 10 will be given to the individual with the most diverse microbiome in our cohort while a grade of 1 will be given to the individual with the least diverse microbiome in our cohort).

The Microbiome Report provides an analysis for gut bacteria for general wellness informational purposes only. It is based only on the available science to date.
The information provided in this report is NOT intended to be used for clinical diagnostic purposes and should not be used in formulating treatment recommendations.
This test was developed and its performance characteristics validated by the laboratory. It has not been cleared or approved by the FDA.

The report includes:

- Ecological analysis of your gut microbiome composition (Richness, Evenness, Diversity)
- Your Microbiome composition in the phylum and genus level
- Important bacterial ratios in the phylum and genus level
- Probiotic Bacteria abundance and composition
- Important Microbiome members abundance
- Unique bacteria from your gut microbiome
- Important nutritional functions by your microbiome (B-Vitamins and Short Chain Fatty Acids).
- In cases where multiple stool samples are provided, comparative analyses of the changes are performed so you can track and see how your microbiome changes with time.

Bacterial Composition

Phylum Composition
Genus Composition

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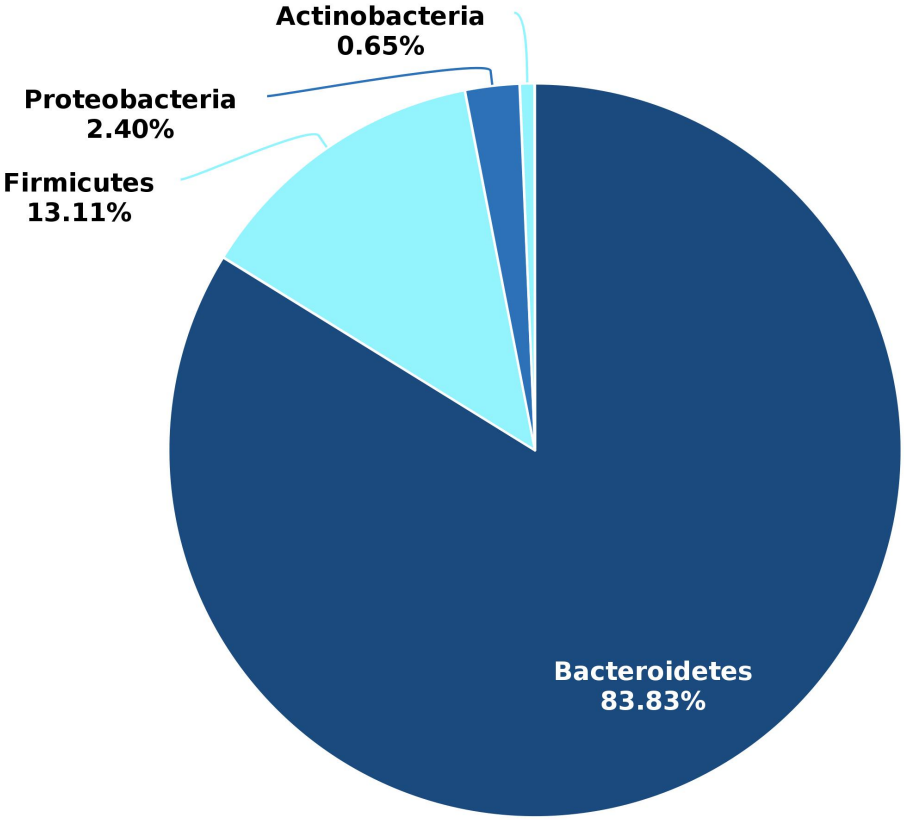
Phylum Composition

Above AVG
Average
Below AVG



Bacterial Phyla	You Relative Abundance %	Population Relative Abundance %
Bacteroidetes	*83.83*	*37.13*
Firmicutes	*13.11*	*49.01*
Proteobacteria	*2.4*	*1.42*
Actinobacteria	*0.65*	*3.68*

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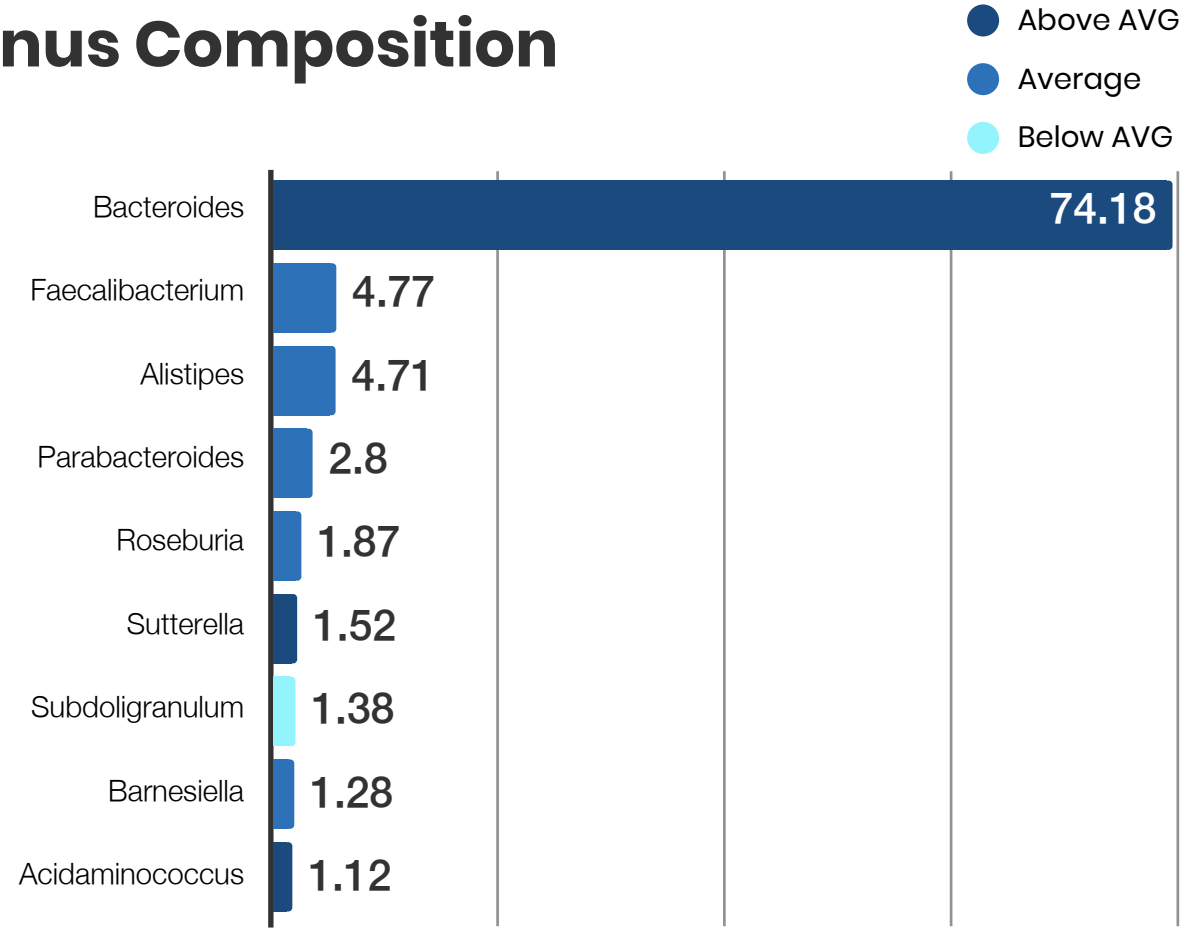
Genus Composition



