bostonheart diagnostics®

GI Balance

Gastrointestinal Microbiome Analysis

May 30, 2023

Patient: TEST, PHENOTWO
Gender: F

Ernst J. Schaefer, MD
Laboratory Director / Chief Medical Officer

Powered by: PhenoBiome

Patient Information

Name: TEST, PHENOTWO
DOB: 10.10.2000
Patient ID: 161563
Gender: F

Provider

Name: DOCTOR TEST MD
Account No: 888821

Specimen Details

Accession Number: T0326373
Collection Date & Time: 12.06.2022 03:16 PM
Received Date & Time: 12.06.2022 03:16:00 PM
Report Date & Time: 12.06.2022 03:16:00 PM

MY MICROBIOME RECOMMENDATIONS

Based on your gut microbiome test results, you have 3 over-represented and 4 under-represented bacteria. Specific foods, nutrients and supplements may be used to adjust the overall gut microbial balance shifting it toward a more healthy and balanced state.

We have identified 3 areas of focus based on your test results to help you achieve this shift and have provided specific recommendations below targeting these areas.

Your Areas of Focus

1. B Vitamins
2. Lipoate
3. Prebiotics

Nutrients of Interest for You

FOOD

- Dark green leafy vegetables, brussels sprouts, tomatoes, turnips, mushrooms
- Legumes such as: chickpeas, black-eyed peas, and kidney beans
- Whole grains such as: brown rice, quinoa, barley
- Nuts and seeds: chia, flax, hemp
- Animal protein such as: beef, poultry, pork, fish, dairy, eggs

SUPPLEMENTS

- B Complex with active B vitamins (EX: 5MTHF)
- ALA (Listed as: Alpha-lipoic acid)
- Chicory, Inulin, FOS
- Vitamin D3

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Welcome to Your Gut Microbiome Personal Report

Welcome!

You are about to receive innovative insights about your body that, up until now, have never been available. The science of the human body only recently evolved enough to allow scientists to identify and analyze a person's gut microbiome. Your report not only provides you with a road map of your gut bacteria and other microorganisms, but gives direction on how you can potentially use this information to shift the microbiome composition from unhealthy to healthy.

We spend a lifetime trying to learn more about ourselves, especially how our body works and how our health is affected by our habits and behaviors. Traditionally, we have learned what works and what doesn't through trial and error. But experience alone doesn't always give us the information we need. Your report will help you to better understand the factors that can affect how your body ticks.

This report will provide you with the complete picture of your gut microbiome by assessing the metabolic pathways and physiological properties that rely on the gut microbiome to thrive. You will get the information that you need to understand the health of your microbiome and which specific nutrients are needed to optimize your gut microbiome on a very personal and individual level.

What Is Microbiome Testing?

Microbiome testing uses a physical specimen from the body (i.e. stool for the gut microbiome) to reveal information about the bacteria and other microorganisms present in the microbiome of interest. Current technologies allow us to identify microbial communities in various body sites that have important physiological functions. We can then analyze and compare multiple microbiome samples to identify health/disease-associated patterns. Testing enables us to distinguish a healthy from unhealthy microbiome, and subsequently informs us on how to support a healthy microbiome or how to correct an unhealthy microbiome.

Why Is Your Microbiome Important?

The microbiome plays a vital role in human nutrition, digestion, immunity, and disease. Your body is full of trillions of microbes, including bacteria, viruses, and fungi, mostly inside your intestines and on your skin. In fact, in a healthy human adult, microbes outnumber human cells by a ratio of 10:1. These microbes have been working with our bodies to keep us healthy since we were born, and are inextricably linked to our health. In fact, in many disease states, the microbial composition is found to be altered, which likely exacerbates the disease.

Historically, the microbiome has been a poorly understood part of human health, but that has changed in the last couple of decades. And as more studies come out, we are learning more and more about the role of microbes in metabolic disease, infectious disease, cancers, gastrointestinal and digestive disorders, autoimmune disease, and psychological or mental health.

The microbiota contain an incredible amount of versatile metabolic genes that contribute to unique enzymes and biochemical pathways. In this report, we assess these pathways and categorize them into physiological properties or phenotypes. In this way, you are able to gain a greater understanding of how your gut microbes are working together and with your body to optimize your health, and, where appropriate, see specifically where you could improve your nutrition to optimize the health of your microbes, thereby improving the health of your body.

