



# GI Axis

## Gut Microbiome Test

Sample ID :

Patient Name : Example Report

Sample Date :

## Test Report Index

After analysing thousands of microbes, YourGutMap's test report is broken down into three sections:

### Module 1 = Gut Interaction Insights

A snapshot of how the current balance of the gut microbiome impacts health. This section contains colour coded dashboards and easy to understand graphs - to provide a detailed summary of the gut microbiome.

Page 04 Microbiome Diversity (Shannon Index)

Page 05 Gut Health Axes dashboard

Page 06 Gut Interaction Insights Dashboard

### Module 2 = Microbial Analysis

Designed for health practitioners, this section explores the synergistic relationship between bacteria involved in 10 Gut Health Axes, and 20 Health Insights. With detailed explanations of roles and mechanisms of specific bacteria, more than 120 published studies to unlock these comprehensive gut health insights.

Page 08 Significant Bacteria - abundance and mechanisms

Page 09 Antibiotic Degradation

Page 10 - 20 Gut-Axes Deep Dive - pathways, mechanisms, and specific bacteria

Page 21 - 38 Gut Interaction Insights Dashboard - pathways, mechanisms, and specific bacteria

### Module 3 = Unique Gut Based Nutrition Plan

Now that we have unlocked health insights based on the microbial balance, we can suggest tailored nutritional interventions to help naturally rebalance the gut microbiome.

Based on the concept of starving the bacteria that need to be reduced, and feeding that bacteria that need to be increased - we assess the nutritional breakdown of over 200 foods.

Considering fibres, polyphenols, micronutrients, and many other factors - we provide suggestions to change the diet to help take care of imbalances and overgrowths.

Pages 40 - 43 Personalised Nutrition Recommendations

This report is intended for informational and educational purposes only and is not a substitute for medical advice, diagnosis, or treatment. Any dietary changes, supplements, or lifestyle changes should be made under the guidance of a qualified health practitioner. If you are experiencing significant symptoms or have a medical condition, please consult your doctor or a healthcare professional. The findings and recommendations in this report are based on current scientific research but are not intended to diagnose, treat, cure, or prevent any disease.





# Module 1

Gut Interaction Insights

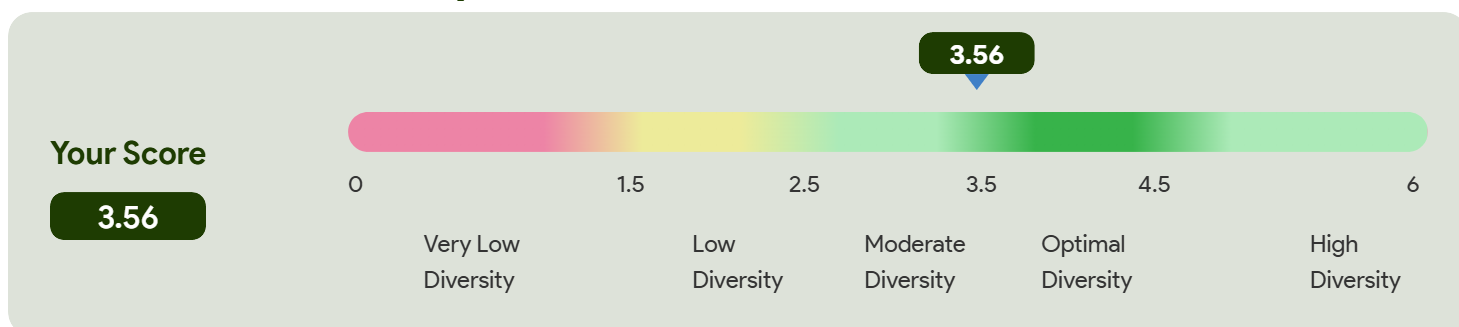
## Shannon Index

The Shannon Index is a widely used scientific measure that helps us understand the diversity of the gut microbiome.

It takes into account not just how many different types of bacteria are present, but also how evenly they are distributed. A higher Shannon score generally means the gut has a richer and more balanced community of bacteria, which is often linked in published research to better resilience, digestion, and overall health

This section shows the specific diversity score. Subsequent sections of the report will breakdown what the bacteria balance means for specific health conditions and health goal

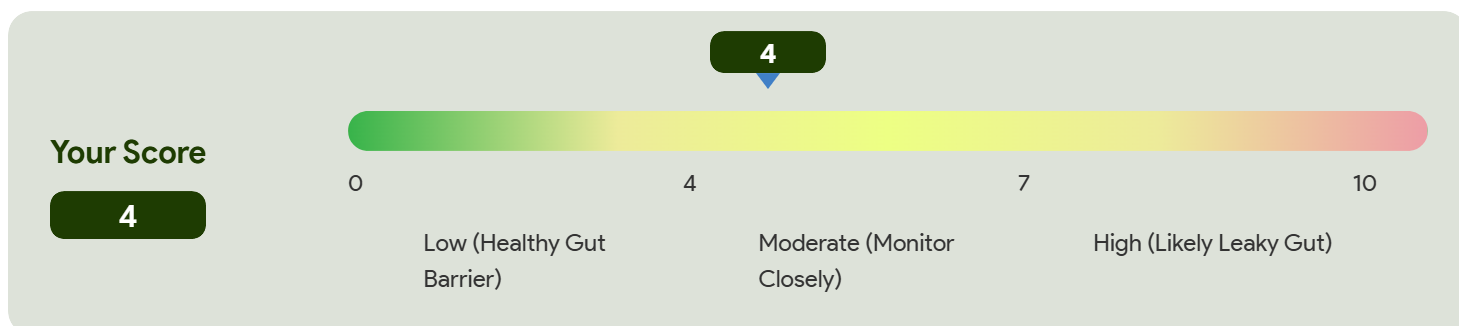
### Microbiome Diversity - Shannon Index



## Intestinal Permeability index

The Intestinal Permeability Index measures how well the gut barrier prevents harmful substances from entering the bloodstream. A high index suggests a healthy barrier, while a low index may indicate a "leaky gut" and risk of inflammation.

### Microbiome Diversity - Intestinal Permeability index





## Gut-Axes Dashboard

The gut doesn't just digest food - it also communicates with key systems throughout the body. These communication pathways are known as gut axes. The gut axes dashboard considers all of the individual bacteria that are involved in the specific gut axis, both those bacteria that have a beneficial effect, and those that can have negative effects as well.

**Good**

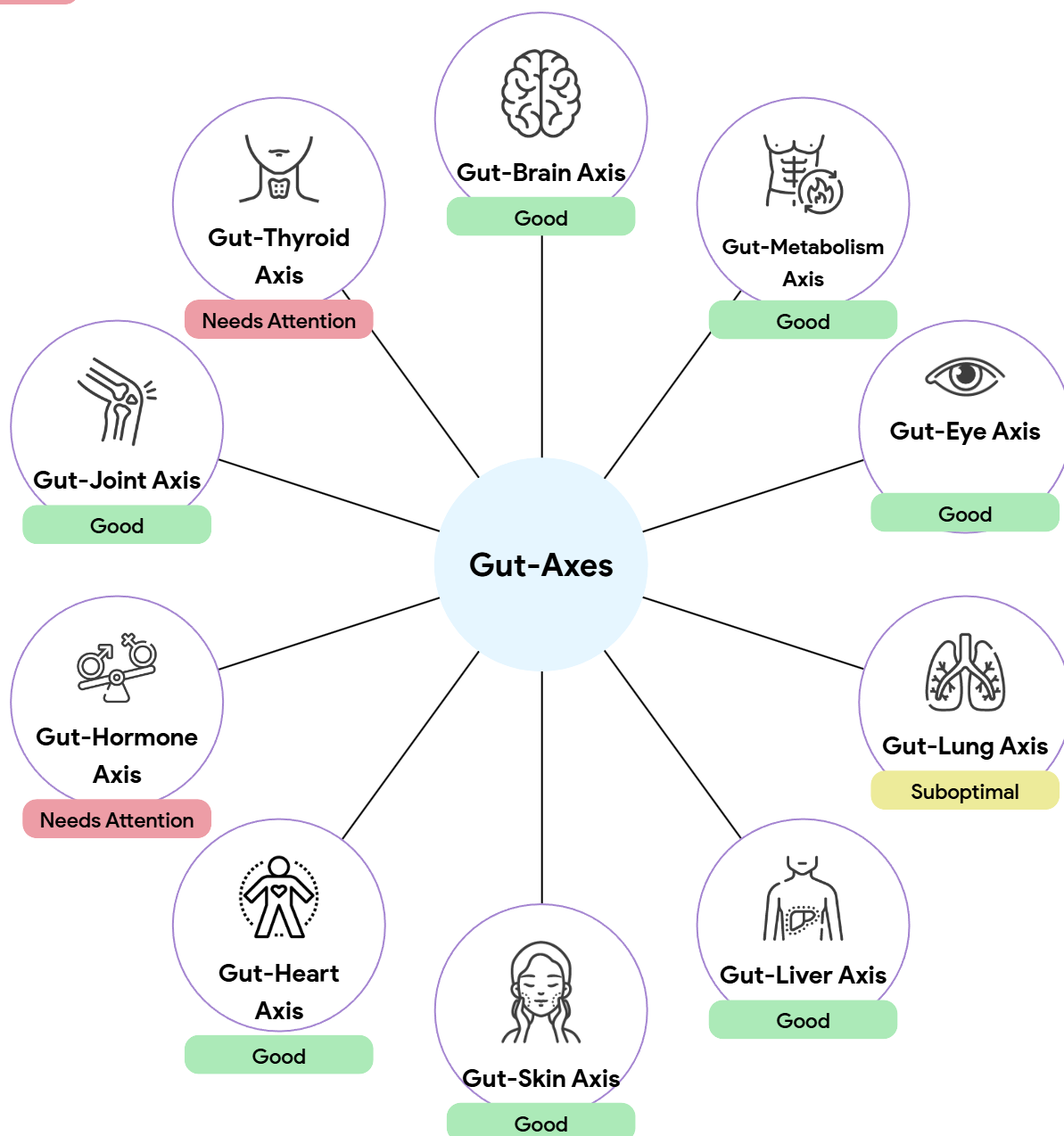
The bacteria balance is at an optimal level for the specific gut axis

**Suboptimal**

Some of bacteria levels show signs of imbalances for the specific gut axis

**Needs Attention**

The bacteria levels identified are imbalanced for the specific gut axis



## Gut Interaction Insights Dashboard

Based on the unique balance of bacteria in the gut, we've identified 20 key health insights that may be relevant to your overall well-being. These insights are drawn from the latest clinical research and reflect how specific bacteria in the microbiome are linked to various aspects of health.

**Good**

The bacteria balance is at an optimal level for the specific area of health

**Suboptimal**

Some of bacteria levels show signs of imbalances for the specific area of health

**Needs Attention**

The bacteria levels identified are imbalanced for the specific area of health



**SCFA  
Producers**

Suboptimal



**Inflammation  
Index**

Good



**Immunity**

Suboptimal



**Histamine  
Index**

Good



**Protein  
Absorption**

Needs Attention



**Carbohydrate  
Absorption**

Good



**Fat  
Absorption**

Good



**Micronutrient  
Absorption**

Needs Attention



**Bowel  
Habits**

Good



**Fitness**

Good



**Mood  
& Mental Health**

Suboptimal



**Autoimmunity**

Good



**Detoxification**

Suboptimal



**Stress  
Resilience**

Good



**Longevity**

Good



**Insulin  
Balance**

Needs Attention



**Bloating  
& Gas**

Good



**ADHD**

Good



**ASD**

Suboptimal



**Sleep**

Good



Sample ID :  
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# Module 2

Microbial Analysis

## Significant Bacteria

This section of the report details 9 of the most well researched and abundant bacteria in the gut microbiome.

Significant bacteria can give insights into the levels of bacteria in the gut compared to the average person, and optimal abundance ranges based on the latest clinical research.

It is important to note, that looking at these bacteria in isolation does not give the full picture, as bacteria in the gut have a synergistic relationship. The Gut-Axes and Health Insights sections will provide more detailed insight of bacteria levels for specific health concerns.

Bacteria	Role	Optimal Abundance %	Average Abundance %	Your Abundance %
Faecalibacterium prausnitzii	Butyrate-producing; supports anti-inflammatory signalling and gut lining repair.	0.188 - 2.62%	~1.084%	5.3671
Akkermansia muciniphila	Degrades mucin to strengthen the gut barrier and regulate immune responses.	0.0012 - 0.28%	~0.0084%	4.3232
Bifidobacterium spp.	Ferments fibres and supports immune maturation and gut wall integrity.	0.1239 - 4.497%	~1.006%	1.3900
Bifidobacterium longum	Reduces gut inflammation and promotes barrier and cognitive health.	0.0134 - 0.76%	~0.137%	0.4700
Bifidobacterium adolescentis	Produces SCFAs and assists in fibre breakdown and immune balance.	0.0022 - 0.35%	~0.018%	0.0490
Lactobacillales spp.	Produces lactic acid; supports microbial balance and mucosal immunity.	0.076 - 0.85%	~0.246%	0.2040
Roseburia spp.	Butyrate-producing; promotes colonic health and energy regulation.	0.124 - 1.55%	~0.611%	1.8385
Coprococcus spp.	Butyrate-producing; involved in gut-brain signalling and mood.	0.039 - 0.25%	~0.1445%	0.8029
Adlercreutzia equolifaciens	Converts soy isoflavones into equol with hormonal activity.	0.0035 - 0.072%	~0.017%	Not Detected
Barnesiella spp.	Competes with pathogens and supports microbial diversity.	0.0022 - 0.013%	~0.005%	0.1855
Bacteroides thetaiotaomicron	Breaks down plant fibres and supports nutrient absorption.	0.104 - 1.33%	~0.47%	0.0495
Streptococcus thermophilus	Aids lactose digestion and supports gut microbial balance.	0.00075 - 0.023%	~0.002%	0.1274
Lactococcus lactis	Produces lactic acid and supports mucosal immunity.	0.00048 - 0.0058%	~0.0012%	Not Detected
Anaerostipes spp.	Converts lactate to butyrate for gut energy and repair.	0.056 - 0.96%	~0.313%	0.8668
Anaerobutyricum hallii	Produces butyrate from lactate and acetate for gut health.	0.03 - 0.74%	~0.172%	Not Detected



## Antibiotic Degradation

These bacteria have been shown in studies to be some of the most damaged by antibiotic use. It's important to consider these specific bacteria that these bacteria can also be substantially reduced through inadvertent antibiotic digestion, which can occur from the consumption of meat and dairy products.