Bacterial Genus	You Relative Abundance %	Population Relative Abundance %
Bacteroides	74.18	13.51
Faecalibacterium	4.77	6.18
Alistipes	4.71	3.71
Parabacteroides	2.8	1.66
Roseburia	1.87	1.48
Sutterella	1.52	0.18
Subdoligranulum	1.38	3.60
Barnesiella	1.28	0.68
Acidaminococcus	1.12	0.00
Blautia	0.81	1.55

Your 50 most abundant species list

This list will present the fifty most prevalent species found in your gut, and their abundance compared to population average.

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Bacterial Specie	You Relative Abundance %	Population Relative Abundance %
Bacteroides stercoris	27.45	0.18
Bacteroides ovatus	13.61	0.38
Bacteroides uniformis	11.35	1.17
Bacteroides massiliensis	7.95	0.54
Bacteroides sp_2_1_22	5.49	0.00
Faecalibacterium prausnitzii	4.77	6.18
Bacteroides vulgatus	4.21	1.17
Alistipes putredinis	3.51	1.86
Bacteroides thetaiotaomicron	2.38	0.16
Parabacteroides distasonis	1.77	0.14
Roseburia intestinalis	1.69	0.27
Sutterella wadsworthensis	1.52	0.18
Subdoligranulum unclassified	1.38	3.58
Barnesiella intestinihominis	1.28	0.68
Alistipes shahii	1.14	0.49
Acidaminococcus unclassified	1.09	0.00
Parabacteroides merdae	1.03	0.80
Odoribacter splanchnicus	0.72	0.45
Bacteroides dorei	0.58	0.52
Oscillibacter unclassified	0.52	0.11
Dorea longicatena	0.44	0.89
Eubacterium biforme	0.43	0.00
Bilophila unclassified	0.42	0.16
Ruminococcus gnavus	0.41	0.00

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Bacterial Specie	You Relative Abundance %	Population Relative Abundance %
Bacteroides clarus	0.41	0.00
Bacteroides cellulosilyticus	0.37	0.08
Enterococcus faecium	0.35	0.00
Lachnospiraceae bacterium_1_1_57faa	0.32	0.03
Bifidobacterium longum	0.32	0.41
Ruminococcus torques	0.32	0.78
Bacteroides caccae	0.31	0.61
Bifidobacterium bifidum	0.31	0.00
Escherichia coli	0.29	0.04
Eubacterium hallii	0.23	0.96
Dorea formicigenerans	0.2	0.39
Roseburia inulinivorans	0.16	0.32
Bacteroidales bacterium_ph8	0.13	0.32
Coprococcus comes	0.12	0.51
Flavonifractor plautii	0.1	0.00
Megasphaera unclassified	0.09	0.00
Ruminococcus obeum	0.08	0.59
Bilophila wadsworthia	0.07	0.01
Lachnospiraceae bacterium_7_1_58faa	0.07	0.01
Enterobacter cloacae	0.06	0.00
Dialister succinatiphilus	0.06	0.00
Bacteroides xylanisolvens	0.06	0.04
Lachnospiraceae bacterium_5_1_63faa	0.04	0.13
Coprobacillus unclassified	0.04	0.00

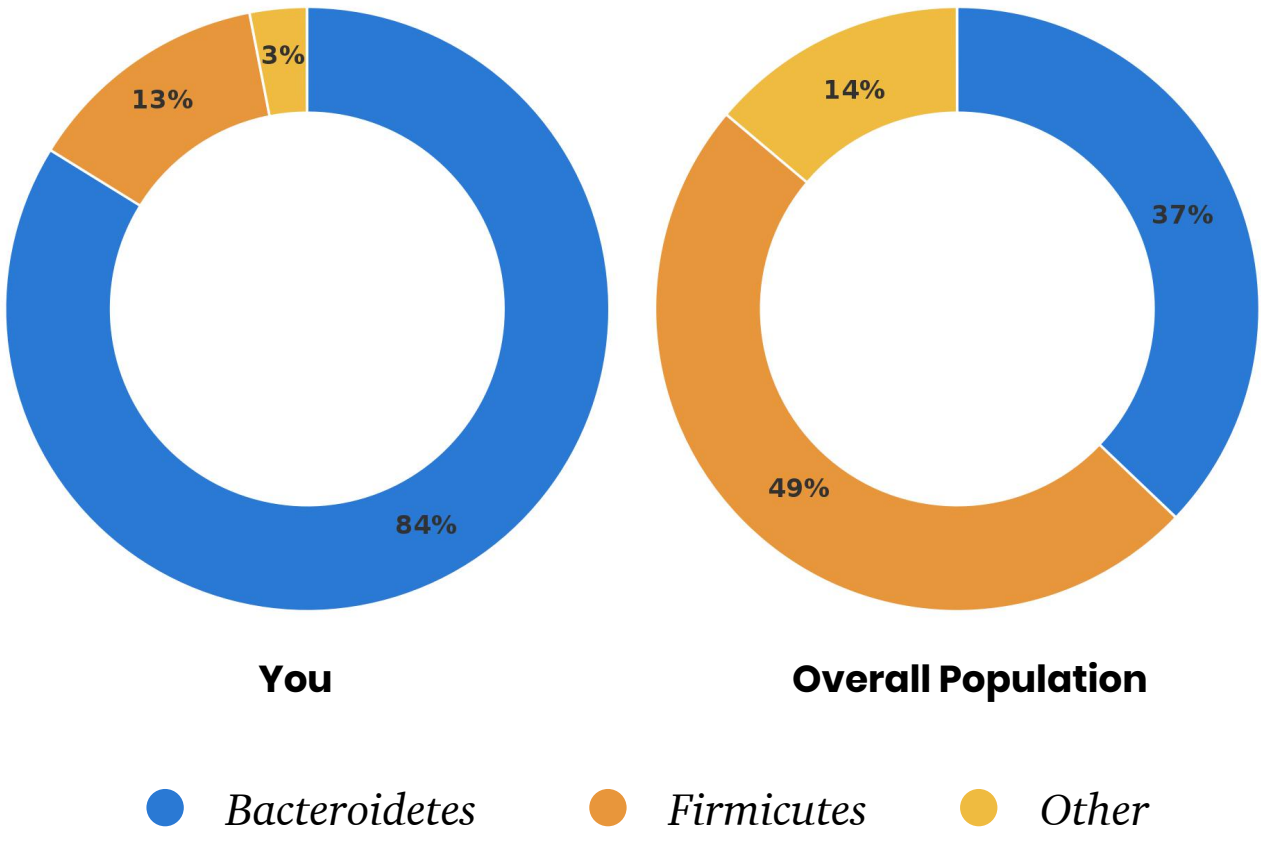
Bacterial Abundance Ratios

The abundance ratios for certain bacterial taxa may provide insights on health and diet.

