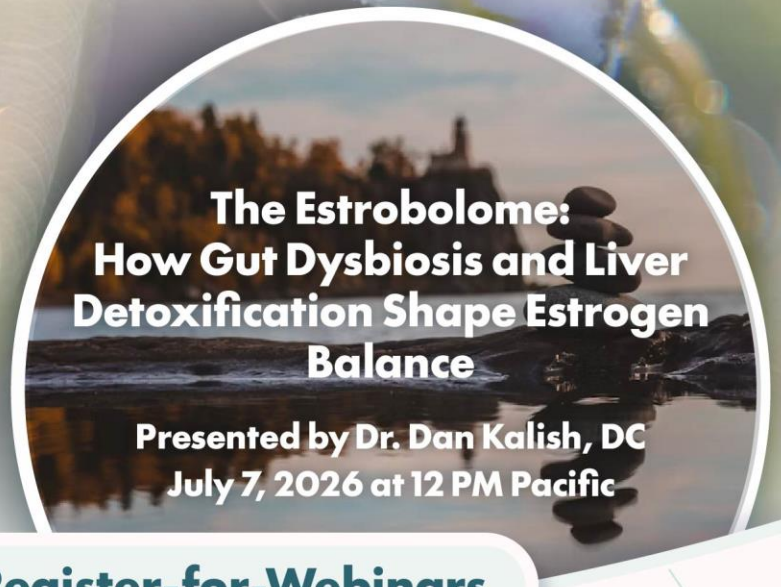
UPCOMING EVENTS

ADHD in Perimenopause: The Estrogen-Dopamine Connection and Clinical Implications

Presented by Ruth Hobson, ND
July 1, 2026 at 12 PM Pacific



The Estrobolome: How Gut Dysbiosis and Liver Detoxification Shape Estrogen Balance

Presented by Dr. Dan Kalish, DC
July 7, 2026 at 12 PM Pacific

Visit doctorsdata.com/Register-for-Webinars

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WILL BEGIN SHORTLY

MORE WEB EVENTS

Harnessing the Microbiome to Boost GLP-1: Insights from the GI360™

Jeannie Gorman, MS, CCN

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SCIENCE + INSIGHT

For 50+ years, DDI has been recognized and respected by many American and European regulating and governing agencies.

- Doctor's Data is a **federally licensed CLIA laboratory** with appropriate state certifications and licenses.
- We participate in quality assurance and proficiency testing programs including those offered by the **College of American Pathology (CAP), Centers for Disease Control (CDC), New York State Department of Health, Le Centre de Toxicologie du Quebec and others.**
- DDI is an approved provider for the **Joint Research Centre of the European Commission: Reference Material Unit**
  - We assist with the certification of reference materials
  - We do the same for the NY State Department of Health

[Qualifications-and-Licensing]

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Licenses and Certifications

American Proficiency Institute Certificate
Clinical Laboratory Improvement Act (CLIA) Certificate #14D0646470. Categories: Routine Chemistry, Toxicology, Bacteriology, Mycology, Parasitology and General Immunology.
College of American Pathologists
DEQAS Vitamin D Certificate
EQUIP Certificate
European Commission Joint Research Center Validated Supplier for Trace Elements
New York State Department of Health PFI #5449. Categories: Clinical Chemistry (routine), Toxicology (Blood Lead), Mycology, Parasitology and Hematology.
Maryland Department of Health Laboratory Permit #795. Categories: Clinical Chemistry (routine), Toxicology (Blood Lead, Heavy Metals), Microbiology, Bacteriology, Mycology and Parasitology.
Ohio Department of Health Laboratory Approval #C10074.
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Today's Session Objectives:

- Describe the GI360's™ comprehensive assessment of microbiome composition
- Identify patients on, or considering, GLP-1 agonist or incretin-based therapy with metabolic dysfunction, appetite dysregulation, or suboptimal clinical response for stool testing
- Interpret GI360™ results in the context of imbalances leading to impaired endogenous GLP-1 signaling and metabolic response
- Implement targeted interventions to support GLP-1 signaling and treatment outcomes
- Explore a variety of testing and retesting to monitor microbiome changes and metabolic signaling in patients on GLP-1/incretin-based therapies