Bacteria	Average Relative Abundance (%)	Healthy Relative Abundance (%)	Abundance if Damaged by Antibiotics (%)	Your Abundance (%)
Bifidobacterium spp.	5	0.1239 - 4.497%	~1.006%	1.3900
Lactobacillales spp.	3	0.076 - 0.85%	~0.246%	0.2040
Faecalibacterium prausnitzii	6	0.188 - 2.62%	~1.084%	5.3671
Akkermansia muciniphila	1	0.0012 - 0.28%	~0.0084%	4.3232
Ruminococcus spp.	4	0.007 - 0.174%	~0.021%	0.4513
Bacteroides spp.	25	5.885 - 31.13%	~17.051%	4.4168
Clostridium spp.	10	≤0.085%	~0.035%	1.7748





## Gut-Axes Deep Dive

This section of the report provides a specific bacteria analysis for each of the gut axes. If there are signs of imbalance, the Personal Nutrition Guide will help to remodulate the gut microbiome.

**Beneficial Bacteria** - are the bacteria that have been shown in clinical research to influence a positive mechanism for the specific gut axis.

**Disruptive Bacteria** - these bacteria have been shown in clinical research to have negative effects on the specific gut-axis.

The mechanism for each bacteria is explained for each pathway, specific to the relevant gut axis.

Good

The bacteria balance is at an optimal level for the specific gut axis

Suboptimal

Some of bacteria levels show signs of imbalances for the specific gut axis

Needs Attention

The bacteria levels identified are imbalanced for the specific gut axis

## Gut-Skin Axis



Good

### Beneficial Bacteria for Skin Health

These bacteria are associated with healthy, hydrated, low-inflammation skin and protection from acne, eczema, rosacea, and psoriasis.

Bacteria	Mechanism	Healthy Relative Abundance%	Your Abundance%
Faecalibacterium prausnitzii	Anti-inflammatory, gut barrier support	0.188 - 2.62%	5.3671
Lactobacillales spp.	Controls inflammation, helps eczema/acne	0.076 - 0.85%	0.2040
Bifidobacterium spp.	Enhances gut & skin barrier	0.1239 - 4.497%	1.3900
Roseburia spp.	Butyrate-producing; supports gut lining and reduces inflammation	0.124 - 1.55%	1.8385
Blautia spp.	SCFA-producing; supports gut barrier and balances immune response	0.297 - 3.89%	0.5694
Parabacteroides distasonis	Anti-inflammatory; helps regulate bile acids and metabolism	0.095 - 0.74%	1.0206
Bacteroides fragilis	Produces polysaccharide A; regulates immune system and gut barrier	0.0496 - 0.94%	0.0658

### Disruptive Bacteria for Skin Health

Overgrowth of these may be linked to acne, rosacea, eczema, psoriasis, and general skin inflammation through increased gut permeability, endotoxin production, and systemic inflammation.

Bacteria	Mechanism	Healthy Relative Abundance%	Your Abundance%
Prevotella spp.	Can drive chronic inflammation	≤2.011%	Not Detected
Clostridioides difficile	Produces toxins; causes diarrhea and gut inflammation	≤0.047%	Not Detected
Klebsiella pneumoniae	Pathogenic; promotes gut inflammation and antibiotic resistance	≤0.011%	Not Detected
[Ruminococcus] gnavus	Produces inflammatory polysaccharides; linked to IBD and mood issues	≤0.34%	0.5128
Bilophila wadsworthia	Produces hydrogen sulfide; associated with inflammation and bile acid imbalance	≤0.457%	0.1385



Sample ID :  
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Studies referenced: (21), (22) , (23) , (24) , (25)

## Gut-Thyroid Axis

Needs Attention

### Beneficial Bacteria for Thyroid Axis

Studies have shown the potential positive impact of these bacteria in thyroid health

Bacteria	Mechanism	Healthy Relative Abundance%	Your Abundance%
Bifidobacterium spp.	Supports barrier, reduces inflammation, and aids micronutrient absorption (e.g., zinc, selenium)	0.1239 - 4.497%	1.3900
Roseburia spp.	Butyrate-producing; enhances gut barrier and reduces inflammation linked to thyroid function	0.124 - 1.55%	1.8385
Faecalibacterium prausnitzii	Anti-inflammatory SCFA producer; protects against autoimmune thyroid inflammation	0.188 - 2.62%	5.3671
Bacteroides spp.	Overgrowth linked to endotoxins and gut barrier dysfunction; may impact thyroid autoimmunity	5.885 - 31.13%	4.4168

### Disruptive Bacteria for Thyroid Axis

Research shows links to higher levels of these bacteria correlating to impaired thyroid function.

Bacteria	Mechanism	Healthy Relative Abundance%	Your Abundance%
Klebsiella spp.	Often elevated in AITD; involved in molecular mimicry and inflammation	≤0.168%	18.7765
Eggerthella lenta	Pro-inflammatory; stimulates Th17 pathways and systemic inflammation	≤0.017%	0.0761
Escherichia coli	Produces LPS; promotes inflammation and disrupts micronutrient absorption	≤0.12%	13.0332
Clostridium spp.	Toxin-producing; triggers inflammation and thyroid dysfunction	≤0.085%	1.7748

## Gut-Metabolism Axis



Good

### Beneficial Bacteria for Metabolism Axis

These bacteria have a multifactorial impact on the metabolism, and have been linked to lower fat mass, and higher lean mass

Bacteria	Mechanism	Healthy Relative Abundance%	Your Abundance%
<i>Blautia wexlerae</i>	Regulates lipid metabolism; associated with improved glucose tolerance	0.1062 - 1.83%	0.0631
<i>Roseburia spp.</i>	Produces butyrate; supports insulin sensitivity and energy regulation.	0.124 - 1.55%	1.8385
<i>Faecalibacterium prausnitzii</i>	Produces butyrate; reduces inflammation and supports metabolic homeostasis.	0.188 - 2.62%	5.3671
<i>Akkermansia muciniphila</i>	Improves gut barrier; enhances insulin sensitivity and metabolic balance.	0.0012 - 0.28%	4.3232
<i>Bacteroides thetaiotaomicron</i>	Overgrowth may promote gut inflammation and impair metabolic signalling	0.104 - 1.33%	0.0495
<i>Coprococcus</i>	Overgrowth may disrupt SCFA balance, affecting metabolic regulation.	0.039 - 1.047%	0.8029

### Disruptive Bacteria for Metabolism Axis

Studies show the link between these bacteria and weight gain and obesity

Bacteria	Mechanism	Healthy Relative Abundance%	Your Abundance%
<i>Methanobrevibacter smithii</i>	Excess activity may slow transit and promote energy harvest and weight gain	≤0.24%	0.3063
<i>Bacteroidetes</i>	Imbalance may impair bile acid metabolism and promote insulin resistance.	≤1.24%	Not Detected



## Gut-Heart Axis



Good

### Beneficial Bacteria for Heart Axis

Studies link optimal levels of these bacteria to cardiometabolic health, through a variety of pathways

Bacteria	Mechanism	Healthy Relative Abundance%	Your Abundance%
Bifidobacterium spp.	Reduces inflammation; supports lipid metabolism and cardiovascular health	0.1239 - 4.497%	1.3900
Bifidobacterium adolescentis	Produces SCFAs; helps regulate cholesterol and reduce vascular inflammation.	0.0022 - 0.35%	0.0490
Bifidobacterium longum	Lowers LDL cholesterol; supports endothelial function and heart health.	0.0134 - 0.76%	0.4700
Akkermansia muciniphila	Strengthens gut barrier; improves lipid profiles and vascular integrity.	0.0012 - 0.28%	4.3232
Faecalibacterium prausnitzii	Produces butyrate; reduces systemic inflammation and supports heart health.	0.188 - 2.62%	5.3671
Roseburia spp.	Butyrate-producing; reduces inflammation and improves lipid metabolism linked to heart health.	0.124 - 1.55%	1.8385

### Disruptive Bacteria for Heart Axis

These bacteria cover some of the known pathways of cardiovascular health problems

Bacteria	Mechanism	Healthy Relative Abundance%	Your Abundance%
Clostridium spp.	Some species produce toxins; linked to inflammation and cardiovascular risk.	≤0.085%	1.7748
[Clostridium] hylemonae	Disrupts gut-heart axis via secondary bile acid metabolism, impacting cholesterol.	≤0.006%	Not Detected
[Clostridium] innocuum	Triggers inflammation and impairs endothelial function.	≤0.084%	0.0710
Bacteroidetes spp.	Overgrowth can lead to endotoxin release and chronic low-grade inflammation.	≤0.9%	Not Detected
Proteobacteria spp.	Includes endotoxin-producing species; linked to systemic inflammation and CVD.	≤4.6%	Not Detected





## Gut-Liver Axis



Good

### Beneficial Bacteria for Liver Axis

These bacteria have been shown in published research to positively influence pathways linked to liver health

Bacteria	Mechanism	Healthy Relative Abundance%	Your Abundance%
Akkermansia muciniphila	Improves gut barrier and reduces liver inflammation.	0.0012 - 0.28%	4.3232
Faecalibacterium prausnitzii	Produces anti-inflammatory SCFAs like butyrate.	0.188 - 2.62%	5.3671
Roseburia spp.	Enhances SCFA production, supporting liver metabolism.	0.124 - 1.55%	1.8385
Roseburia intestinalis	Butyrate producer; reduces hepatic inflammation and supports liver energy metabolism.	0.054 - 0.69%	0.2305
Roseburia hominis	Enhances gut barrier and reduces hepatic oxidative stress.	0.0314 - 0.13%	0.0102
Roseburia rectibacter	Supports SCFA production linked to liver health.	0.01114 - 0.061%	Not Detected
Bifidobacterium spp.	Improves gut integrity and lowers endotoxin load to the liver.	0.1239 - 4.497%	1.3900
Bifidobacterium adolescentis	Modulates immune response and reduces liver fat accumulation.	0.0022 - 0.35%	0.0490
Bifidobacterium longum	Reduces endotoxemia and liver inflammation.	0.0134 - 0.76%	0.4700

### Disruptive Bacteria for Liver Axis

Bacteria that are linked to liver, and related problems in published studies

Bacteria	Mechanism	Healthy Relative Abundance%	Your Abundance%
Escherichia coli	Produces endotoxins and contributes to liver inflammation and gut barrier disruption.	≤0.12%	13.0332
Pseudomonas	Produces endotoxins that may worsen liver inflammation.	≤0.002%	Not Detected
Streptococcus spp.	Increases gut permeability and liver injury risk.	≤0.4%	0.1274
[Ruminococcus] gnavus	Produces inflammatory polysaccharides; contributes to metabolic inflammation and gut-liver axis disruption.	≤0.34%	0.5128
Methanobrevibacter	Alters bile acid metabolism and contributes to NAFLD.	≤0.316%	0.4565



Sample ID :  
Received :

Studies referenced: (41), (42) , (43) , (44) , (45)

## Gut-Joint Axis



Good

### Beneficial Bacteria for Joint Axis

Bacteria that are involved in specific anti inflammatory pathways and joint health

Bacteria	Mechanism	Healthy Relative Abundance%	Your Abundance%
Faecalibacterium prausnitzii	Reduces joint inflammation via anti-inflammatory SCFAs.	0.188 - 2.62%	5.3671
Roseburia spp.	Produces butyrate, which protects against joint inflammation.	0.124 - 1.55%	1.8385
Roseburia intestinalis	Modulates immune response to prevent arthritis progression.	0.054 - 0.69%	0.2305
Roseburia hominis	Maintains gut barrier and reduces systemic inflammation.	0.0314 - 0.13%	0.0102
Roseburia rectibacter	Supports gut-joint homeostasis through SCFA production.	0.01114 - 0.061%	Not Detected
Akkermansia muciniphila	Supports gut barrier and reduces inflammation.	0.0012 - 0.28%	4.3232
Bifidobacterium spp.	Modulates gut-immune axis and helps alleviate systemic inflammation in joints.	0.1239 - 4.497%	1.3900
Bifidobacterium adolescentis	Regulates immune cells and reduces joint inflammation.	0.0022 - 0.35%	0.0490
Bifidobacterium longum	Decreases pro-inflammatory cytokines linked to arthritis.	0.0134 - 0.76%	0.4700