Phylum Level
Genus Level

Bacteroidetes/Firmicutes ratio

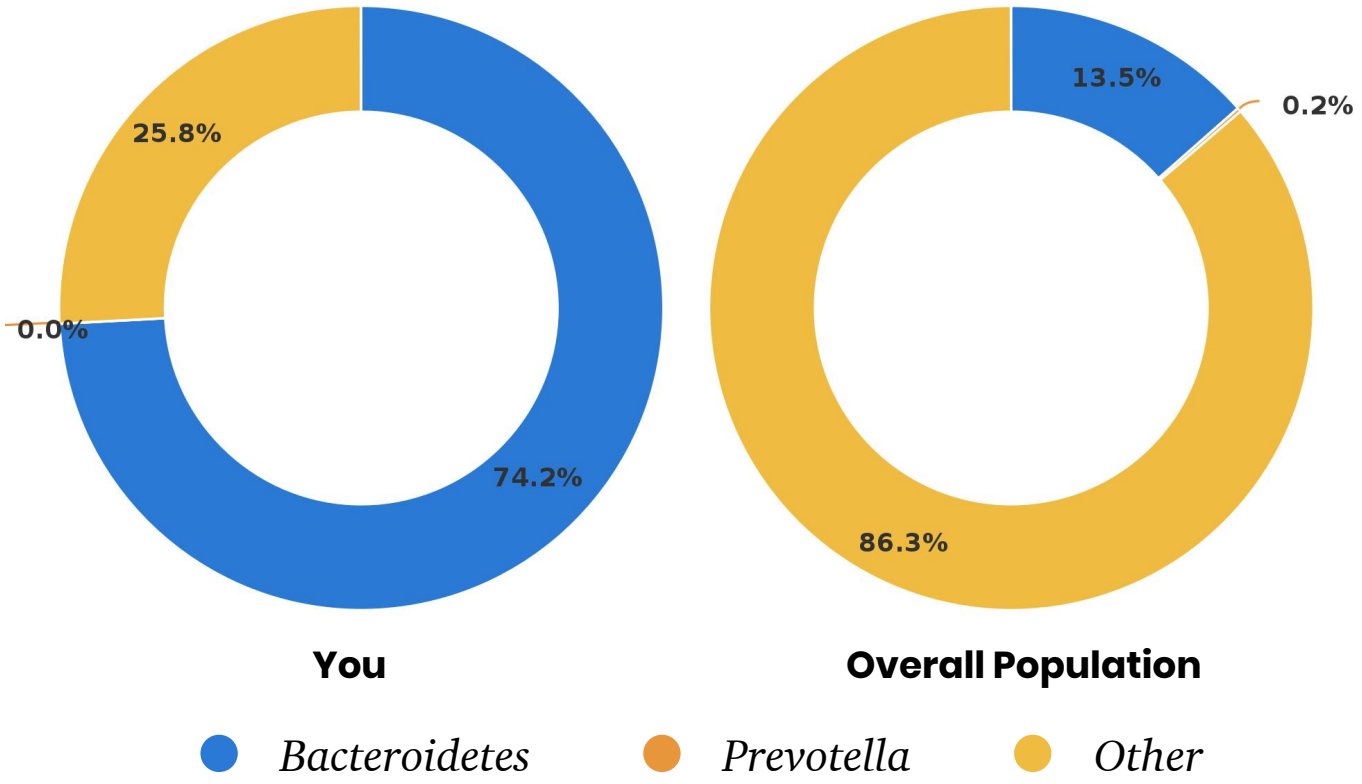
Firmicutes & Bacteroidetes are the two most abundant phyla in the human gut microbiome. High ratio was linked in several studies to (21,22) overweight and obese individuals (however, this ratio is still debatable in the scientific community).



- Your most up-to-date *Bacteroidetes* abundance is high compared to its average abundance in the population.
- Your most up-to-date *Firmicutes* abundance is low compared to its average abundance in the population.
- Your *Bacteroidetes* to *Firmicutes* ratio is high compared to the population.
- High ratio was reported to be inversely correlated with obesity, though studies are inconclusive.

Bacteroidetes/Prevotella ratio

Prevotella & Bacteroides are the most abundant bacteria in the genus level. Several studies have demonstrated that the ratio of the two is considered indicative of the type of consumed diet. High levels of Bacteroides are positively associated with high fat and high protein diet. However, Prevotella is strongly associated with high fiber diet with lower rates of fat and protein(23).



- Your most up-to-date *Bacteroidetes* abundance is high compared to its average abundance in the population.
- Your most up-to-date *Prevotella* abundance is low compared to its average abundance in the population.
- Your *Bacteroidetes* to *Prevotella* ratio is high compared to the population.
- High ratios are associated with western diets (high protein and fat diets).

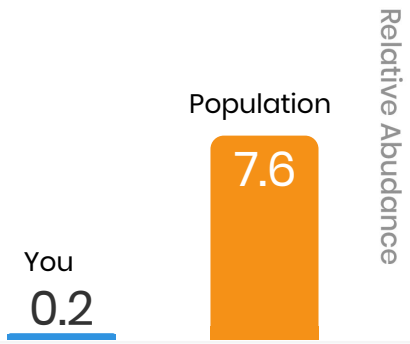
Important Microbiome Members

Akkermansia muciniphila
Alistipes sp.
Eubacterium sp.
Roseburia sp.
Faecalibacterium prausnitzii

According to several studies, these bacterial genus and species have been associated with beneficial health marker,obtain important functional roles and have been negatively associated with various disease when found in high abundance in the human gut.