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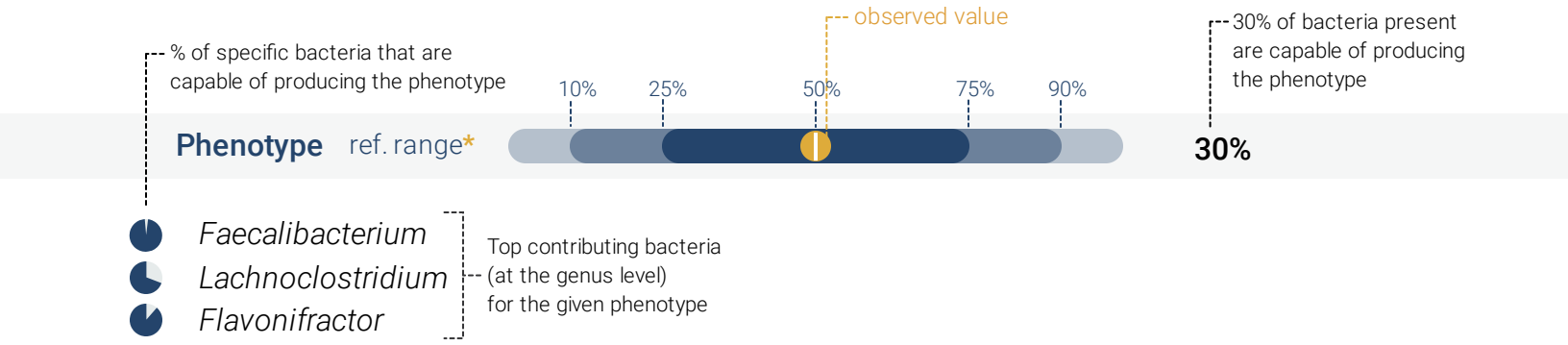
How To Read This Report



* Observed Community Phenotype Index, taxonomic abundance and diversity values are plotted against a corresponding distribution from reference dataset consisting of samples of healthy individuals collected from American Gut Project (AGP) study.

What You'll Learn About Your Gut

On the following pages you will see a summary of your results. You'll learn which physiological functions or phenotypes in your body are within normal range or need attention, and you'll gain an understanding of how your gut bacteria are contributing to the function (whether optimally or not optimally) of each phenotype. You'll also gain insight into the diversity of your gut bacteria, and traditional markers of gut microbiome health, including important ratios and commensal bacteria. The vitamins and nutrients listed on the pages of this report refer to the ability of specific bacteria in your gut to make them. They do not show the actual levels of these vitamins and nutrients in your body.

- REPORT SUMMARY
- BACTERIAL BALANCE
- NUTRIENT MAP
- CARDIOVASCULAR TOXIN PRODUCERS
- SHORT CHAIN FATTY ACID PRODUCTION
- SUGAR UTILIZATION
- VITAMIN PRODUCTION
- AMINO ACID PRODUCTION

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REPORT SUMMARY

MICROBIOME KEY CHARACTERISTICS

Alpha diversity 15.4

Alpha diversity is a measure of intra-sample diversity. It shows how phylogenetically broad the bacterial community is.

** calculated using Faith PD metric (reference dataset: AGP)*

Your Top 5 Taxa

1. *Prevotella*
2. *Prevotellamassilia*
3. *Ruminococcoides*
4. *Faecalibacterium*
5. *Blautia*

Ratios

		ref. range	
Firmicutes/Bacteroidetes	IN-RANGE	0.0 - 106.3	0.628
Prevotellaceae/Bacteroidaceae	ABOVE AVERAGE	0.0 - 28,841.7	42.601

CARDIOVASCULAR TOXIN PRODUCERS

Lipopolysaccharides (LPS)	IN-RANGE	Prevotella, Prevotellamassilia
Trimethylamine N-Oxide (TMAO)	IN-RANGE	Enterobacteriaceae, Enterobacterales

SHORT CHAIN FATTY ACID PRODUCTION

Butyrate producers	BELOW AVERAGE	Faecalibacterium, Eubacterium, Roseburia
Propionate producers	BELOW AVERAGE	Blautia, Dialister, Enterobacteriaceae
Acetate producers	IN-RANGE	Prevotella, Prevotellamassilia