### Disruptive Bacteria for Joint Axis

Bacteria with links to joint related problems

Bacteria	Mechanism	Healthy Relative Abundance%	Your Abundance%
Collinsella spp.	Increases gut permeability and joint inflammation.	≤0.779%	0.6197
Collinsella aerofaciens	Promotes pro-inflammatory cytokine release.	≤0.779%	0.6197
Collinsella aerofaciens ATCC 25986	Impairs gut barrier and triggers arthritis-related genes.	≤0.0152%	Not Detected
Eggerthella lenta	Modifies immune signaling and may worsen joint disease.	≤0.017%	0.0761
Escherichia coli	Produces endotoxins that promote systemic and joint inflammation.	≤0.12%	13.0332
Prevotella copri	Linked to rheumatoid arthritis onset and severity.	≤0.0043%	Not Detected
Klebsiella pneumoniae	Triggers immune responses in arthritis and spondylitis.	≤0.011%	Not Detected
Proteus mirabilis	Mimics host proteins; linked to rheumatoid arthritis.	≤0.012%	Not Detected



Sample ID :  
Received :

Studies referenced: (46), (47) , (48) , (49) , (50)

Gut-Eye Axis



Good

Beneficial Bacteria for Eye Axis

Published studies show the mechanisms involved in a variety of eye conditions

Bacteria	Mechanism	Healthy Relative Abundance%	Your Abundance%
Bifidobacterium spp.	Supports ocular immunity and tear film stability	0.1239 - 4.497%	1.3900
Faecalibacterium prausnitzii	Anti-inflammatory; protects retina & ocular barriers	0.188 - 2.62%	5.3671
Roseburia spp.	Supports gut-retina axis via SCFA metabolites	0.124 - 1.55%	1.8385
Roseburia intestinalis	Supports retinal barrier via butyrate	0.054 - 0.69%	0.2305
Roseburia hominis	Reduces ocular inflammation via SCFA production	0.0314 - 0.13%	0.0102
Bifidobacterium adolescentis	Regulates ocular immunity and barrier integrity.	0.0022 - 0.35%	0.0490
Bifidobacterium longum	Protects against eye inflammation and oxidative stress.	0.0134 - 0.76%	0.4700

Disruptive Bacteria for Eye Axis

Bacteria that have been shown to influence stressors and inflammation linked to eye health

Bacteria	Mechanism	Healthy Relative Abundance%	Your Abundance%
Escherichia coli	Promote uveitis, AMD, barrier breakdown	≤0.12%	13.0332
Betaproteobacteria Spp.	Found in glaucoma; promotes immune dysregulation	≤0.149%	0.1643
Prevotella spp.	Linked to autoimmune ocular inflammation	≤2.011%	Not Detected
Anaerotruncus spp.	Enriched in AMD—associated with degeneration	≤0.052%	Not Detected
Anaerotruncus colihominis	Worsens retinal health via immune activation.	≤0.052%	Not Detected



## Gut-Hormone Axis

Needs Attention

### Beneficial Bacteria for Hormone Axis

Bacteria that have been shown in studies to support hormonal regulation

Bacteria	Mechanism	Healthy Relative Abundance%	Your Abundance%
Faecalibacterium prausnitzii	Produces SCFAs; regulates gut-hormone axis via inflammation control.	0.188 - 2.62%	5.3671
Lactobacillus spp.	Supports estrogen metabolism and hormonal balance.	0.0004 - 0.0107%	Not Detected
Lactobacillus delbrueckii	Ferments lactose; may influence hormonal signalling pathways.	0.0004 - 0.0098%	Not Detected
Ligilactobacillus ruminis	Modulates gut immunity; may affect endocrine functions.	0.0012 - 0.0063%	Not Detected
Bacteroides spp.	Involved in bile acid metabolism and hormone signalling.	5.885 - 31.13%	4.4168

### Disruptive Bacteria for Hormone Axis

Studies show this bacteria may negative effect hormonal circulation

Bacteria	Mechanism	Healthy Relative Abundance%	Your Abundance%
Clostridium spp.	Produces beta-glucuronidase, may re-circulate estrogens	≤0.085%	1.7748
Escherichia coli	Produces beta-glucuronidase; may re-circulate estrogens and promote inflammation	≤0.12%	13.0332
Betaproteobacteria Spp.	Linked to hormonal imbalance via gut inflammation and dysbiosis	≤0.149%	0.1643



Sample ID :  
Received :

Studies referenced: (36), (37) , (38) , (39) , (40)

## Gut-Brain Axis

Good

### Beneficial Bacteria for Brain Axis

These bacteria are associated with healthy mood regulation, reduced inflammation, and cognitive support.

Bacteria	Mechanism	Healthy Relative Abundance%	Your Abundance%
Faecalibacterium prausnitzii	Anti-inflammatory; promotes gut health.	0.188 - 2.62%	5.3671
Bifidobacterium spp.	Supports digestion; balances gut microbiota.	0.1239 - 4.497%	1.3900
Bifidobacterium adolescentis	Aids in fermentation of dietary fiber; supports immune health.	0.0022 - 0.35%	0.0490
Bifidobacterium longum	Reduces inflammation; supports brain and gut health.	0.0134 - 0.76%	0.4700
Roseburia spp.	Produces butyrate; promotes colon health.	0.124 - 1.55%	1.8385
Roseburia intestinalis	Butyrate producer; improves glucose metabolism & lowers inflammation.	0.054 - 0.69%	0.2305
Roseburia hominis	Butyrate producer; supports metabolic balance & reduces insulin resistance.	0.0314 - 0.13%	0.0102
Roseburia rectibacter	Butyrate producer; improves metabolism & glucose regulation.	0.01114 - 0.061%	Not Detected
Lactobacillus spp.	Produces lactic acid; maintains gut pH & immune function.	0.0004 - 0.0107%	Not Detected
Lactobacillus crispatus	Maintains vaginal & gut health; inhibits pathogens.	0.0004 - 0.0023%	Not Detected

### Disruptive Bacteria for Brain Axis

These microbes are associated in research with neuroinflammation, anxiety, or impaired gut-brain signaling when overabundant.

Bacteria	Mechanism	Healthy Relative Abundance%	Your Abundance%
Gammaproteobacteria spp.	Includes endotoxin-producing species; linked to neuroinflammation.	≤4.6%	32.0398
Escherichia coli	Produces endotoxins; may affect gut-brain signaling and inflammation.	≤0.12%	13.0332
Clostridium spp.	Some species are harmful; linked to toxin production.	≤0.085%	1.7748
[Clostridium] hylemonae	May produce harmful secondary bile acids.	≤0.006%	Not Detected
[Clostridium] innocuum	Opportunistic; can contribute to infection.	≤0.084%	0.0710
[Clostridium] asparagiforme	Potentially linked to metabolic disruption.	≤0.036%	Not Detected
Enterobacter spp.	Opportunistic pathogens; linked to inflammation.	0.00000%	0.1679



Sample ID :  
Received :

Studies referenced: (11), (12) , (13) , (14) , (15)



## Gut-Lung Axis

Suboptimal

### Beneficial Bacteria for Lung Health

These bacteria are associated with reduced respiratory inflammation, immune modulation, and lung barrier support.

Bacteria	Mechanism	Healthy Relative Abundance%	Your Abundance%
Faecalibacterium prausnitzii	Anti-inflammatory; improves lung immunity via gut signaling	0.188 - 2.62%	5.3671
Rothia spp.	Helps maintain mucosal barrier; contributes to immune balance	0.0009 - 0.0093%	Not Detected
Rothia mucilaginosa	Involved in oral-lung microbial defense; modulates immune response	0.0007 - 0.0023%	Not Detected
Veillonella spp.	Converts lactate to SCFAs; supports lung immunity	0.0052 - 0.095%	Not Detected
Roseburia spp.	Produces butyrate; reduces inflammation in lungs and gut	0.124 - 1.55%	1.8385
Roseburia intestinalis	Butyrate production; supports lung-gut barrier and anti-inflammatory response	0.054 - 0.69%	0.2305
Roseburia hominis	Improves immune tolerance; reduces allergic inflammation	0.0314 - 0.13%	0.0102
Roseburia rectibacter	Butyrate producer; enhances respiratory mucosal defense	0.01114 - 0.061%	Not Detected
Lachnospira spp.	SCFA producer; reduces airway inflammation	0.022 - 0.92%	0.1110

### Disruptive Bacteria for Lung Health

These microbes are associated with pro-inflammatory responses, increased susceptibility to respiratory conditions, or impaired gut-lung axis signaling.

Bacteria	Mechanism	Healthy Relative Abundance%	Your Abundance%
Escherichia coli	Can trigger lung inflammation via endotoxins	≤0.12%	13.0332
Haemophilus spp.	Respiratory pathogen; may worsen lung conditions like asthma	≤0.075%	0.0183
Aspergillus spp.	Fungal pathogen; linked to lung infections and allergy	≤0.01%	Not Detected
Penicillium spp.	Airborne mold; may cause respiratory irritation or allergic reactions	≤0.0007%	Not Detected
Prevotella spp.	Overgrowth linked to chronic lung inflammation and immune dysregulation	≤2.011%	Not Detected



Sample ID :  
Received :

Studies referenced: (26), (27), (28), (29), (30)

## Gut Interaction Insights Dashboard

Based on the unique balance of bacteria in your gut, we've identified 20 key health insights that may be relevant to your overall well-being. These insights are drawn from the latest clinical research, and reflect how specific microbes in your microbiome are linked to various aspects of health.

The 'Average Person' label on the graph reflects exactly that - the average person's result for the specific health insight. This data is derived from over 150,000 other gut microbiome samples.

Important - the Average Person isn't necessarily the health goal, but rather a point of reference. The colour coding of the graphs shows the optimal and suboptimal ranges.

As well as the graphical representation, this section of the reports also includes a detailed bacterial breakdown, explaining the mechanisms of specific bacteria for each health insight.

**ARA %** = Average Relevant Abundance. This is derived from our reference bioinformatics base of 150,000+ gut microbiome samples.

**HRA %** = Healthy Relative Abundance. This is derived by referencing the available published literature.

**Your Abundance %** = The abundance of specific bacteria found from analysis of the stool sample submitted for testing.



## SCFA Producers

Suboptimal

Bacteria	Mechanism	HRA %	ARA %	Your Abundance %
Faecalibacterium prausnitzii	Major butyrate producer	0.188 - 2.62%	~1.084%	5.3671
Roseburia spp.	Produces butyrate; supports gut inflammation reduction	0.124 - 1.55%	~0.611%	1.8385
Anaerobutyricum hallii	Butyrate & propionate producer	0.03 - 0.74%	~0.172%	Not Detected
Eubacterium rectale	Major butyrate producer; supports colon health	0.0173 - 1.2%	~0.0894%	Not Detected
Butyricicoccus spp.	Produces butyrate; supports gut barrier	0.0006 - 0.0034%	~0.0013%	0.1551
Anaerostipes spp.	Ferments lactate to butyrate	0.056 - 0.96%	~0.313%	0.8668
Ruminococcus bromii	Starch degrader supporting butyrate	0.0089 - 0.59%	~0.0345%	Not Detected
Akkermansia muciniphila	Acetate producer, mucin specialist	0.0012 - 0.28%	~0.0084%	4.3232
Bifidobacterium spp.	Cross-feeder; supports butyrate synthesis from acetate/lactate	0.1239 - 4.497%	~1.006%	1.3900
Veillonella spp.	Converts lactate to propionate; helps butyrate-producers indirectly	0.0052 - 0.095%	~0.02%	Not Detected
Rothia spp.	Acetate producer; supports mucosal health & SCFA producers	0.0009 - 0.0093%	~0.0027%	Not Detected
Lactobacillales spp.	Lactate producer; supports butyrate-producing bacteria	0.076 - 0.85%	~0.246%	0.2040



Sample ID :  
Received :

Studies referenced: (106), (107), (108), (109), (110), (111),  
(112), (113)

## Inflammation Index

Good

Anti Inflammatory Bacteria	Mechanism	HRA %	ARA %	Your Abundance %
Faecalibacterium prausnitzii	Major butyrate producer; reduces inflammation	0.188 - 2.62%	~1.084%	5.3671
Roseburia spp.	Produces butyrate; anti-inflammatory	0.124 - 1.55%	~0.611%	1.8385
Roseburia intestinalis	Butyrate-producing; supports anti-inflammatory pathways	0.054 - 0.69%	~0.23%	0.2305
Roseburia hominis	Improves immune balance; reduces gut inflammation	0.0314 - 0.13%	~0.364%	0.0102
Lachnospira eligens	SCFA producer; supports mucosal and immune health	0.0222 - 0.92%	~0.186%	0.1110
Bacteroides thetaiotaomicron	Maintains mucosal health; involved in SCFA production	0.104 - 1.33%	~0.47%	0.0495
Akkermansia muciniphila	Supports gut barrier & immune modulation	0.0012 - 0.28%	~0.0084%	4.3232
Bifidobacterium spp.	Immune-modulating acetate producers	0.1239 - 4.497%	~1.006%	1.3900
Lactobacillales spp.	Immune modulating and antimicrobial	0.076 - 0.85%	~0.246%	0.2040
Anaerobutyricum hallii	Cross-feeding, anti-inflammatory	0.03 - 0.74%	~0.172%	Not Detected
Pro Inflammatory Bacteria	Mechanism	HRA %	ARA %	Your Abundance %
Escherichia coli	Produces endotoxins; promotes inflammation	≤0.12%	~0.019%	13.0332
Enterobacteriaceae spp.	Includes pro-inflammatory species; linked to gut dysbiosis	≤3.903%	~0.603%	32.0186
Klebsiella spp.	Triggers immune response; linked to inflammation and autoimmunity	≤0.168%	~0.019%	18.7765
Shigella spp.	Pathogenic; causes intestinal inflammation and damage	≤0.0021%	~0.0008%	Not Detected
Clostridioides difficile	Toxin-producing and inflammatory	≤0.047%	~0.023%	Not Detected
Desulfovibrio spp.	Sulfate reducer, pro-inflammatory	≤0.581%	~0.225%	Not Detected
Proteus spp.	Urease activity and inflammatory role	≤0.01%	~0.0009%	Not Detected