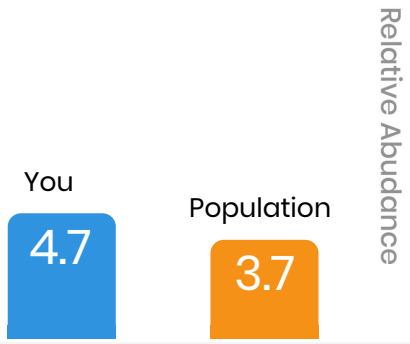
Eubacterium sp.

Play an important role in the gut microbiome and are known as a core bacteria in the human gut (Appears in more than 95% of the population). They are among the first gut colonizers after birth.
Important in digestion of complex carbohydrates originated from beans, legumes and whole grains.
(24,25)



Alistpies sp.

Are known as a core bacteria in the human gut (appears in more than 95% of the population).
Their abundance increases in plant based diet and decreases in a diet rich with fat and meat. It is negatively associated with Colitis, Crohn's and IBD disease(26). On the other hand, very high rates of Alistipes were associated with abdominal pain in children(27)

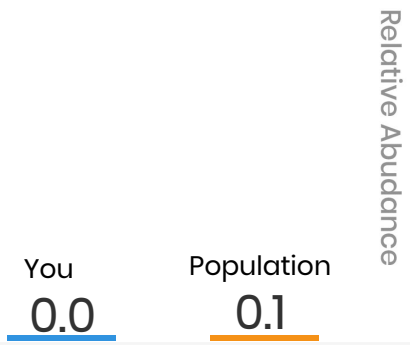


Roseburia sp.

Are part of the commensal bacterial community that that resides in humans gut. They are known to produce short-chain fatty acids, especially butyrate, which possibly affects colonic motility, immunity maintenance and anti-inflammatory properties.
This genus was observed to be positively associated with Mediterranean diet, and negatively associated with metabolic disease, immune disorders and neurological diseases(28)

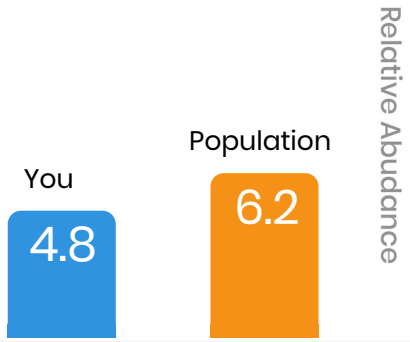
Akkermansia muciniphila

Akkermansia muciniphila are positively associated with greater microbial gene richness and with a healthier metabolic status. Moreover, *A. muciniphila* are associated with greater improvement in glucose homoeostasis, blood lipids and waist circumference after calorie restriction(29)



Faecalibacterium prausnitzii

Are highly abundant species in the human gut microbiome. In healthy adults, *F. prausnitzii* represents more than 5% of the bacteria in the intestine, making it one of the most common gut bacteria and It is known to boosts our immune system and reduce inflammation. Lower than normal levels of *F. prausnitzii* in the intestines have been associated with Crohn's Disease, obesity, asthma and Major Depressive Disorder. (30,31). On the other hand, very high rates of Alistipes were associated with abdominal pain in children(27)



Rare Species

Rare species are defined as bacterial species which are absent or present at low abundance in the total population cohort, but are present or relatively abundant in your gut, respectively.

In other words, these are the bacteria whose abundance in your gut is markedly different than in the general population.

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Rare Species

Bacterial Genus	You Relative Abundance %	Population Relative Abundance %	*Ratio*
Bacteroides stercoris	27.45	0.18	> 30
Acidaminococcus unclassified	1.09	0.00	> 30
Bacteroides ovatus	13.61	0.38	> 30
Bacteroides sp_2_1_22	5.49	0.00	> 30
Bacteroides thetaiotaomicron	2.38	0.16	**14.875**
Bacteroides massiliensis	7.95	0.54	**14.722**
Parabacteroides distasonis	1.77	0.14	**12.643**
Bacteroides uniformis	11.35	1.17	**9.701**
Sutterella wadsworthensis	1.52	0.18	**8.444**
Roseburia intestinalis	1.69	0.27	**6.259**
Oscillibacter unclassified	0.52	0.11	**4.727**

Rare Species

Bacterial Genus	You Relative Abundance %	Population Relative Abundance %	*Ratio*
Bacteroides vulgatus	4.21	1.17	**3.598**
Alistipes shahii	1.14	0.49	**2.327**

Important Gut Microbiome Functional Metabolites

Short Chain Fatty Acids (SCFA)

SCFA are key bacterial fermentation products that are produced when available non-digestive carbohydrates and dietary fiber are fermented in the colon. They play a significant role in providing energy to the colonocytes and have an important role in central appetite regulation. The main SCFA produced in the gut are Acetate, Butyrate and Propionate. High values in SCFA production meters indicate a strong potential of SCFA production in your gut.

Vitamin B Biosynthesis

B-vitamins are necessary cofactors for various aspects of human metabolism, including fat and carbohydrate metabolism and DNA synthesis. Human cells are not capable of producing B-vitamins in sufficient amounts; Thus, we obtain such vitamins either from directly from diet, or by utilizing vitamins produced by gut microbiota (36). B vitamins are indeed present in many food products, but they are water-soluble and many of them are temperature sensitive. Therefore, these vitamins are easily washed off or destroyed during the cooking process therefore, there is great interest in the B-vitamin production by the gut microbiota.

Although the gut microbiome os producing vitamin B's in different amounts, there is ongoing research about its association to these vitamin's levels in the blood.

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SCFA Production Meter

4.38

Butyrate

INFO

Butyrate serves as the main energy source for colonocytes, has anti-inflammatory properties, prevents oxidative stress and may protect against colonic cancer (32,33)

Propionate

INFO

Propionate serves as carbon source in the liver, has anti-inflammatory properties, lowers blood cholesterol, stimulates satiety and alters brain function in rats (34,35)

You can support Butyrate and Propionate producing bacteria by enriching your diet with:

Inulin

- Artichoke
- Leek
- Garlic
- Onion
- Asparagus

Arabinoxylan

- Rye
- Wheat
- Barley
- Oat
- Rice
- Maize

Resistant Starch

- Green Banana
- Rice

Fructooligosaccharides

- Banana
- Garlic
- Onion
- Asparagus

Pectin

- Apple
- Apricot
- Carrot
- Orange

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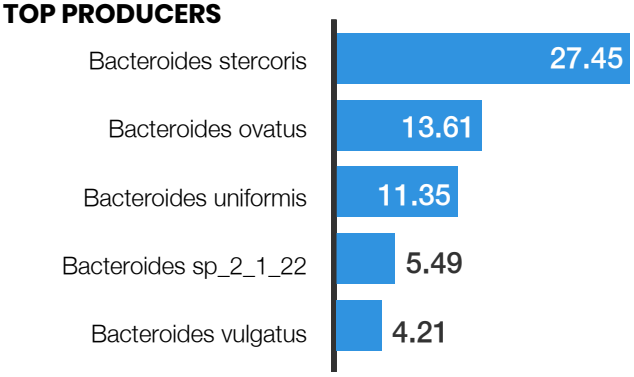
Vitamin B Meter

8.68

B3
Niacin

INFO
Studies have been shown that high rates of vitamin B3 can increase high-density lipoprotein (HDL; "good") cholesterol levels by 10-30%, reduce low-density lipoprotein (LDL; "bad") cholesterol levels by 10-25%, and reduce triglyceride levels by 20-50% (44). Niacin was also shown to decreases lipoprotein and can reduce lipid accumulation in the liver (45-46).