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REPORT SUMMARY

SUGAR UTILIZATION

FOS utilisers	ABOVE AVERAGE	Prevotella, Prevotellamassilia, Blautia
Arabinose utilizers	IN-RANGE	Prevotella, Enterobacteriaceae, Blautia
Inositol utilizers	IN-RANGE	Roseburia, Blautia, Enterobacterales
Lactose utilizers	IN-RANGE	Prevotella, Faecalibacterium

VITAMIN PRODUCTION

Thiamine (B1) producers	ABOVE AVERAGE	Prevotella, Prevotellamassilia, Blautia
Riboflavin (B2) producers	IN-RANGE	Prevotella, Prevotellamassilia, Blautia
Niacin (B3) producers	ABOVE AVERAGE	Prevotella, Prevotellamassilia
Pantothenate (B5) producers	IN-RANGE	Prevotella, Prevotellamassilia, Eubacterium
Pyridoxine (B6) producers	IN-RANGE	Prevotella, Prevotellamassilia, Eubacterium
Biotin (B7) producers	BELOW AVERAGE	Enterobacteriaceae, Dialister, Bacteroides
Folate (B9) producers	IN-RANGE	Prevotella, Prevotellamassilia, Blautia
Cobalamin (B12) producers	BELOW AVERAGE	Blautia, Faecalibacterium, Eubacterium

AMINO ACID PRODUCTION

Cysteine producers	IN-RANGE	Prevotella, Prevotellamassilia
Trytophan producers	ABOVE AVERAGE	Prevotella, Prevotellamassilia
Histidine producers	ABOVE AVERAGE	Prevotella, Prevotellamassilia

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BACTERIAL BALANCES

OVERREPRESENTED BACTERIA		ref. range	
Prevotella	ABOVE AVERAGE	0.0 - 90.2%	49.7%
Prevotellamassilia	ABOVE AVERAGE	0.0 - 34.8%	6.6%
Ruminococcoides	ABOVE AVERAGE	0.0 - 28.5%	5.3%

IN-RANGE BACTERIA		ref. range	
Roseburia	IN-RANGE	0.0 - 30.2%	1.7%
Hungatella	IN-RANGE	0.0 - 14.2%	1.1%
Lachnospira	IN-RANGE	0.0 - 12.0%	1.0%
Gemmiger	IN-RANGE	0.0 - 25.2%	1.0%

UNDERREPRESENTED BACTERIA		ref. range	
Faecalibacterium	IN-RANGE	0.0 - 43.8%	3.7%
Alistipes	IN-RANGE	0.0 - 41.1%	0.4%
Bacteroides	BELOW AVERAGE	0.0 - 56.2%	1.0%
Phocaeicola	BELOW AVERAGE	0.0 - 47.3%	0.3%

BACTERIA OF INTEREST		ref. range	
Roseburia	IN-RANGE	0.0 - 6.6%	1.7%
Bacteroides	BELOW AVERAGE	0.0 - 28.8%	1.0%
Prevotella	HIGH	0.0 - 48.9%	49.7%

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CARDIOVASCULAR TOXIN PRODUCERS

The gut microbiome plays a key role in heart health with toxins created by bacteria being associated with increased risk for CVD. The percentage (on the scale from 0 to 100) of producers of each toxin is shown along with the top contributor

Lipopolysaccharides (LPS)

14.5 - 84.8%

64.7%

LPS is part of the outer membrane of gram-negative bacteria and is highly inflammatory. Elevations in LPS have been associated with higher risk of CVD.

- *Prevotella*
- *Prevotellamassilia*
- *Enterobacteriaceae*

Trimethylamine (TMAO)

0.5 - 8.6%

3.9%

Trimethylamine (TMA) is produced by bacteria in the gut microbiome from dietary precursors and further modified to Trimethylamine N-Oxide (TMAO) in the liver. Elevations in TMAO have been strongly associated with CVD.

- *Enterobacteriaceae*
- *Enterobacterales*
- *Dysosmobacter*

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SHORT CHAIN FATTY ACID PRODUCTION

Short chain fatty acids (SCFA) are the beneficial products of carbohydrate fermentation that are associated with a diverse microbiome and overall health. The percentage (on the scale from 0 to 100) of SCFAs producers is shown along with top contributors.