Sample ID :  
Received :

Studies referenced: (61), (62), (63), (64), (65), (114), (115),  
(116), (117), (118)

## Immunity

Suboptimal

Positive Bacteria for Immunity	Mechanism	HRA %	ARA %	Your Abundance %
Faecalibacterium prausnitzii	Anti-inflammatory; modulates immune signaling	0.188 - 2.62%	~1.084%	5.3671
Akkermansia muciniphila	Strengthens mucosal barrier; modulates immune response	0.0012 - 0.28%	~0.0084%	4.3232
Lactobacillus spp.	Enhances mucosal immunity and antimicrobial peptide production	0.0004 - 0.0107%	~0.0017%	Not Detected
Lactobacillus delbrueckii	Supports epithelial integrity; involved in adaptive immunity	0.0004 - 0.0098%	~0.0017%	Not Detected
Bifidobacterium spp.	Modulates dendritic cells and T-reg cells; enhances immune tolerance	0.1239 - 4.497%	~1.006%	1.3900
Lachnospira eligens	SCFA production supports anti-inflammatory pathways	0.0222 - 0.92%	~0.186%	0.1110
Bacteroides fragilis	Produces polysaccharide A (PSA); modulates T-cell balance	0.0496 - 0.94%	~0.183%	0.0658
Negative Bacteria for Immunity	Mechanism	HRA %	ARA %	Your Abundance %
Escherichia coli	Can impair mucosal immunity and promote inflammation via endotoxins (LPS)	≤0.12%	~0.019%	13.0332
Enterobacteriaceae spp.	Associated with gut dysbiosis and immune activation	≤3.903%	~0.603%	32.0186
Prevotella spp.	Overgrowth linked to Th17-mediated inflammation and immune imbalance	≤2.011%	~0.162%	Not Detected
Clostridium spp.	Some species produce toxins that impair immune signaling	≤0.085%	~0.035%	1.7748
Clostridioides difficile	Produces toxins A & B; disrupts gut barrier and immune tolerance	≤0.047%	~0.023%	Not Detected



Sample ID :  
Received :

Studies referenced: (96), (97) , (98) , (99) , (100)



## Histamine Index



Good

Histamine Degrading Bacteria	Mechanism	HRA %	ARA %	Your Abundance %
Bifidobacterium spp.	May support histamine degradation and reduce gut inflammation	0.1239 - 4.497%	~1.006%	1.3900
Bifidobacterium longum	Supports mucosal integrity; linked to histamine degradation pathways	0.0134 - 0.76%	~0.137%	0.4700
Bifidobacterium bifidum	May degrade histamine and modulate immune responses	0.0006 - 0.053%	~0.0032%	0.3612
Lactobacillus spp.	Some strains degrade histamine; others produce it (strain-specific)	0.0004 - 0.0107%	~0.0017%	Not Detected
Lactobacillus plantarum	Known to degrade histamine and regulate DAO (diamine oxidase)	0.000335 - 0.0029%	~0.0016%	Not Detected
Faecalibacterium spp.	Anti-inflammatory; indirectly supports histamine balance	0.675-9.12%	~4.363%	8.6092
Faecalibacterium prausnitzii	Reduces inflammation and strengthens gut barrier; supports histamine regulation	0.188 - 2.62%	~1.084%	5.3671
Akkermansia spp.	Improves gut barrier function; may help reduce histamine response indirectly	0.0012-0.35%	~0.01%	4.3232
Roseburia spp.	Butyrate producer; supports gut lining integrity, helping with histamine modulation	0.124 - 1.55%	~0.611%	1.8385
Histamine Producing Bacteria	Mechanism	HRA %	ARA %	Your Abundance %
Morganella morganii	Converts histidine to histamine via histidine decarboxylase	≤0.0018%	~0.0006%	Not Detected
Klebsiella pneumoniae	Produces histamine through decarboxylation of histidine	≤0.011%	~0.0019%	Not Detected
Proteus mirabilis	Histidine decarboxylase activity; contributes to histamine buildup	≤0.012%	~0.001%	Not Detected
Enterobacter cloacae	Capable of histamine production via histidine decarboxylase	≤0.0036%	~0.0009%	Not Detected
Citrobacter freundii	Known to decarboxylate histidine to histamine	≤0.0037%	~0.0009%	0.0102



## Protein Absorption

Needs Attention

Positive Bacteria for Protein Metabolism	Mechanism	HRA %	ARA %	Your Abundance %
Bacteroides thetaiotaomicron	Breaks down proteins and complex carbohydrates; aids in amino acid utilization	0.104 - 1.33%	~0.47%	0.0495
Bacteroides spp.	Some strains degrade protein and generate ammonia and sulfides	5.885 - 31.13%	~17.051%	4.4168
Coprococcus spp.	Ferments protein-derived substrates into SCFAs	0.039 - 0.25%	~0.1445%	0.8029
Coprococcus eutactus	Involved in amino acid fermentation; SCFA producer	0.0035 - 0.027%	~0.01%	0.4963
Coprococcus catus	Ferments protein and carbohydrates; promotes gut health	0.0116 - 0.156%	~0.049%	0.0814
Coprococcus comes	Produces SCFAs from amino acids; may help regulate gut pH	0.0135 - 0.382%	~0.084%	0.1875
Anaerobutyricum hallii	Ferments amino acids to produce butyrate; protein metabolizer	0.03 - 0.74%	~0.172%	Not Detected
Bacteroides fragilis	Can degrade amino acids; some strains linked to inflammation	0.0496 - 0.94%	~0.183%	0.0658
Negative Bacteria for Protein Metabolism	Mechanism	HRA %	ARA %	Your Abundance %
Klebsiella spp.	Produces putrefactive byproducts; associated with ammonia & toxic amines	≤0.168%	~0.019%	18.7765
Enterobacteriaceae spp.	Ferments proteins to harmful compounds; increases gut pH	≤3.903%	~0.603%	32.0186
Bacteroides caccae	Protein fermentation; may promote mucin degradation	≤1.012%	~0.21%	0.0267
Bacteroides ovatus	Involved in protein metabolism; may release harmful nitrogen byproducts	≤0.37%	~0.143%	0.6966
Clostridium spp.	Putrefaction of protein; produces toxins	≤0.085%	~0.035%	1.7748
Escherichia coli	Produces ammonia and other toxic byproducts	≤0.12%	~0.019%	13.0332



Sample ID :  
Received :

Studies referenced: (133), (134), (135), (136), (137), (138),  
(139), (140), (141), (142)

## Carbohydrate Absorption



Good

Positive Bacteria for Carbohydrate Metabolism	Mechanism	HRA %	ARA %	Your Abundance %
Ruminococcus bromii	Breaks down resistant starch	0.0089 - 0.59%	~0.0345%	Not Detected
Bacteroides thetaiotaomicron	Degrades complex polysaccharides; key in carb breakdown	0.104 - 1.33%	~0.47%	0.0495
Roseburia spp.	Ferments carbohydrates to produce SCFAs	0.124 - 1.55%	~0.611%	1.8385
Roseburia intestinalis	Converts carbohydrates into butyrate	0.054 - 0.69%	~0.23%	0.2305
Roseburia hominis	Butyrate producer; ferments dietary fiber	0.0314 - 0.13%	~0.364%	0.0102
Coprococcus spp.	Ferments carbs into SCFAs (especially acetate, butyrate)	0.039 - 0.25%	~0.1445%	0.8029
Coprococcus eutactus	Ferments carbohydrates; SCFA-producing	0.0035 - 0.027%	~0.01%	0.4963
Coprococcus catus	Known to ferment lactate to propionate	0.0116 - 0.156%	~0.049%	0.0814
Coprococcus comes	SCFA producer via carbohydrate metabolism	0.0135 - 0.382%	~0.084%	0.1875
Faecalibacterium prausnitzii	Converts carbs to butyrate; anti-inflammatory	0.188 - 2.62%	~1.084%	5.3671
Anaerobutyricum hallii	Ferments carbs and lactate to butyrate	0.03 - 0.74%	~0.172%	Not Detected
Akkermansia muciniphila	Degrades mucin; involved in mucosal carb metabolism	0.0012 - 0.28%	~0.0084%	4.3232
Negative Bacteria for Carbohydrate Metabolism	Mechanism	HRA %	ARA %	Your Abundance %
Enterobacteriaceae spp.	Ferments simple sugars; linked to dysbiosis when overgrown	≤3.903%	~0.603%	32.0186
Clostridium perfringens	Produces gas and toxins from carb fermentation; associated with gut disruption	≤0.0046%	~0.0015%	Not Detected



Sample ID :  
Received :

Studies referenced: (133), (134), (135), (136), (137), (138),  
(139), (140), (141), (142)

## Fat Absorption

Good

Positive Bacteria for Fat Metabolism	Mechanism	HRA %	ARA %	Your Abundance %
Bacteroides spp.	Contributes to bile acid metabolism and lipid breakdown	5.885 - 31.13%	~17.051%	4.4168
Bacteroides thetaiotaomicron	Aids digestion of polysaccharides; influences lipid metabolism indirectly	0.104 - 1.33%	~0.47%	0.0495
Akkermansia spp.	Enhances gut barrier; modulates fat absorption and lipid metabolism	0.0012 - 0.35%	~0.01%	4.3232
Akkermansia muciniphila	Supports mucin layer; improves metabolic health including fat processing	0.0012 - 0.28%	~0.0084%	4.3232
Roseburia spp.	Produces SCFAs that may influence lipid metabolism	0.124 - 1.55%	~0.611%	1.8385
Roseburia intestinalis	Butyrate producer; modulates fat absorption and gut barrier	0.054 - 0.69%	~0.23%	0.2305
Bifidobacterium spp.	Enhances bile salt hydrolase activity; may improve fat digestion	0.1239 - 4.497%	~1.006%	1.3900
Bifidobacterium longum	Promotes bile metabolism; may support healthy fat absorption	0.0134 - 0.76%	~0.137%	0.4700
Negative Bacteria for Fat Metabolism	Mechanism	HRA %	ARA %	Your Abundance %
Bilophila wadsworthia	Promotes bile acid imbalance, associated with high-fat diet	≤0.457%	~0.166%	0.1385
Escherichia coli	Can disrupt gut barrier, influence fat metabolism negatively	≤0.12%	~0.019%	13.0332
Klebsiella pneumoniae	May impair lipid digestion; linked to metabolic inflammation	≤0.011%	~0.0019%	Not Detected
Enterococcus faecalis	Associated with gut inflammation; may disrupt bile metabolism	≤0.0049%	~0.001%	Not Detected
Pseudomonas aeruginosa	Linked to gut dysbiosis; may interfere with fat absorption mechanisms	≤0.0007%	~0.0007%	Not Detected



Sample ID :  
Received :

Studies referenced: (133), (134), (135), (136), (137), (138),  
(139), (140), (141), (142)

## Micronutrient Absorption

Needs Attention

	Bacteria	Mechanism	HRA %	ARA %	Your Abundance %
Vitamin B1 (Thiamine)	Bacteroides fragilis	Synthesises thiamine; supports host absorption in colon.	0.0496 - 0.94%	~0.183%	0.0658
Vitamin B2 (Riboflavin)	Lactobacillus spp.	Produces riboflavin; enhances mucosal absorption efficiency.	0.0004 - 0.0107%	~0.0017%	Not Detected
Vitamin B3 (Niacin)	Bacteroides spp.	Converts precursors into niacin for host use.	5.885 - 31.13%	~17.051%	4.4168
Vitamin B5 (Pantothenic acid)	Enterococcus spp.	Synthesises pantothenate in gut lumen.	0.0036 - 0.0347%	~0.009%	0.0427
Vitamin B6 (Pyridoxine)	Bifidobacterium spp.	Contributes to pyridoxine pool for host metabolism.	0.1239 - 4.497%	~1.006%	1.3900
Folic acid	Lactobacillus plantarum	Synthesises folate; promotes enterocyte uptake.	0.000335 - 0.0029%	~0.0016%	Not Detected
Biotin	Bacteroides thetaiotaomicron	Produces biotin; aids epithelial absorption and balance.	0.104 - 1.33%	~0.47%	0.0495
Vitamin K	Bacteroides spp.	Produces menaquinones (K2) for host absorption.	5.885 - 31.13%	~17.051%	4.4168
Vitamin B12 (Cobalamin)	Propionibacterium spp.	Synthesises B12 analogues aiding microbiota balance.	0.0004 - 0.002%	~0.0009%	Not Detected
Magnesium	Lactobacillus spp.	May support magnesium solubility via pH modulation and gut health.	0.0004 - 0.0107%	~0.0017%	Not Detected
Calcium	Bifidobacterium spp.	Improves calcium uptake via SCFA production.	0.1239 - 4.497%	~1.006%	1.3900
Iron	Bacteroides thetaiotaomicron	Influences iron metabolism through microbial metabolites.	0.104 - 1.33%	~0.47%	0.0495
Zinc	Lactobacillus plantarum	Binds zinc; improves mucosal uptake and stability.	0.000335 - 0.0029%	~0.0016%	Not Detected



Sample ID :  
Received :

Studies referenced: (123), (124) , (125) , (126) , (127), (128) , (129) , (130) , (131) , (132)