TOP PRODUCERS



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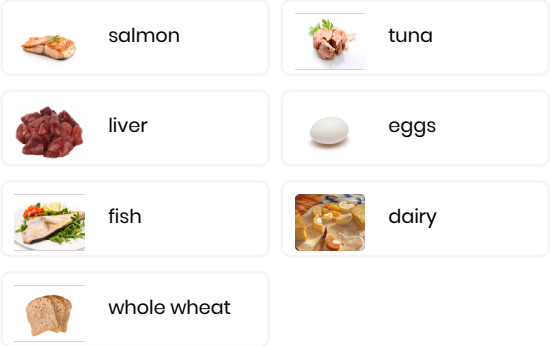
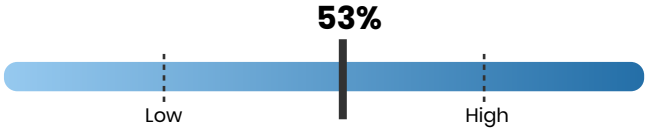


B12
Cobalamin



INFO
Vitamin B12 is required for proper red blood cell formation, neurological function, and DNA synthesis. Vitamin B12 deficiency has also been associated with megaloblastic anemia, fatigue, weakness, constipation and loss of appetite(59) and was associated with improved brain health, sleeping patterns and reduced depression symptoms (60-61).

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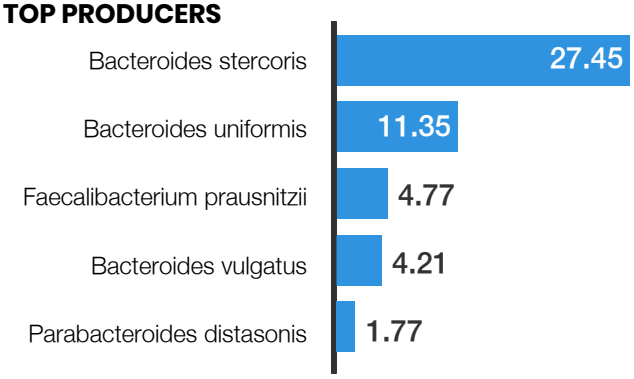

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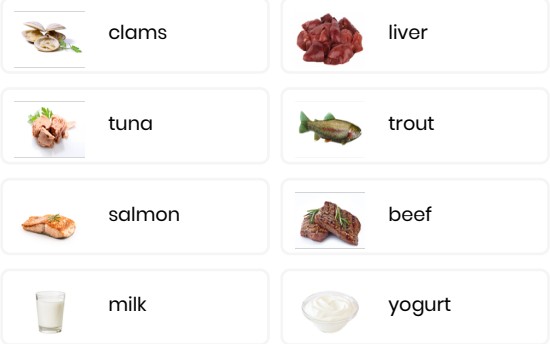

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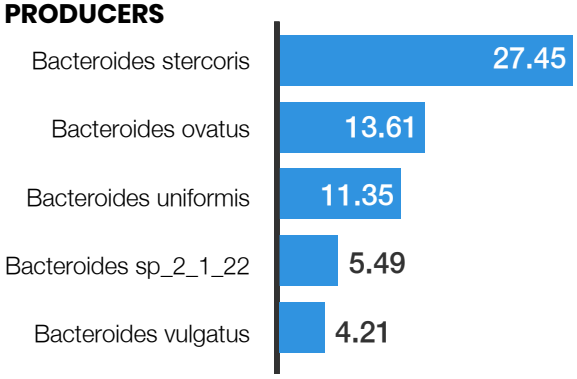
Vitamin B Meter

8.68

B1
Thiamin

INFO
Vitamin B1 helps to make ATP, the body's main energy-carrying molecule. Thiamine is essential for a metabolic pathway called pyruvate dehydrogenase, which works to metabolize sugars that we eat(37).Additionally, thiamine levels in plasma have been shown to be lower in people with type 2 diabetes(38) and it was also has been shown to improve cardiac function in people with heart failure(39).

TOP PRODUCERS



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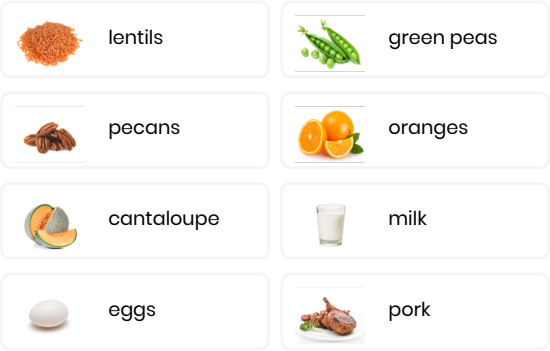
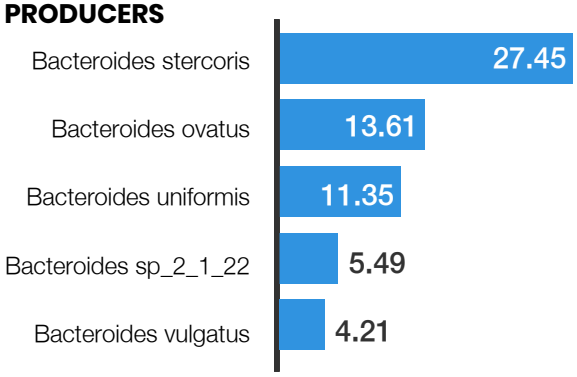


B9
Folate

INFO
Folate has an important role in nucleic acid synthesis, stability and in DNA repair mechanisms. It has great importance in normal brain development and function, cognitive function and depression disorders(54-56) and several studies have shown that high rates of folate might reduce the risk of some forms of cancer(57-58).