Butyrate producers

8.2 - 55.2% **17.6%**

Butyrate is produced by microbial fermentation and plays an integral role in maintaining digestive health by regulating gene expression, cell differentiation, gut tissue development, immune modulation, oxidative stress reduction, and more.

- *Faecalibacterium*
- *Eubacterium*
- *Roseburia*

Propionate producers

11.7 - 76.6% **13.9%**

Propionate is known to have a significantly positive impact on the immune system, including improving lung health and increasing resistance to infection. It is typically converted to glucose in the liver and may prevent some lipogenic effects of acetate.

- *Blautia*
- *Dialister*
- *Enterobacteriaceae*

Acetate producers

51.8 - 96.9% **90.1%**

Acetate production is tightly regulated within the microbiome. It is largely utilized for cholesterol synthesis and lipogenesis, and excessive production combined with insufficient butyrate production can lead to fat gain, particularly around the liver.

- *Prevotella*
- *Prevotellamassilia*
- *Faecalibacterium*

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SUGAR UTILIZATION

Polysaccharides and mono/oligosaccharides are utilized for biosynthesis and energy metabolismin gut colonizing bacteria. These phenotypes display the potential of present bacteria to utilize the following sugars. The percentage (on the scale from 0 to 100) of sugars utilizers is shown along with top contributors.

FOS utilizers

20.6 - 82.4% — **70.6%**

Fructo-oligosaccharides (FOS) is a prebiotic with positive impact on the diversity and abundance of the microbiome. Dietary sources of FOS are onions, garlic, chicory and artichokes. Bacteria who utilize FOS can be helpful in weight loss and correcting constipation.

- *Prevotella*
- *Prevotellamassilia*
- *Blautia*

Arabinose utilizers

9.2 - 53.7% — **16.5%**

Arabinose is a prebiotic that promotes diversity within the microbiome. Dietary sources of arabinose are whole grains, apples and citrus fruits and fermented foods. Bacteria who utilize arabinose can be helpful with blood sugar balancing, metabolic syndrome.

- *Prevotella*
- *Enterobacteriaceae*
- *Blautia*

Inositol utilizers

1.7 - 16.2% — **5.3%**

Inositol is important for microbiome adaptation and diversity. Dietary sources are fiber rich foods, such as beans, nuts and seeds, citrus and melons. Inositol can be beneficial for metabolic syndrome, lipid imbalances, insulin resistance.

- *Roseburia*
- *Blautia*
- *Enterobacterales*

Lactose utilizers

14.0 - 71.6% — **54.4%**

Lactose intolerance is a common medical problem marked by bloating, diarrhea, abdminal pain, or cramping, resulting from a reduction in the lactase enzyme. Colonic bacterial adaptation can significantly improve symptoms of intolerance.

- *Prevotella*
- *Faecalibacterium*
- *Enterobacteriaceae*

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VITAMIN PRODUCTION

B Vitamins are precursors of nearly all metabolic coenzymes universally essential in all lifeforms. With the exception of B12, which is dispensable for some bacterial species, all B vitamins that are not able to be produced, must be retrieved through exogenous sources. The percentage (on the scale from 0 to 100) of vitamins producers is shown along with top contributors.

Thiamine (B1) producers

32.2 - 86.1%

76.8%

Thiamin is a water-soluble B vitamin that plays a critical role in energy metabolism, particularly in the brain and nervous system, as well as in the growth and function of cells. Some bacteria are able to produce thiamin, while others are not.

- *Prevotella*
- *Prevotellamassilia*
- *Blautia*

Riboflavin (B2) producers

56.5 - 93.4%

83.6%

Riboflavin is a B-vitamin that is a component of two important coenzymes required for energy production and fatty acid metabolism, as well as metabolism of drugs and steroids. Some bacteria are able to produce riboflavin, while others are not.

- *Prevotella*
- *Prevotellamassilia*
- *Blautia*

Niacin (B3) producers

48.3 - 92.4%

86.8%

Niacin is a B-vitamin required for the coenzyme NAD, which is involved in more than 400 enzymatic reactions in the body. Noteably, NAD works to convert food into energy for our cells. Some bacteria are able to produce niacin, while others are not.