## Bowel Habits

Good

Positive Bacteria for Bowel Habits	Mechanism	HRA %	ARA %	Your Abundance %
Faecalibacterium prausnitzii	SCFA (especially butyrate) producer; supports gut motility and anti-inflammatory effect	0.188 - 2.62%	~1.084%	5.3671
Roseburia spp.	SCFA producer, especially butyrate; improves bowel movement	0.124 - 1.55%	~0.611%	1.8385
Roseburia intestinalis	SCFA producer, especially butyrate; improves bowel movement	0.054 - 0.69%	~0.23%	0.2305
Roseburia hominis	SCFA producer, especially butyrate; improves bowel movement	0.0314 - 0.13%	~0.364%	0.0102
Bifidobacterium spp.	Enhances gut transit and stool formation	0.1239 - 4.497%	~1.006%	1.3900
Bifidobacterium adolescentis	Involved in carbohydrate fermentation; mild support for motility	0.0022 - 0.35%	~0.018%	0.0490
Bifidobacterium longum	Documented to support regularity and improve stool quality	0.0134 - 0.76%	~0.137%	0.4700
Negative Bacteria for Bowel Habits	Mechanism	HRA %	ARA %	Your Abundance %
Methanobrevibacter smithii	Slows gut transit via methane production, leading to constipation	≤0.24%	~0.017%	0.3063
Enterobacteriaceae spp.	May increase gas, bloating, and gut dysbiosis	≤3.903%	~0.603%	32.0186
Methanobrevibacter spp.	Methane production linked to sluggish bowel motility	≤0.316%	~0.009%	0.4565
Clostridioides difficile	Toxin-producing; causes diarrhea and gut inflammation	≤0.047%	~0.023%	Not Detected
Escherichia coli	Pathogenic strains may cause diarrhea or constipation via inflammation	≤0.12%	~0.019%	13.0332



Sample ID :  
Received :

Studies referenced: (66), (67), (68), (69), (70), (71), (72), (73), (74), (75)

## Fitness

Good

Positive Bacteria for Athletic Performance & Fitness	Mechanism	HRA %	ARA %	Your Abundance %
Coprococcus eutactus	SCFA producer; supports mood, endurance, and recovery	0.0035 - 0.027%	~0.01%	0.4963
Bifidobacterium longum	Reduces gut inflammation and supports immune recovery post-exercise	0.0134 - 0.76%	~0.137%	0.4700
Roseburia spp.	Butyrate producer; supports gut health and muscle recovery	0.124 - 1.55%	~0.611%	1.8385
Roseburia intestinalis	Produces butyrate; linked to anti-inflammatory benefits post-workout	0.054 - 0.69%	~0.23%	0.2305
Roseburia hominis	Enhances energy metabolism via SCFA production	0.0314 - 0.13%	~0.364%	0.0102
Faecalibacterium prausnitzii	Anti-inflammatory SCFA producer; promotes post-exercise recovery	0.188 - 2.62%	~1.084%	5.3671
Coprococcus spp.	Some strains may shift to pro-inflammatory behavior in dysbiosis	0.039 - 0.25%	~0.1445%	0.8029
Lachnospiraceae spp.	Certain strains may promote inflammation when dominant	3.641 - 17.77%	~9.25%	8.7359
Veillonella spp.	While helpful in some exercise contexts, overgrowth may contribute to inflammation	0.0052 - 0.095%	~0.02%	Not Detected
Negative Bacteria for Athletic Performance & Fitness	Mechanism	HRA %	ARA %	Your Abundance %
Clostridium spp.	Can produce endotoxins and contribute to post-exercise inflammation	≤0.085%	~0.035%	1.7748
Escherichia spp.	Linked to gut permeability and inflammation under stress	≤0.161%	~0.025%	13.0332
Shigella spp.	Pathogenic; triggers inflammation and impairs gut function	≤0.0021%	~0.0008%	Not Detected



Sample ID :  
Received :

Studies referenced: (101), (102) , (103) , (104) , (105)

## Mood & Mental Health

Suboptimal

Positive Bacteria for Mood / Mental Health	Mechanism	HRA %	ARA %	Your Abundance %
Bifidobacterium adolescentis	Produces GABA and supports serotonin pathways	0.0022 - 0.35%	~0.018%	0.0490
Lactobacillus rhamnosus	Modulates GABA receptors; reduces anxiety-like behavior	0.0052 - 0.14%	~0.024%	Not Detected
Faecalibacterium prausnitzii	Anti-inflammatory; linked to improved emotional well-being	0.188 - 2.62%	~1.084%	5.3671
Bifidobacterium longum	Reduces stress hormones; supports gut-brain axis balance	0.0134 - 0.76%	~0.137%	0.4700
Negative Bacteria for Mood / Mental Health	Mechanism	HRA %	ARA %	Your Abundance %
Escherichia coli	Produces lipopolysaccharides (LPS); associated with anxiety and stress	≤0.12%	~0.019%	13.0332
Enterobacteriaceae spp.	Triggers neuroinflammation and gut-brain axis disruption	≤3.903%	~0.603%	32.0186
Clostridium spp.	Produces neurotoxins; may impair mood and cognition	≤0.085%	~0.035%	1.7748
Streptococcus spp.	Linked to brain fog and anxiety in excess	≤0.4%	~0.1323%	0.1274

## Autoimmunity

Good

Positive Bacteria for Autoimmunity	Mechanism	HRA %	ARA %	Your Abundance %
Faecalibacterium prausnitzii	Produces anti-inflammatory butyrate and reduces cytokine levels	0.188 - 2.62%	~1.084%	5.3671
Akkermansia muciniphila	Supports mucosal immunity and reduces gut inflammation	0.0012 - 0.28%	~0.0084%	4.3232
Bacteroides fragilis	Modulates immune response; balances T-reg cells	0.0496 - 0.94%	~0.183%	0.0658
Negative Bacteria for Autoimmunity	Mechanism	HRA %	ARA %	Your Abundance %
Betaproteobacteria spp.	Associated with immune activation and gut inflammation	0.00000%	0.00000%	0.1643
Prevotella spp.	Linked to pro-inflammatory responses and autoimmunity	≤2.011%	~0.162%	Not Detected
Bilophila wadsworthia	Produces sulfides, linked to IBD	≤0.457%	~0.166%	0.1385
Klebsiella pneumoniae	Associated with inflammatory autoimmune conditions	≤0.011%	~0.0019%	Not Detected



Sample ID :  
Received :

Studies referenced: (143), (144), (145), (146), (147)



## Detoxification



Suboptimal

Positive Bacteria for Detoxification	Mechanism	HRA %	ARA %	Your Abundance %
Akkermansia muciniphila	Strengthens gut barrier and supports mucosal detoxification	0.0012 - 0.28%	~0.0084%	4.3232
Faecalibacterium prausnitzii	Reduces inflammation and assists in butyrate-supported detoxification	0.188 - 2.62%	~1.084%	5.3671
Bacteroides thetaiotaomicron	Breaks down dietary toxins and metabolizes xenobiotics	0.104 - 1.33%	~0.47%	0.0495
Negative Bacteria for Detoxification	Mechanism	HRA %	ARA %	Your Abundance %
Alphaproteobacteria spp.	Can interfere with drug metabolism and modulate host liver enzymes	≤0.003%	~0.001%	0.3542
Staphylococcus spp.	Associated with bioactivation of toxins and xenobiotics	≤0.0017%	~0.0011%	Not Detected
Escherichia coli	Can produce β-glucuronidase that reactivates detoxified compounds	≤0.12%	~0.019%	13.0332

## Stress Resilience



Good

Positive Bacteria for Stress Resilience	Mechanism	HRA %	ARA %	Your Abundance %
Lactobacillus spp.	Produces GABA and modulates stress-induced cortisol levels	0.0004 - 0.0107%	~0.0017%	Not Detected
Lactobacillus delbrueckii	Supports gut-brain axis via anti-inflammatory signaling	0.0004 - 0.0098%	~0.0017%	Not Detected
Lactobacillus crispatus	Helps regulate mood and dampen stress-related inflammation	0.0004 - 0.0023%	~0.0009%	Not Detected
Bifidobacterium spp.	Supports HPA axis balance and reduces stress hormone responses	0.1239 - 4.497%	~1.006%	1.3900
Bifidobacterium adolescentis	Reduces anxiety-like behavior and modulates neuroinflammation	0.0022 - 0.35%	~0.018%	0.0490
Bifidobacterium longum	Modulates stress-induced cortisol and supports emotional regulation	0.0134 - 0.76%	~0.137%	0.4700
Roseburia spp.	Produces butyrate, promoting calmness via vagus nerve signaling	0.124 - 1.55%	~0.611%	1.8385
Roseburia intestinalis	Helps reduce systemic stress markers and supports resilience	0.054 - 0.69%	~0.23%	0.2305
Roseburia hominis	Linked to reduced stress reactivity and mood stability	0.0314 - 0.13%	~0.364%	0.0102



Sample ID :  
Received :

Studies referenced: (148) , (149) , (150) , (151) , (152),  
Studies referenced: (81) , (82) , (83) , (84) , (85)

## Longevity

Good

Positive Bacteria for Longevity	Mechanism	HRA %	ARA %	Your Abundance %
Akkermansia spp.	Promotes metabolic health and gut barrier integrity, supporting longevity	0.0012-0.35%	~0.01%	4.3232
Akkermansia muciniphila	Improves gut lining, reduces inflammation, and supports healthy aging	0.0012 - 0.28%	~0.0084%	4.3232
Faecalibacterium spp.	Produces anti-inflammatory butyrate, linked to reduced age-related diseases	0.675-9.12%	~4.363%	8.6092
Faecalibacterium prausnitzii	Anti-inflammatory species associated with longevity and healthy aging	0.188 - 2.62%	~1.084%	5.3671
Bifidobacterium spp.	Maintains gut microbiota diversity and immune regulation with age	0.1239 - 4.497%	~1.006%	1.3900
Bifidobacterium longum	Linked to healthy aging through immune modulation and SCFA production	0.0134 - 0.76%	~0.137%	0.4700
Bifidobacterium adolescentis	Supports intestinal health and anti-aging immune response	0.0022 - 0.35%	~0.018%	0.0490
Roseburia spp.	Produces butyrate, reduces inflammation, supports metabolic aging	0.124 - 1.55%	~0.611%	1.8385
Roseburia hominis	Associated with gut homeostasis and metabolic resilience in aging	0.0314 - 0.13%	~0.364%	0.0102
Roseburia intestinalis	Linked to anti-inflammatory functions and improved aging markers	0.054 - 0.69%	~0.23%	0.2305
Roseburia rectibacter	Contributes to butyrate production, maintaining healthy gut with age	0.01114 - 0.061%	~0.03%	Not Detected



Sample ID :  
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Studies referenced: (153) , (154) , (155) , (156) , (157)

## Insulin Balance

Needs Attention

Positive Bacteria Insulin Balance	Mechanism	HRA %	ARA %	Your Abundance %
Akkermansia muciniphila	Improves insulin sensitivity and reduces systemic inflammation	0.0012 - 0.28%	~0.0084%	4.3232
Eubacterium rectale	Produces butyrate, supports glucose metabolism and insulin signaling	0.0173 - 1.2%	~0.0894%	Not Detected
Coprococcus spp.	Associated with improved glycemic control and SCFA production	0.039 - 0.25%	~0.1445%	0.8029
Lactobacillus spp.	Modulates gut barrier and improves glucose homeostasis	0.0004 - 0.0107%	~0.0017%	Not Detected
Lactobacillus delbrueckii	Supports insulin sensitivity via anti-inflammatory action	0.0004 - 0.0098%	~0.0017%	Not Detected
Lactobacillus crispatus	Linked to metabolic benefits including improved insulin response	0.0004 - 0.0023%	~0.0009%	Not Detected
Negative Bacteria for Insulin Balance	Mechanism	HRA %	ARA %	Your Abundance %
[Ruminococcus] gnavus	Associated with increased inflammation and insulin resistance	≤0.34%	~0.088%	0.5128
Flavonifractor	Linked to higher insulin levels and disrupted glucose metabolism	≤0.301%	~0.12%	Not Detected
Escherichia coli	Contributes to endotoxin production and impaired insulin signaling	≤0.12%	~0.019%	13.0332

## Bloating / Gas

Good

Positive Bacteria Bloating / Gas	Mechanism	HRA %	ARA %	Your Abundance %
Lactobacillus spp.	Ferments carbohydrates into lactic acid, limiting gas buildup	0.0004 - 0.0107%	~0.0017%	Not Detected
Enterococcus faecium	Assists in fermentation and limits pathogenic overgrowth	0.0013 - 0.0094%	~0.0035%	0.0427
Bifidobacterium spp.	Converts fibers to SCFAs; reduces gas and maintains gut balance	0.1239 - 4.497%	~1.006%	1.3900
Bifidobacterium breve	Supports balanced fermentation and reduces bloating	≤0.013%	~0.0026%	0.0391
Negative Bacteria Bloating / Gas	Mechanism	HRA %	ARA %	Your Abundance %
Bilophila wadsworthia	Produces sulfides, linked to bloating	≤0.457%	~0.166%	0.1385
Clostridium spp.	Produces gas and toxins from proteins	≤0.085%	~0.035%	1.7748
Clostridium perfringens	Gas-producing gut pathogen	≤0.0046%	~0.0015%	Not Detected
Methanobrevibacter smithii	Creates methane, slows gut motility	≤0.24%	~0.017%	0.3063
Desulfovibrio spp.	Releases hydrogen sulfide gas	≤0.581%	~0.225%	Not Detected