TOP PRODUCERS



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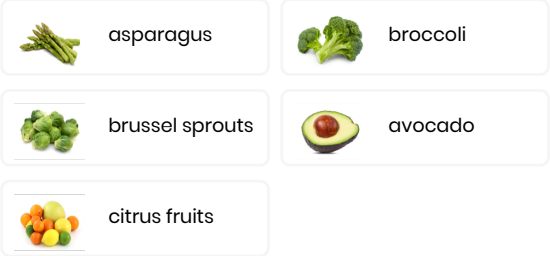

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Vitamin B Meter

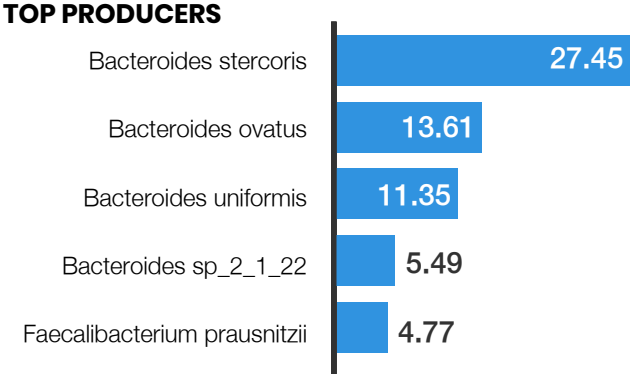
8.68

B2
Riboflavin

INFO

Vitamin B2 was shown to have anti-inflammatory properties in several studies(40,41). It has been shown to be produced in the gut in larger amounts after ingestion of vegetable-based than meat-based foods (42). Riboflavin is required for mitochondrial function (Mitochondrial dysfunction is thought to play a causal role in some types of migraine), researchers are studying the potential use of riboflavin to prevent or treat migraine headaches (43).

TOP PRODUCERS



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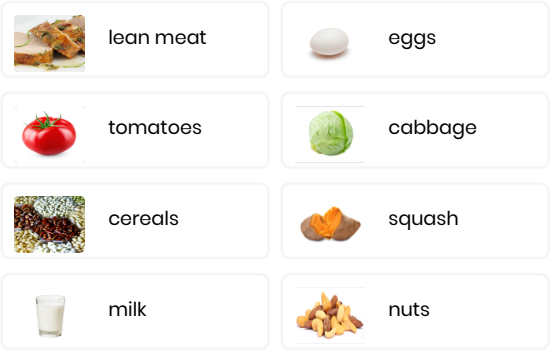
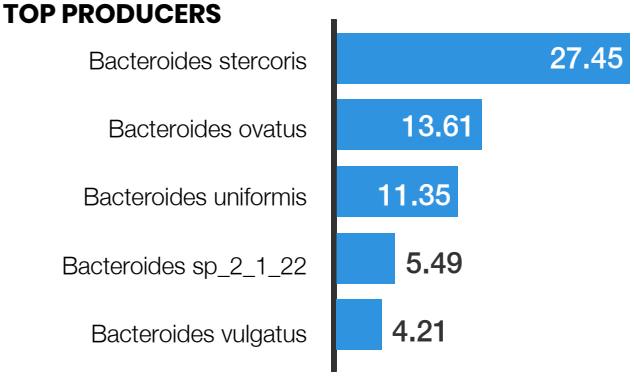


B7
Biotin

INFO

High rates of biotin are often promoted for hair, skin, and nail health(52). In several studies Biotin has been inversely associated with disease progression and associated with improve symptoms in patients with progressive multiple sclerosis(53).

TOP PRODUCERS



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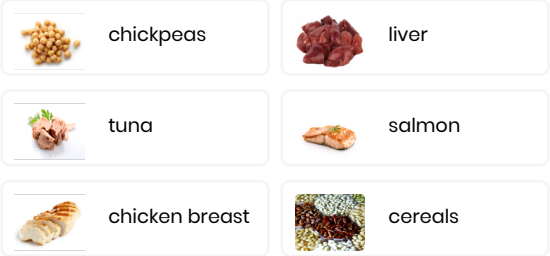

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DAY TWO

Vitamin B Meter

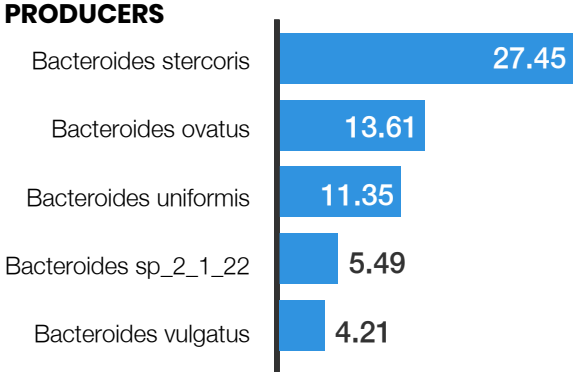
8.68

B6
Pyridoxin

INFO

Vitamin B6 might reduce cardiovascular disease risk by lowering homocysteine levels to reduce heart disease risk (48-49). Several studies have shown that higher rates of B6 were associated with nausea and vomiting in the first few months of pregnancy(50-51).

TOP PRODUCERS



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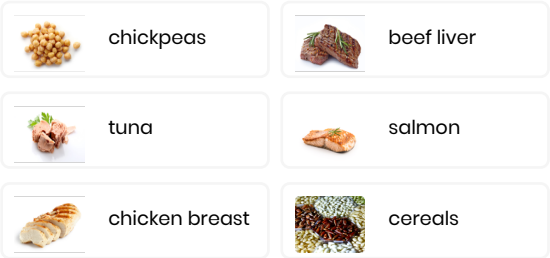
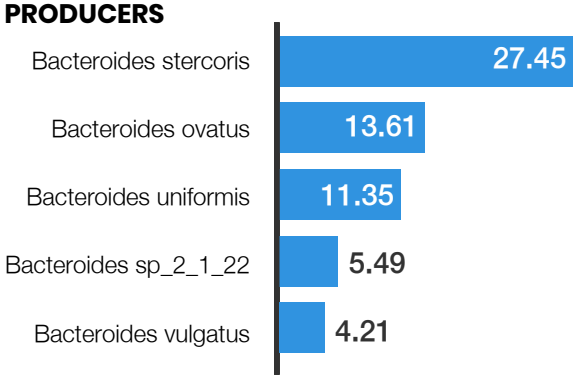


B5
Pantothenate

INFO

Pantothenic acid has a role in triglyceride synthesis and lipoprotein metabolism so it was hypothesized that pantothenic acid supplementation might reduce lipid levels in patients with hyperlipidemia(47).