- *Prevotella*
- *Prevotellamassilia*
- *Ruminococcoides*

Pantothenate (B5) producers

28.9 - 87.3%

70.7%

Pantothenate is a B-vitamin that plays a major role in energy production, particularly the breakdown of fatty acids. It may play a role in reducing lipid production in certain individuals. Some bacteria are able to produce pantothenate, while others are not.

- *Prevotella*
- *Prevotellamassilia*
- *Eubacterium*

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VITAMIN PRODUCTION

Pyridoxine (B6) producers
41.6 - 89.7%
78.1%

Pyridoxine is a B-vitamin required for coenzymes that play a role in enzymatic reactions mostly concerning protein metabolism, immune function, and brain development during pregnancy. Some bacteria are able to produce pyridoxine, while others are not.

- *Prevotella*
- *Prevotellamassilia*
- *Eubacterium*

Biotin (B7) producers
6.8 - 67.6%
9.5%

Biotin is a B-vitamin that plays a critical role in energy production, histone modification, gene regulation, and cell signaling. Signs of deficiency include skin rashes, hair loss, and brittle nails. Some bacteria are able to produce biotin, while others are not.

- *Enterobacteriaceae*
- *Dialister*
- *Bacteroides*

Folate (B9) producers
44.5 - 92.6%
79.0%

Folate is a B-vitamin that is required to synthesize DNA, metabolize amino acids, enable methylation, and prevent anemia, as well as protect against neural tube defects in pregnancy. Some bacteria are able to produce folate, while others are not.

- *Prevotella*
- *Prevotellamassilia*
- *Blautia*

Cobalamin (B12) producers
16.5 - 79.1%
28.4%

Cobalamin is a B-vitamin that is important in synthesizing DNA and red blood cells, brain and nervous system function, and metabolism. It is required to prevent magaloblastic anemia. Some bacteria are able to produce cobalamin, while others are not.

- *Blautia*
- *Faecalibacterium*
- *Eubacterium*

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AMINO ACID PRODUCTION

Amino acids are indispensable for the microbiome health. Bacteria that are not capable of producing amino acids require exogenous sources from diet or other bacteria. The percentage (on the scale from 0 to 100) of amino acids producers is shown along with top contributors.

Cysteine producers

71.8 - 98.5%

96.9%

Cysteine is a nonessential sulfur containing amino acid in the methionine - homocysteine pathway and one of three amino acids that build glutathione. Cysteine is beneficial as an antioxidant, assists with collagen formation and immune system regulation.

- *Prevotella*
- *Prevotellamassilia*
- *Ruminococcoides*

Trytophan producers

45.4 - 90.2%

88.8%

Tryptophan is an essential amino acid with an important role in the gut-brain axis (GBS). Tryptophan is important in the production of neurotransmitters that regulate mood, particularly depression, and intestinal barrier integrity.

- *Prevotella*
- *Prevotellamassilia*
- *Ruminococcoides*

Histidine producers

61.4 - 97.2%

96.8%

Histadine is an essential amino acid and precursor to histamine. Histadine and its derivatives have important roles in the immune response, blood clotting pathways, and detoxification.

- *Prevotella*
- *Prevotellamassilia*
- *Ruminococcoides*

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Technical Notes

DISCLAIMER

This test was developed and its performance characteristics were determined by Phenobiome and Clinical Enterprises. The test has not been cleared or approved by the Food and Drug Administration. This test should be interpreted in context with other clinical findings.

TEST LIMITATIONS

TECHNICAL DETAILS

The type of bacteria that you have in your large intestine or colon can be ascertained by next generation sequencing of your stool. We isolate and sequence a specific variable region (V4) of the 16S ribosomal RNA (rRNA) gene which is unique to bacteria and Archaea (ancient bacteria) allowing for their specific identification and quantitation. This sequencing is carried out by our partner Eurofins laboratory Clinical Enterprise (also in Framingham, MA) on Illumina MiSeq instruments using specific reagents and standards from Zymo Research. The methodology is extremely accurate and reproducible and has been validated following all CLIA and CAP guidelines as a laboratory developed test. The data generated are used to produce FASTq files which are analyzed internally to ensure data quality, and are then securely transferred to our partner company PhenoBiome to generate this report using their informatics platform

LABORATORY INFORMATION

Performing Lab:
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