Sample ID :  
Received :

Studies referenced: (51) , (52) , (53) , (54) , (55)

## ADHD



Good

Positive Bacteria for ADHD	Mechanism	HRA %	ARA %	Your Abundance %
Faecalibacterium prausnitzii	Reduces gut inflammation; supports brain health	0.188 - 2.62%	~1.084%	5.3671
Veillonellaceae spp.	Linked to improved focus and energy metabolism	0.012 - 0.559%	~0.066%	0.1545
Veillonella	Converts lactate to propionate; may aid cognitive performance	0.0052 - 0.095%	~0.02%	Not Detected
Bifidobacterium spp.	Supports neurotransmitter balance and brain development	0.1239 - 4.497%	~1.006%	1.3900
Bifidobacterium adolescentis	Involved in dopamine modulation; reduces ADHD symptoms	0.0022 - 0.35%	~0.018%	0.0490
Bifidobacterium longum	Promotes mental well-being and stress resilience	0.0134 - 0.76%	~0.137%	0.4700
Negative Bacteria for ADHD	Mechanism	HRA %	ARA %	Your Abundance %
Enterobacteriaceae spp.	Linked to neuroinflammation and mood imbalance	≤3.903%	~0.603%	32.0186
Prevotella spp.	Associated with cognitive and behavioral issues	≤2.011%	~0.162%	Not Detected
Eggerthella spp.	Linked to neuroactive compound production	≤0.0825%	~0.02%	0.0761
Eggerthellaceae	Potential disruptor of gut-brain signaling	≤0.309%	~0.07%	0.1117
Eggerthella lenta	Associated with increased neurotoxin risk	≤0.017%	~0.011%	0.0761



Sample ID :  
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Studies referenced: (51) , (52) , (53) , (54) , (55)

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## ASD



Suboptimal

Positive Bacteria for ASD	Mechanism	HRA %	ARA %	Your Abundance %
Bifidobacterium spp.	Improves gut-brain signaling and reduces inflammation	0.1239 - 4.497%	~1.006%	1.3900
Bifidobacterium adolescentis	Supports dopamine regulation and neurodevelopment	0.0022 - 0.35%	~0.018%	0.0490
Bifidobacterium longum	Enhances gut barrier and emotional balance	0.0134 - 0.76%	~0.137%	0.4700
Lactobacillus spp	Modulates GABA and serotonin; calms nervous system	0.0003 - 0.0008%	~0.0004%	Not Detected
Lactobacillus delbrueckii	Helps reduce oxidative stress in ASD	0.0004 - 0.0098%	~0.0017%	Not Detected
Lactobacillus crispatus	Supports microbiota balance and anti-inflammatory tone	0.0004 - 0.0023%	~0.0009%	Not Detected
Dorea spp.	Contributes to gut health and neuroactive compound production	0.0615 - 0.881%	~0.258%	0.1220
Dorea formicigenerans	Linked with better stool consistency in ASD	0.016 - 0.227%	~0.069%	Not Detected
Faecalibacterium prausnitzii	Anti-inflammatory; supports cognitive function	0.188 - 2.62%	~1.084%	5.3671
Negative Bacteria for ASD	Mechanism	HRA %	ARA %	Your Abundance %
Clostridium spp.	Produces neurotoxins and disrupts behavior	≤0.085%	~0.035%	1.7748
Peptostreptococcaceae spp.	Linked to gut inflammation in ASD	≤0.084%	~0.04%	0.0561
Clostridia spp.	Associated with higher neuroactive toxin load	≤34.08%	~19.97%	28.4569
Bacilli spp.	Imbalance may contribute to GI symptoms in ASD	≤0.27%	~0.17%	0.2040
Gammaproteobacteria	Linked to immune dysregulation and gut issues	≤4.604%	~0.814%	32.0398



Sample ID :  
Received :

Studies referenced: (56) , (57) , (58) , (59) , (60) , Studies  
referenced: (86) , (87) , (88) , (89) , (90)

## Sleep

Good

Positive Bacteria for Sleep	Mechanism	HRA %	ARA %	Your Abundance %
Lachnospiraceae spp.	Supports SCFA production and circadian regulation	3.641 - 17.77%	~9.25%	8.7359
Faecalibacterium prausnitzii	Anti-inflammatory; helps regulate melatonin pathway	0.188 - 2.62%	~1.084%	5.3671
Bifidobacterium spp.	Modulates tryptophan metabolism for serotonin synthesis	0.1239 - 4.497%	~1.006%	1.3900
Bifidobacterium adolescentis	Enhances serotonin and GABA balance	0.0022 - 0.35%	~0.018%	0.0490
Bifidobacterium longum	Supports calm mood and healthy sleep cycles	0.0134 - 0.76%	~0.137%	0.4700
Lactiplantibacillus spp.	Contributes to GABA production and sleep onset	0.0004 - 0.0033%	~0.0008%	Not Detected
Negative Bacteria for Sleep	Mechanism	HRA %	ARA %	Your Abundance %
Desulfovibrio spp.	Produces hydrogen sulfide; linked to poor sleep quality	≤0.581%	~0.225%	Not Detected
Selenomonadales spp.	Associated with gut imbalance and circadian disruption	≤0.17%	~0.003%	0.4207
Negativicutes spp.	Linked to inflammation and neurotransmitter imbalance	≤2.24%	~0.921%	1.0528
Enterobacteriaceae spp.	May affect serotonin balance and sleep latency	≤3.903%	~0.603%	32.0186
[Ruminococcus] torques	Linked with gut permeability and disturbed sleep	≤0.38%	~0.099%	0.2291



Sample ID :  
Received :

Studies referenced: (56) , (57) , (58) , (59) , (60) , Studies  
referenced: (86) , (87) , (88) , (89) , (90)



# Module 3

Unique Gut Based Nutrition Plan

## Food & Nutrient Analysis

This module of the report details the food and nutrient suggestions that can be implemented to help naturally rebalance the gut microbiome. Nutrients within foods such as probiotics, prebiotics, polyphenols, and micronutrients - can be used to feed certain gut bacteria, and starve others.

The food recommendations are tailored and unique to each stool sample, based on the microbial analysis.

### Top 30 Beneficial Foods

Based on the published scientific research, these foods contain the most appropriate nutritional elements to help rebalance the gut microbiome. These are the foods to focus on including in the diet.

### Top 30 Detrimental Foods

These are the most prominent foods that have qualities that could further exacerbate microbial imbalances in the gut, based on the available published research. These should be reduced or removed from the diet.

Please bear in mind - this food recommendation module has no bias, other than rebalancing the gut microbiome. There may be foods in the lists that are not of preference, or cannot be consumed for medical reasons.

Foods appearing in the Detrimental Foods does not make them 'bad' foods - only they have qualities that could further imbalance the gut microbiota.

### Important

When implemented under the supervision of a suitably qualified health practitioner, these recommended food choices are principles - other foods and drinks can, and should, still be consumed. It is important to consider other factors of health, especially when removing foods, to ensure the diet is still balanced from a macro and micro nutrient point of view.

*Any dietary changes should only be made under the supervision of a suitably qualified health practitioner. This test does not diagnose allergies, intolerances, or food sensitivities. The food recommendations are purely principles of foods that feed, or starve, targeted bacteria based on the unique microbial balance in the gut.*



## Top 30 Beneficial Foods

Based on the published scientific research, these foods contain the most appropriate nutritional elements to help rebalance the gut microbiome. These are the foods to focus on including in the diet.

### Priority to include in diet

Lentils



Asparagus



Chicory root



Bananas



Black beans



Leeks



Barley



Apples



Oats



### Beneficial

Garlic



Miso



Jerusalem artichokes



Fermented garlic



Okra



Fermented beets



Sauerkraut



Kale



Quinoa



Broccoli



Blueberries



Almonds



Cottage cheese



Pickles



Flaxseeds



Pomegranate



Zucchini



Tempeh



Lettuce



Cucumbers



Pickled beets



## Top 30 Detrimental Foods

These are the most prominent foods that have qualities that could further exacerbate microbial imbalances in the gut, based on the available published research. These should be reduced or removed from the diet.

### Priority to remove, or reduce from diet

Bacon



Pastries



Heavy cream



Organ meats



Sweetened tea



Dates



Peanuts



White flour



Fatty beef



### Advisable to limit in diet

Liver



Cherries



White pasta



Energy drinks



Sweetened cereal



Processed cheese



Sweet sauces



Sweetcorn



White rice



Artificial creamers



White sugar



Fried fish



Tomatoes



Butter



Milk chocolate



Hard cheese



Refined grains



Biscuits



Coconut Water



Refined sugar



Cola



## Precision Prebiotics

Prebiotics are special types of dietary fibers that fuel bacteria in the gut, helping them grow and thrive. Unlike probiotics, which introduce new bacteria, prebiotics feed the bacteria that are already present in the gut.

In this section, we match the unique gut profile from the stool sample analysis, to the most suitable prebiotic supplements, selecting those that are most likely to support the growth of beneficial species based on your specific results.

We have no commercial affiliations with supplement companies, nor are we trying to promote our own prebiotics! Instead this section details the specific prebiotic ingredients that will be most effective based on the stool sample analysis. This allows an educated and targeted choice that can have the greatest positive impact on the gut health and overall well-being.

Based on the stool sample analysis, the most suitable prebiotics formulations will contain:

### Most Suitable Prebiotics

Inulin

Resistant starch

Polydextrose

Lactulose



## References

- 1 Jiang, Y. et al., 2021. Gut microbiota and ocular diseases: a bibliometric and visual analysis. *Frontiers in Cellular and Infection Microbiology*, 11, p.646348.
- 2 Nakamura, Y.K. et al., 2016. Gut microbial alterations in a murine model of Sjögren's syndrome. *Investigative Ophthalmology & Visual Science*, 57(9), pp.3621–3629.
- 3 Zysset-Burri, D.C. et al., 2020. Retinal pigment epithelium dysfunction induced by gut microbiota dysbiosis. *Investigative Ophthalmology & Visual Science*, 61(13), p.13.
- 4 Zhou, Y. et al., 2022. Altered gut microbiota composition in patients with age-related macular degeneration. *Investigative Ophthalmology & Visual Science*, 63(1), p.2.
- 5 Rowan, S. et al., 2017. Involvement of a gut-retina axis in protection against dietary glycemia-induced age-related macular degeneration. *PNAS*, 114(22), pp.E4472–E4481.
- 6 Turnbaugh, P.J. et al., 2006. An obesity-associated gut microbiome with increased capacity for energy harvest. *Nature*, 444(7122), pp.1027–1031.
- 7 Ridaura, V.K. et al., 2013. Gut microbiota from twins discordant for obesity modulate metabolism in mice. *Science*, 341(6150), p.1241214.
- 8 Le Chatelier, E. et al., 2013. Richness of human gut microbiome correlates with metabolic markers. *Nature*, 500(7464), pp.541–546.
- 9 Cani, P.D. et al., 2007. Metabolic endotoxemia initiates obesity and insulin resistance. *Diabetes*, 56(7), pp.1761–1772.
- 10 Cotillard, A. et al., 2013. Dietary intervention impact on gut microbial gene richness. *Nature*, 500(7464), pp.585–588.
- 11 Cryan, J.F. and Dinan, T.G., 2012. Mind-altering microorganisms: the impact of the gut microbiota on brain and behaviour. *Nature Reviews Neuroscience*, 13(10), pp.701–712.
- 12 Foster, J.A. and McVey Neufeld, K.A., 2013. Gut–brain axis: how the microbiome influences anxiety and depression. *Trends in Neurosciences*, 36(5), pp.305–312.
- 13 Carabotti, M. et al., 2015. The gut–brain axis: interactions between enteric microbiota, central and enteric nervous systems. *Annals of Gastroenterology*, 28(2), pp.203–209.
- 14 Sampson, T.R. and Mazmanian, S.K., 2015. Control of brain development, function, and behavior by the microbiome. *Cell Host & Microbe*, 17(5), pp.565–576.
- 15 Bastiaanssen, T.F.S. et al., 2019. Making sense of...the microbiome in psychiatry. *International Journal of Neuropsychopharmacology*, 22(11), pp.661–682.
- 16 Tang, W.H.W. et al., 2017. Gut microbiota in cardiovascular health and disease. *Circulation Research*, 120(7), pp.1183–1196.
- 17 Wang, Z. et al., 2011. Gut flora metabolism of phosphatidylcholine promotes cardiovascular disease. *Nature*, 472(7341), pp.57–63.
- 18 Koeth, R.A. et al., 2013. Intestinal microbiota metabolism of L-carnitine promotes atherosclerosis. *Nature Medicine*, 19(5), pp.576–585.
- 19 Jonsson, A.L. and Bäckhed, F., 2017. Role of gut microbiota in atherosclerosis. *Nature Reviews Cardiology*, 14(2), pp.79–87.
- 20 Jie, Z. et al., 2017. The gut microbiome in atherosclerotic cardiovascular disease. *Nature Communications*, 8(1), p.845.
- 21 Salem, I. et al., 2018. The gut microbiome as a major regulator of the gut–skin axis. *Frontiers in Microbiology*, 9, p.1459.
- 22 O'Neill, C.A. et al., 2016. The gut–skin axis in health and disease: A paradigm with therapeutic implications. *BioEssays*, 38(11), pp.1167–1176.
- 23 De Pessemer, B. et al., 2021. Gut–skin axis: current knowledge of the interrelationship between intestinal and skin microbiota. *Microorganisms*, 9(2), p.353.
- 24 Lee, S.Y. et al., 2018. Microbiome in the gut–skin axis in atopic dermatitis. *Allergy, Asthma & Immunology Research*, 10(4), pp.354–362.