TOP PRODUCERS



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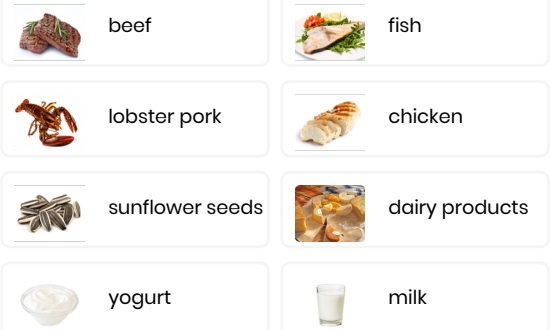

Analysis of Ecological Parameters

Microbial Diversity is a measure combining both bacterial **Richness** and **Evenness**

Gut Microbial Diversity is associated with a healthy microbiome and overall wellness.[19,20]

Species Richness
The number of different species represented in your bacterial community

Species Evenness
Refers to how close in abundance are each species in the microbiome.

Species Diversity
a quantitative measure that reflects the richness of species in the microbiome and how evenly they are distributed

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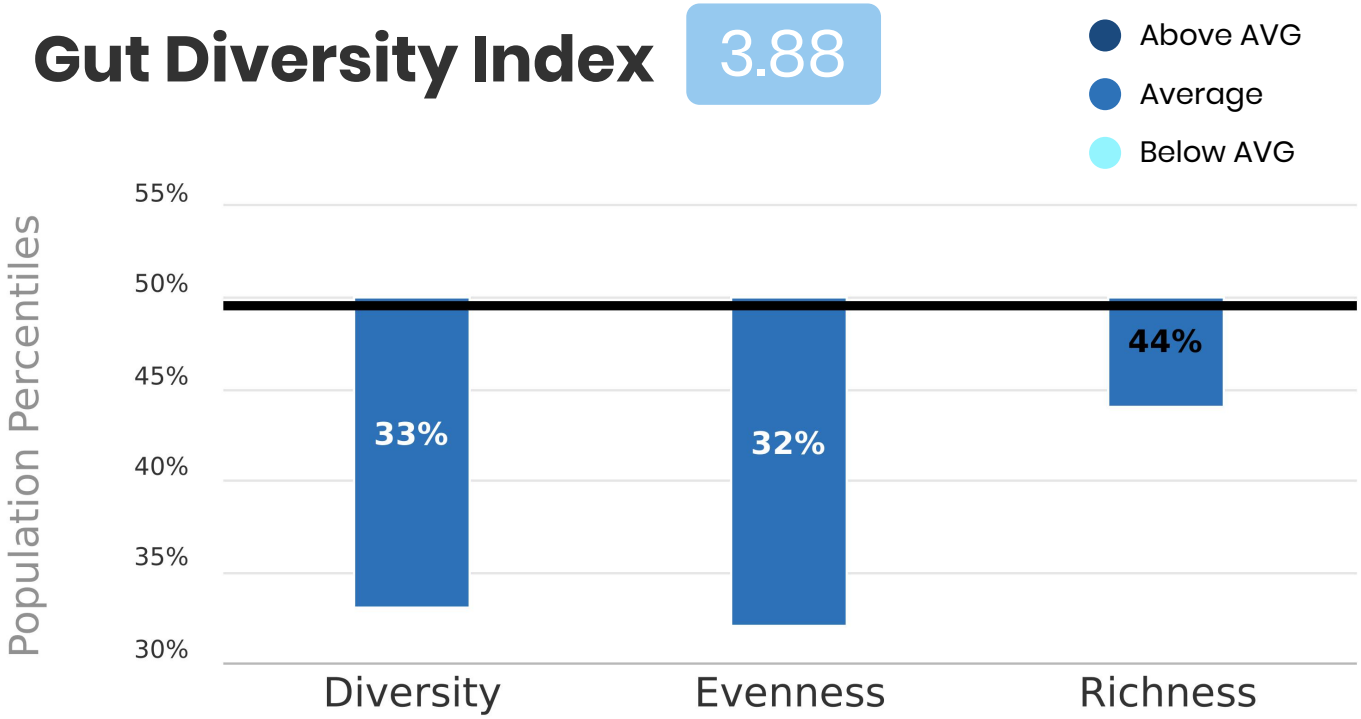
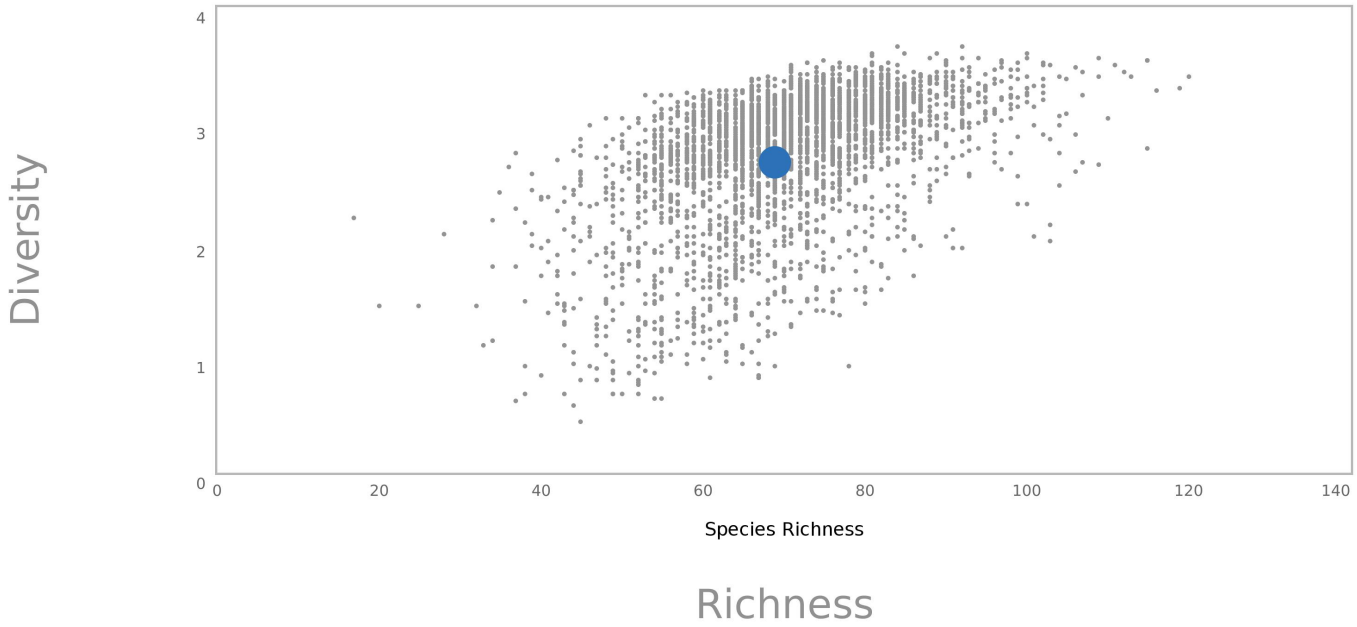
Gut Diversity Index 3.88





- Your microbial diversity measures are somewhat above average in relation to the total population.
- High microbial diversity and richness were shown to be positively correlated with various health measures. Eating more fiber and frequent exercise can help with increasing gut microbial diversity.