## References

- 25 Bowe, W.P. and Logan, A.C., 2011. Acne vulgaris, probiotics and the gut–brain–skin axis – back to the future? *Gut Pathogens*, 3(1), p.1.
- 26 Budden, K.F. et al., 2017. Emerging pathogenic links between microbiota and the gut–lung axis. *Nature Reviews Microbiology*, 15(1), pp.55–63.
- 27 Dang, A.T. and Marsland, B.J., 2019. Microbes, metabolites, and the gut–lung axis. *Mucosal Immunology*, 12(4), pp.843–850.
- 28 Marsland, B.J., Trompette, A. and Gollwitzer, E.S., 2015. The gut–lung axis in respiratory disease. *Annals of the American Thoracic Society*, 12(Supplement 2), pp.S150–S156.
- 29 Dumas, A. et al., 2018. The role of the lung microbiota and the gut–lung axis in respiratory infectious diseases. *Cellular Microbiology*, 20(12), e12966.
- 30 Enaud, R. et al., 2020. The gut–lung axis in health and respiratory diseases: A place for inter-organ and inter-kingdom crosstalks. *Frontiers in Cellular and Infection Microbiology*, 10, p.9.
- 31 Virili, C. et al., 2019. Gut microbiota and Hashimoto's thyroiditis. *Reviews in Endocrine and Metabolic Disorders*, 20, pp.465–472.
- 32 Zhao, F. et al., 2018. Alterations of the gut microbiota in Hashimoto's thyroiditis patients. *Thyroid*, 28(2), pp.175–186.
- 33 Ishaq, H.M. et al., 2018. Molecular estimation of alteration in intestinal microbial composition in Hashimoto's thyroiditis. *International Journal of Molecular Sciences*, 19(9), p.2897.
- 34 Zhou, Y. et al., 2020. Gut microbiota dysbiosis in patients with thyroid nodules. *Frontiers in Cellular and Infection Microbiology*, 10, p.505015.
- 35 Liu, Y. et al., 2021. Correlation between gut microbiota and autoimmune thyroid disease. *Frontiers in Cell and Developmental Biology*, 9, p.582818.
- 36 Al-Naggar, Y. et al., 2022. The gut microbiota–hormone axis in endocrine health and disease. *Endocrine Reviews*, 43(2), pp.173–192.
- 37 Bajaj, J.S. et al., 2020. Gut microbial patterns in female hormonal health. *Journal of Clinical Endocrinology & Metabolism*, 105(8), pp.2502–2513.
- 38 Łagowska, K. et al., 2022. Role of the gut microbiota in hormonal balance. *Nutrients*, 14(4), p.793.
- 39 Chen, Y. et al., 2020. Gut microbiota and sex hormone levels in polycystic ovary syndrome. *Frontiers in Endocrinology*, 11, p.273.
- 40 Tremellen, K. and Pearce, K., 2020. Dysbiosis of Gut Microbiota (DOGMA) – a novel theory for the development of Polycystic Ovarian Syndrome. *Medical Hypotheses*, 94, pp.93–97.
- 41 Tripathi, A. et al., 2018. The gut–liver axis and the intersection with the microbiome. *Nature Reviews Gastroenterology & Hepatology*, 15(7), pp.397–411.
- 42 Albillos, A., de Gottardi, A. and Rescigno, M., 2020. The gut–liver axis in liver disease: Pathophysiological basis for therapy. *Journal of Hepatology*, 72(3), pp.558–577.
- 43 Compare, D. et al., 2012. Gut–liver axis: the impact of gut microbiota on non-alcoholic fatty liver disease. *Nutrition, Metabolism and Cardiovascular Diseases*, 22(4), pp.471–476.
- 44 Sarin, S.K. et al., 2019. Gut microbiome in liver disease. *Gastroenterology Clinics of North America*, 48(2), pp.389–403.
- 45 Le Roy, T. et al., 2013. Gut microbiota regulation of bile acid metabolism controls the impact of fat intake on liver steatosis. *Cell Metabolism*, 17(2), pp.225–235.
- 46 Scher, J.U. et al., 2013. Expansion of intestinal *Prevotella copri* correlates with enhanced susceptibility to arthritis. *eLife*, 2, e01202.
- 47 Maeda, Y. and Takeda, K., 2019. Role of gut microbiota in rheumatoid arthritis. *Journal of Clinical Medicine*, 6(4), p.60.
- 48 Breban, M. et al., 2017. Faecal microbiota study reveals specific dysbiosis in spondyloarthritis. *Annals of the Rheumatic Diseases*, 76(9), pp.1614–1622.



## References

- 49 Marietta, E.V. et al., 2016. Suppression of inflammatory arthritis by human gut-derived *Prevotella histicola* in humanized mice. *Arthritis & Rheumatology*, 68(2), pp.287–295.
- 50 Zhang, X. et al., 2015. The oral and gut microbiomes are perturbed in rheumatoid arthritis and partly normalized after treatment. *Nature Medicine*, 21(8), pp.895–905.
- 51 Budden, K.F. et al., 2017. Emerging pathogenic links between microbiota and the gut–lung axis. *Nature Reviews Microbiology*, 15(1), pp.55–63.
- 52 Dang, A.T. and Marsland, B.J., 2019. Microbes, metabolites, and the gut–lung axis. *Mucosal Immunology*, 12(4), pp.843–850.
- 53 Marsland, B.J., Trompette, A. and Gollwitzer, E.S., 2015. The gut–lung axis in respiratory disease. *Annals of the American Thoracic Society*, 12(Supplement 2), pp.S150–S156.
- 54 Dumas, A. et al., 2018. The role of the lung microbiota and the gut–lung axis in respiratory infectious diseases. *Cellular Microbiology*, 20(12), e12966.
- 55 Enaud, R. et al., 2020. The gut–lung axis in health and respiratory diseases: A place for inter-organ and inter-kingdom crosstalks. *Frontiers in Cellular and Infection Microbiology*, 10, p.9.
- 56 Virili, C. et al., 2019. Gut microbiota and Hashimoto's thyroiditis. *Reviews in Endocrine and Metabolic Disorders*, 20, pp.465–472.
- 57 Zhao, F. et al., 2018. Alterations of the gut microbiota in Hashimoto's thyroiditis patients. *Thyroid*, 28(2), pp.175–186.
- 58 Ishaq, H.M. et al., 2018. Molecular estimation of alteration in intestinal microbial composition in Hashimoto's thyroiditis. *International Journal of Molecular Sciences*, 19(9), p.2897.
- 59 Zhou, Y. et al., 2020. Gut microbiota dysbiosis in patients with thyroid nodules. *Frontiers in Cellular and Infection Microbiology*, 10, p.505015.
- 60 Liu, Y. et al., 2021. Correlation between gut microbiota and autoimmune thyroid disease. *Frontiers in Cell and Developmental Biology*, 9, p.582818.
- 61 Al-Naggar, Y. et al., 2022. The gut microbiota–hormone axis in endocrine health and disease. *Endocrine Reviews*, 43(2), pp.173–192.
- 62 Bajaj, J.S. et al., 2020. Gut microbial patterns in female hormonal health. *Journal of Clinical Endocrinology & Metabolism*, 105(8), pp.2502–2513.
- 63 Łagowska, K. et al., 2022. Role of the gut microbiota in hormonal balance. *Nutrients*, 14(4), p.793.
- 64 Chen, Y. et al., 2020. Gut microbiota and sex hormone levels in polycystic ovary syndrome. *Frontiers in Endocrinology*, 11, p.273.
- 65 Tremellen, K. and Pearce, K., 2020. Dysbiosis of Gut Microbiota (DOGMA) – a novel theory for the development of Polycystic Ovarian Syndrome. *Medical Hypotheses*, 94, pp.93–97.
- 66 Tripathi, A. et al., 2018. The gut–liver axis and the intersection with the microbiome. *Nature Reviews Gastroenterology & Hepatology*, 15(7), pp.397–411.
- 67 Albillos, A., de Gottardi, A. and Rescigno, M., 2020. The gut–liver axis in liver disease: Pathophysiological basis for therapy. *Journal of Hepatology*, 72(3), pp.558–577.
- 68 Compare, D. et al., 2012. Gut–liver axis: the impact of gut microbiota on non-alcoholic fatty liver disease. *Nutrition, Metabolism and Cardiovascular Diseases*, 22(4), pp.471–476.
- 69 Sarin, S.K. et al., 2019. Gut microbiome in liver disease. *Gastroenterology Clinics of North America*, 48(2), pp.389–403.
- 70 Le Roy, T. et al., 2013. Gut microbiota regulation of bile acid metabolism controls the impact of fat intake on liver steatosis. *Cell Metabolism*, 17(2), pp.225–235.
- 71 Scher, J.U. et al., 2013. Expansion of intestinal *Prevotella copri* correlates with enhanced susceptibility to arthritis. *eLife*, 2, e01202.



## References

- 72 Maeda, Y. and Takeda, K., 2019. Role of gut microbiota in rheumatoid arthritis. *Journal of Clinical Medicine*, 6(4), p.60.
- 73 Breban, M. et al., 2017. Faecal microbiota study reveals specific dysbiosis in spondyloarthritis. *Annals of the Rheumatic Diseases*, 76(9), pp.1614–1622.
- 74 Marietta, E.V. et al., 2016. Suppression of inflammatory arthritis by human gut-derived *Prevotella histicola* in humanized mice. *Arthritis & Rheumatology*, 68(2), pp.287–295.
- 75 Zhang, X. et al., 2015. The oral and gut microbiomes are perturbed in rheumatoid arthritis and partly normalized after treatment. *Nature Medicine*, 21(9), pp.895–905.
- 76 Budden, K.F. et al., 2017. Emerging pathogenic links between microbiota and the gut–lung axis. *Nature Reviews Microbiology*, 15(1), pp.55–63.
- 77 Dang, A.T. and Marsland, B.J., 2019. Microbes, metabolites, and the gut–lung axis. *Mucosal Immunology*, 12(4), pp.843–850.
- 78 Marsland, B.J., Trompette, A. and Gollwitzer, E.S., 2015. The gut–lung axis in respiratory disease. *Annals of the American Thoracic Society*, 12(Supplement 2), pp.S150–S156.
- 79 Dumas, A. et al., 2018. The role of the lung microbiota and the gut–lung axis in respiratory infectious diseases. *Cellular Microbiology*, 20(12), e12966.
- 80 Enaud, R. et al., 2020. The gut–lung axis in health and respiratory diseases: A place for inter-organ and inter-kingdom crosstalks. *Frontiers in Cellular and Infection Microbiology*, 10, p.9.
- 81 Virili, C. et al., 2019. Gut microbiota and Hashimoto's thyroiditis. *Reviews in Endocrine and Metabolic Disorders*, 20, pp.465–472.
- 82 Zhao, F. et al., 2018. Alterations of the gut microbiota in Hashimoto's thyroiditis patients. *Thyroid*, 28(2), pp.175–186.
- 83 Ishaq, H.M. et al., 2018. Molecular estimation of alteration in intestinal microbial composition in Hashimoto's thyroiditis. *International Journal of Molecular Sciences*, 19(9), p.2897.
- 84 Zhou, Y. et al., 2020. Gut microbiota dysbiosis in patients with thyroid nodules. *Frontiers in Cellular and Infection Microbiology*, 10, p.505015.
- 85 Liu, Y. et al., 2021. Correlation between gut microbiota and autoimmune thyroid disease. *Frontiers in Cell and Developmental Biology*, 9, p.582818.
- 86 Al-Naggar, Y. et al., 2022. The gut microbiota–hormone axis in endocrine health and disease. *Endocrine Reviews*, 43(2), pp.173–192.
- 87 Bajaj, J.S. et al., 2020. Gut microbial patterns in female hormonal health. *Journal of Clinical Endocrinology & Metabolism*, 105(9), pp.2502–2513.
- 88 Łagowska, K. et al., 2022. Role of the gut microbiota in hormonal balance. *Nutrients*, 14(4), p.793.
- 89 Chen, Y. et al., 2020. Gut microbiota and sex hormone levels in polycystic ovary syndrome. *Frontiers in Endocrinology*, 11, p.273.
- 90 Tremellen, K. and Pearce, K., 2020. Dysbiosis of Gut Microbiota (DOGMA) – a novel theory for the development of Polycystic Ovarian Syndrome. *Medical Hypotheses*, 94, pp.93–97.
- 91 Tripathi, A. et al., 2018. The gut–liver axis and the intersection with the microbiome. *Nature Reviews Gastroenterology & Hepatology*, 15(7), pp.397–411.
- 92 Albillos, A., de Gottardi, A. and Rescigno, M., 2020. The gut–liver axis in liver disease: Pathophysiological basis for therapy. *Journal of Hepatology*, 72(3), pp.558–577.
- 93 Compare, D. et al., 2012. Gut–liver axis: the impact of gut microbiota on non-alcoholic fatty liver disease. *Nutrition, Metabolism and Cardiovascular Diseases*, 22(4), pp.471–476.
- 94 Sarin, S.K. et al., 2019. Gut microbiome in liver disease. *Gastroenterology Clinics of North America*, 48(2), pp.389–403.
- 95 Le Roy, T. et al., 2013. Gut microbiota regulation of bile acid metabolism controls the impact of fat intake on liver steatosis.



## References

- 96 Scher, J.U. et al., 2013. Expansion of intestinal *Prevotella copri* correlates with enhanced susceptibility to arthritis. *eLife*, 2, e01202.
- 97 Maeda, Y. and Takeda, K., 2019. Role of gut microbiota in rheumatoid arthritis. *Journal of Clinical Medicine*, 6(4), p.60.
- 98 Breban, M. et al., 2017. Faecal microbiota study reveals specific dysbiosis in spondyloarthritis. *Annals of the Rheumatic Diseases*, 76(9), pp.1614–1622.
- 99 Marietta, E.V. et al., 2016. Suppression of inflammatory arthritis by human gut-derived *Prevotella histicola* in humanized mice. *Arthritis & Rheumatology*, 68(2), pp.287–295.
- 100 Zhang, X. et al., 2015. The oral and gut microbiomes are perturbed in rheumatoid arthritis and partly normalized after treatment. *Nature Medicine*, 21(8), pp.895–905.
- 101 Clarke, S.F., Murphy, E.F., O'Sullivan, O., Lucey, A.J., Humphreys, M., Hogan, A., Hayes, P., O'Reilly, M., Jeffery, I.B., Wood-Martin, R. and Kerins, D.M., 2014. Exercise and associated dietary extremes impact on gut microbial diversity. *Gut*, 63(12), pp.1913–1920.
- 102 Estaki, M., Pither, J., Baumeister, P., Little, J.P., Gill, S.K., Ghosh, S., Légaré, J. and Blais, L., 2016. Cardiorespiratory fitness as a predictor of intestinal microbial diversity and distinct metagenomic functions. *Microbiome*, 4(1), p.42.
- 103 Allen, J.M., Mailing, L.J., Niemiro, G.M., Moore, R., Cook, M.D., White, B.A., Holscher, H.D. and Woods, J.A., 2018. Exercise alters gut microbiota composition and function in lean and obese humans. *Medicine & Science in Sports & Exercise*, 50(4), pp.747–757.
- 104 Cronin, O., Barton, W., Skuse, P., Penney, N.C., Garcia-Perez, I., Murphy, E.F., Woods, T., Nugent, H., Fanning, A., Melgar, S. and Falvey, E., 2018. A prospective metagenomic and metabolomic analysis of the impact of exercise and/or whey protein supplementation on the gut microbiome of sedentary adults. *mSystems*, 3(3), e00044–18.
- 105 Barton, W., Penney, N.C., Cronin, O., Garcia-Perez, I., Molloy, M.G., Holmes, E., Shanahan, F., Cotter, P.D. and O'Sullivan, O., 2018. The microbiome of professional athletes differs from that of more sedentary subjects in composition and particularly at the functional metabolic level. *Gut*, 67(4), pp.625–633.
- 106 Louis, P. and Flint, H.J., 2017. Formation of propionate and butyrate by the human colonic microbiota. *Environmental Microbiology*, 19(1), pp.29–41.
- 107 Morrison, D.J. and Preston, T., 2016. Formation of short chain fatty acids by the gut microbiota and their impact on human metabolism. *Gut Microbes*, 7(3), pp.189–200.
- 108 Koh, A., De Vadder, F., Kovatcheva-Datchary, P. and Bäckhed, F., 2016. From dietary fiber to host physiology: short-chain fatty acids as key bacterial metabolites. *Cell*, 165(4), pp.1332–1345.
- 109 den Besten, G., van Eunen, K., Groen, A.K., Venema, K., Reijngoud, D.J. and Bakker, B.M., 2013. The role of short-chain fatty acids in the interplay between diet, gut microbiota, and host energy metabolism. *Journal of Lipid Research*, 54(9), pp.2325–2340.
- 110 Canfora, E.E., Jocken, J.W.E. and Blaak, E.E., 2015. Short-chain fatty acids in control of body weight and insulin sensitivity. *Nature Reviews Endocrinology*, 11(10), pp.577–591.
- 111 Rios-Covián, D., Ruas-Madiedo, P., Margolles, A., Gueimonde, M., de los Reyes-Gavilán, C.G. and Salazar, N., 2016. Intestinal short chain fatty acids and their link with diet and human health. *Frontiers in Microbiology*, 7, p.185.
- 112 Louis, P., Hold, G.L. and Flint, H.J., 2014. The gut microbiota, bacterial metabolites and colorectal cancer. *Nature Reviews Microbiology*, 12(10), pp.661–672.
- 113 Parada Venegas, D., De la Fuente, M.K., Landskron, G., González, M.J., Quera, R., Dijkstra, G., Harmsen, H.J., Faber, K.N. and Hermoso, M.A., 2019. Short chain fatty acids (SCFAs)-mediated gut epithelial and immune regulation and its relevance for inflammatory bowel diseases. *Frontiers in Immunology*, 10, p.277.
- 114 Belkaid, Y. and Hand, T.W., 2014. Role of the microbiota in immunity and inflammation. *Cell*, 157(1), pp.121–141.
- 115 Tilg, H., Zmora, N., Adolph, T.E. and Elinav, E., 2020. The intestinal microbiota fuelling metabolic inflammation. *Nature Reviews Immunology*, 20(1), pp.40–54.





## References

- 116 Honda, K. and Littman, D.R., 2016. The microbiota in adaptive immune homeostasis and disease. *Nature*, 535(7610), pp.75–84.
- 117 Zhang, M., Sun, K., Wu, Y., Yang, Y., Tso, P. and Wu, Z., 2017. Interactions between gut microbiota, host genetics and diet relevant to development of metabolic syndromes in mice. *ISME Journal*, 11(3), pp.745–756.
- 118 Man, S.M., Kaakoush, N.O., Mitchell, H.M. and Wilkins, M.R., 2011. The role of bacteria and pattern-recognition receptors in Crohn's disease. *Nature Reviews Gastroenterology & Hepatology*, 8(3), pp.152–168.
- 119 Sánchez-Pérez, S., Comas-Basté, O., Veciana-Nogués, M.T., Latorre-Moratalla, M.L. and Vidal-Carou, M.C., 2022. Histamine intolerance and the role of gut microbiota: A review. *Nutrients*, 14(14), p.2981.
- 120 Schink, M., Konturek, P.C. and Tietz, E., 2018. Microbial patterns in histamine intolerance: a potential connection to gut microbiota composition. *American Journal of Physiology–Gastrointestinal and Liver Physiology*, 315(4), pp.G551–G561.
- 121 Westbroek, I. et al., 2021. Bacterial histamine production and its impact on histamine intolerance and intestinal inflammation. *World Journal of Gastroenterology*, 27(1), pp.43–57.
- 122 Smolinska, S., Jutel, M., Cramer, R. and O'Mahony, L., 2014. Histamine and gut mucosal immune regulation. *Allergy*, 69(3), pp.273–281.
- 123 LeBlanc, J.G., Milani, C., de Giori, G.S., Sesma, F., van Sinderen, D. and Ventura, M., 2013. Bacteria as vitamin suppliers to their host: a gut microbiota perspective. *Current Opinion in Biotechnology*, 24(2), pp.160–168.
- 124 Magnúsdóttir, S. et al., 2015. Systematic genome assessment of B-vitamin biosynthesis suggests co-operation among gut microbes. *Frontiers in Genetics*, 6, p.148.
- 125 Rowland, I.R., 1991. Nutrition and the gut flora. *Nutrition and Health*, 7(3), pp.153–160.
- 126 Rossi, M., Amaretti, A. and Raimondi, S., 2011. Folate production by probiotic bacteria. *Nutrients*, 3(1), pp.118–134.
- 127 Degnan, P.H., Barry, N.A., Mok, K.C., Taga, M.E. and Goodman, A.L., 2014. Human gut microbes use multiple transporters to distinguish vitamin B12 analogs and compete in the gut. *Cell Host & Microbe*, 15(1), pp.47–57.
- 128 Moriyama, Y. and Kanno, E., 2020. Gut microbiota and absorption of B vitamins. *BioFactors*, 46(4), pp.552–560.
- 129 Martens, J.H., Barg, H., Warren, M.J. and Jahn, D., 2002. Microbial production of vitamin B12. *Applied Microbiology and Biotechnology*, 58(3), pp.275–285.
- 130 Kirmiz, N., Galindo, K., Cross, T.L., Luna, E., Salvato, F., Lau, J.T. and Aldrovandi, G.M., 2020. Comparative analysis of fecal short-chain fatty acids and microbiota in breastfed and formula-fed infants. *Frontiers in Microbiology*, 11, p.1133.
- 131 Allen, R.H. and Stabler, S.P., 2008. Identification and quantitation of cobalamin and cobalamin analogues in human feces. *The American Journal of Clinical Nutrition*, 87(5), pp.1324–1335.
- 132 Hill, M.J., 1997. Intestinal flora and endogenous vitamin synthesis. *European Journal of Cancer Prevention*, 6(Suppl 1), pp.S43–S45.
- 133 Flint, H.J., Scott, K.P., Duncan, S.H., Louis, P. and Forano, E., 2012. Microbial degradation of complex carbohydrates in the gut. *Gut Microbes*, 3(4), pp.289–306.
- 134 Turnbaugh, P.J. et al., 2006. An obesity-associated gut microbiome with increased capacity for energy harvest. *Nature*, 444(7122), pp.1027–1031.
- 135 Sonnenburg, J.L. and Bäckhed, F., 2016. Diet–microbiota interactions as moderators of human metabolism. *Nature*, 535(7610), pp.56–64.
- 136 den Besten, G. et al., 2013. The role of short-chain fatty acids in the interplay between diet, gut microbiota, and host energy metabolism. *Journal of Lipid Research*, 54(9), pp.2325–2340.
- 137 Rowland, I., Gibson, G., Heinken, A., Scott, K., Swann, J., Thiele, I. and Tuohy, K., 2018. Gut microbiota functions: metabolism of nutrients and other food components. *European Journal of Nutrition*, 57(1), pp.1–24.
- 138 Martinez, I., Kim, J., Duffy, P.R., Schlegel, V.L. and Walter, J., 2010. Resistant starches types 2 and 4 have differential effects, on the composition of the fecal microbiota in human subjects. *PLoS One*, 5(11), p.e15046.



## References

- 139 Zeng, H. and Chi, Y., 2015. Gut microbiota-derived metabolites and lipid metabolism: understanding the role of short-chain fatty acids. *Food & Function*, 6(9), pp.2850–2859.
- 140 El Kaoutari, A., Armougom, F., Gordon, J.I., Raoult, D. and Henrissat, B., 2013. The abundance and variety of carbohydrate-active enzymes in the human gut microbiota. *Nature Reviews Microbiology*, 11(7), pp.497–504.
- 141 Wu, G.D. et al., 2011. Linking long-term dietary patterns with gut microbial enterotypes. *Science*, 334(6052), pp.105–108.
- 142 Scott, K.P., Gratz, S.W., Sheridan, P.O., Flint, H.J. and Duncan, S.H., 2013. The influence of diet on the gut microbiota. *Pharmacological Research*, 69(1), pp.52–60.
- 143 Cryan, J.F. and Dinan, T.G., 2012. Mind-altering microorganisms: the impact of the gut microbiota on brain and behaviour. *Nature Reviews Neuroscience*, 13(10), pp.701–712.
- 144 Foster, J.A. and McVey Neufeld, K.A., 2013. Gut–brain axis: how the microbiome influences anxiety and depression. *Trends in Neurosciences*, 36(5), pp.305–312.
- 145 Kelly, J.R. et al., 2016. Breaking down the barriers: the gut microbiome, intestinal permeability and stress-related psychiatric disorders. *Frontiers in Cellular Neuroscience*, 9, p.392.
- 146 Jiang, H. et al., 2015. Altered gut microbiota profile in patients with generalized anxiety disorder. *Journal of Psychiatric Research*, 63, pp.1–7.
- 147 Valles-Colomer, M. et al., 2019. The neuroactive potential of the human gut microbiota in quality of life and depression. *Nature Microbiology*, 4(4), pp.623–632.
- 148 Claus, S.P., Guillou, H. and Ellero-Simatos, S., 2016. The gut microbiota: a major player in the toxicity of environmental pollutants?. *NPJ Biofilms and Microbiomes*, 2, p.16003.
- 149 Spanogiannopoulos, P., Bess, E.N., Carmody, R.N. and Turnbaugh, P.J., 2016. The microbial pharmacists within us: a metagenomic view of xenobiotic metabolism. *Nature Reviews Microbiology*, 14(5), pp.273–287.
- 150 Tang, W.H. et al., 2013. Intestinal microbial metabolism of phosphatidylcholine and cardiovascular risk. *New England Journal of Medicine*, 368(17), pp.1575–1584.
- 151 Haiser, H.J. and Turnbaugh, P.J., 2013. Is it time for a metagenomic basis of therapeutics?. *Science*, 341(6146), pp.955–957.
- 152 Selwyn, F.P. et al., 2016. Role of intestinal microbiota in xenobiotic metabolism. *Pharmacology & Therapeutics*, 164, pp.67–80.
- 153 O'Toole, P.W. and Jeffery, I.B., 2015. Gut microbiota and aging. *Science*, 350(6265), pp.1214–1215.
- 154 Biagi, E. et al., 2016. Gut microbiota and extreme longevity. *Current Biology*, 26(11), pp.1480–1485.
- 155 Kong, F. et al., 2016. Gut microbiota signatures of longevity. *Current Biology*, 26(18), pp.2454–2464.
- 156 Claesson, M.J. et al., 2012. Gut microbiota composition correlates with diet and health in the elderly. *Nature*, 488(7410), pp.178–184.
- 157 Wilmski, T. et al., 2021. Gut microbiome pattern reflects healthy ageing and predicts survival in humans. *Nature Metabolism*, 3(2), pp.274–286.