Probiotic Bacteria

Bacteria who are believed to provide health benefits to their host, including better regulation of inflammatory and hypersensitivity responses, reduction of serum cholesterol levels and alleviation of ulcerative colitis.

You can find probiotic bacteria in various kinds of food as: Yogurt, Cheese, Sauerkraut, Pickles, Beer, Cider, Kimchi, Cocoa, Kefir, Miso and Kombucha.

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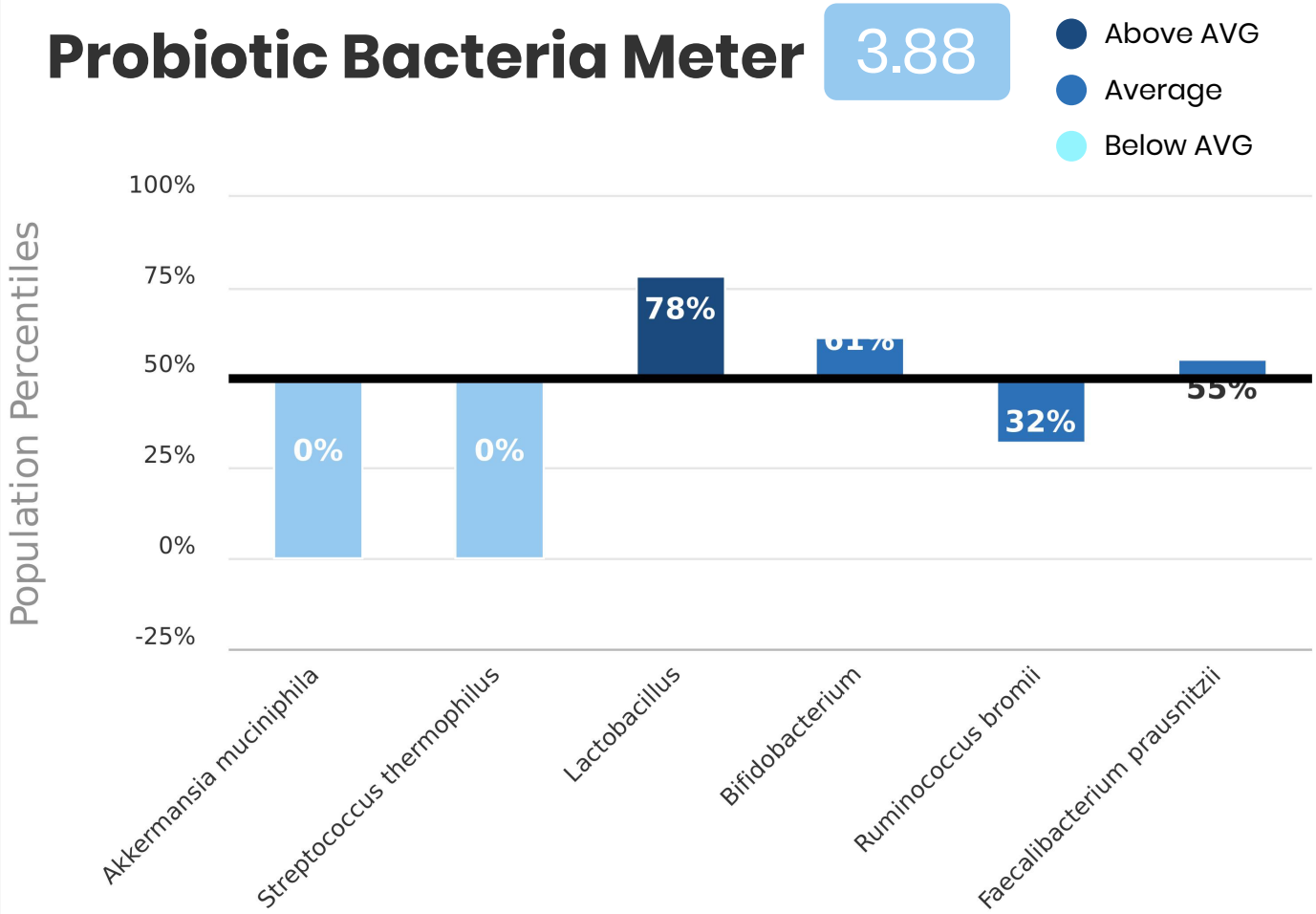
Probiotic Bacteria Meter 3.88



Akkermansia muciniphila	*Below Average*
Streptococcus thermophilus	*Below Average*
Lactobacillus	*Above Average*
Bifidobacterium	*Average*
Ruminococcus bromii	*Average*
Faecalibacterium prausnitzii	*Average*

DayTwo Uses Shotgun Metagenomics Sequencing

Taxonomic Resolution
Shotgun Metagenomics sequencing allows the identification of bacterial taxonomy at the highest resolution possible (strain level), while 16S rRNA sequencing generally allows for a much lower resolution (mostly at the genus level). This is important since species and even in their pathogenicity (ability to cause disease). Unlike Shotgun Metagenomics Sequencing that allows detection of all DNA in the sample, 16S does not allow for identification of viruses and fungi, as the 16S gene is not present in those. in the same genus can vary greatly in their metabolic capabilities

Functional profiling
Whole Genome Sequencing allows for accurate characterization of the metabolic capabilities of the microbial community. In contrast, 16S rRNA sequencing does not allow this, as only a very small fraction of the genomes present are sequenced. In cases where a functional profile is presented based on 16S data, it is important to know that this characterization is based on publicly available, sequenced genomes, and not based on genes actually found in the sample, and can thus be very inaccurate.

Company Overview

DayTwo™ provides solutions based on the DayTwo™ Microbiome Platform aiming to prevent and treat metabolic diseases, primarily diabetes and obesity. The DayTwo™ App provides personally tailored nutrition guidelines aimed at balancing blood sugar levels post meal. As high blood sugar is linked to energy dips, excessive hunger, weight gain, and increased risk for metabolic diseases like obesity and diabetes, balancing blood sugar levels presents a significant health benefit. Users provide personal and clinical information, a stool sample (we use full shotgun next generation sequencing technology to sequence the DNA of the gut microbiome), blood tests etc. - all this data is used to create for each user their personalized cloud-based DayTwo predictor.

Users get a personalized report that includes details of their better and worse foods and complex meals; the ability to search and receive a prediction for various foods and meals; and a detailed report on their microbiome.

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