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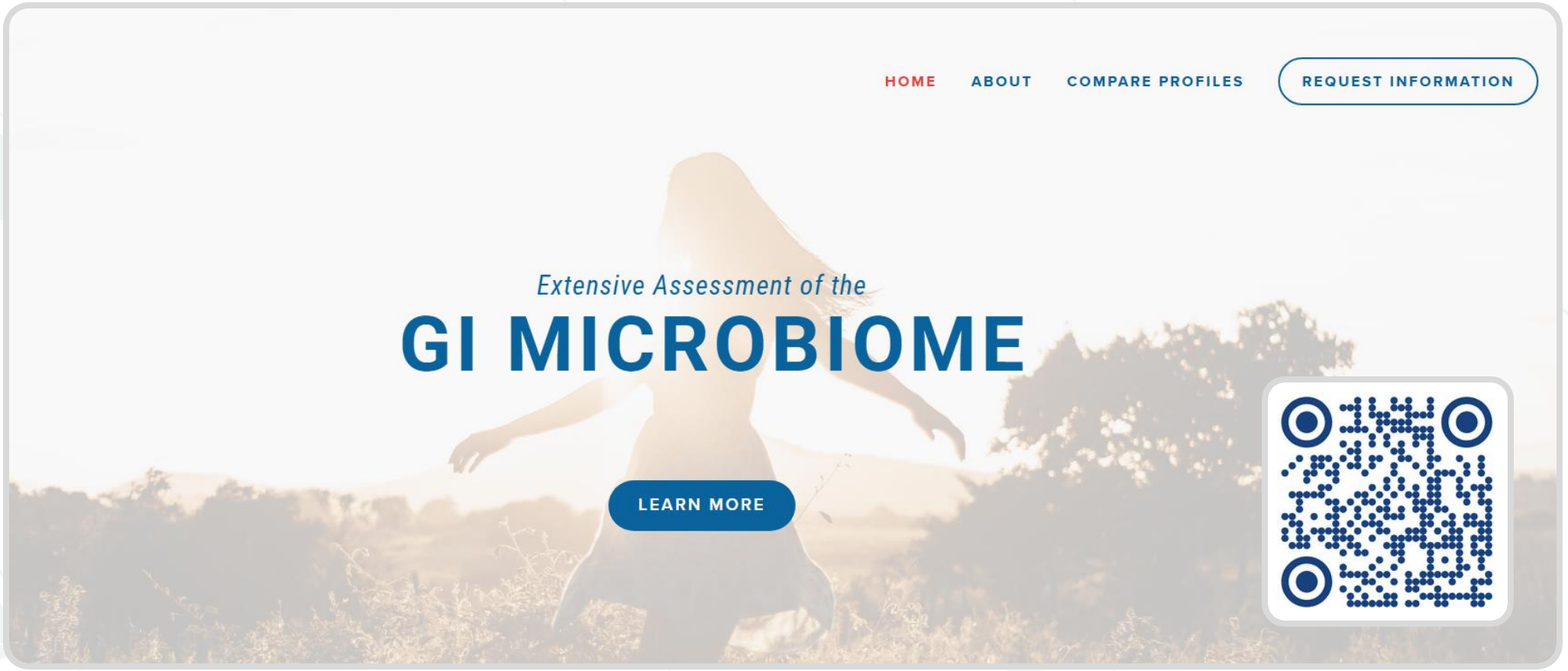

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About

- ABOUT THE TEST
- SAMPLE REPORT
- **RESOURCE GUIDE**
- COLLECTION INSTRUCTIONS
- PUBLICATIONS
- POSTERS AND ABSTRACTS
- VIDEOS AND PODCASTS
- FREQUENTLY ASKED QUESTIONS

RESOURCE GUIDE

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GI360™ Stool Test Profile Options

	GI360™	GI360™ ESSENTIALS	GI360™ MICROBIOME
Microbiome Diversity and Abundance; PCR	✓	✓	✓
Viruses, Pathogens, and Parasites; PCR	✓	✓	
Expanded Parasitology; Microscopy	✓	✓	
Bacterial and Fungal Culturomics w/ Direct Susceptibilities; MALDI-TOF MS	✓	✓	
Stool Chemistries	✓		
Beta-Glucuronidase	✓		

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COLLECTION INSTRUCTIONS

PPIs H2 blockers are contraindicated for H. pylori Antigen testing to avoid false negative.

3 IMPORTANT PREP INFO

BEFORE YOU START: Please read all of the instructions carefully before beginning. Consult your physician for specific instructions and before stopping any medications.

DISCONTINUE THE FOLLOWING	
2 weeks before test	Antibotics, antiparasitics, antifungals, or probiotic supplements, proton pump inhibitors (PPIs) and Bismuth
2 days before test	Aspirin and other NSAIDs, digestive enzymes, laxatives (particularly mineral oil, castor oil, and glycerin enemas/suppositories), activated charcoal, betaine HCl, antacids or bentonite clay

OTHER INFORMATION		
Do not collect samples when there is active bleeding from hemorrhoids or menstruation	Wait at least 4 weeks from a colonoscopy or barium enema before collecting	Do not contaminate the stool with urine or water

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Patient Stool Testing Indications

- **Known GI diagnoses with symptoms**:
  - IBD, IBS, Enteropathogens
- **Chronic Metabolic Conditions:**
  - Diabetes, Obesity, Metabolic Syndrome
- **Immune Dysfunction:**
  - Autoimmunity, MCASynd, prolonged SARS-Cov-2
- **Chronic Inflammatory Diseases:**
  - CVD, Alzheimer's, arthritis, cancer
- **Mental Health:**
  - Chronic stress, depression, anxiety, cognition
  - Other gut-brain axis conditions
- **Low Soluble Fiber Diets:**
  - Processed foods, Low FODMAP, Keto, Vegan/Vegetarian, Carnivore, incretin-based therapy use
- **General Health Concerns:**
  - Fertility and hormonal health
  - Obesity and/or use of incretin-based agonists
  - Liver, adrenal and thyroid dysfunction
  - Iron malabsorption
- **Optimal health and longevity**

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DOI: https://doi.org/10.1016/j.cell.2015.11.001

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Pharmacomicrobiomic Effects

- **Incretin-based receptor agonists:** Increases in ***Akkermansia spp.,*** *Faecalibacterium prausnitzii, Eubacterium, Bifidobacterium spp.*
- **Proton Pump Inhibitors (PPIs):** Raise gastric/intestinal pH and alter bile acid metabolism, promoting overgrowth of *Clostridioides difficile* and *Enterococcus* spp.
- **Metformin (Glucophage):** Enriches short-chain fatty acid–producing taxa (e.g., *Akkermansia muciniphila*, *Bifidobacterium* spp.), while also increasing *Escherichia coli*, which may contribute to GI intolerance. This shift has been described as a potential "beneficial dysbiosis" associated with cardiometabolic improvement (Farup et al., 2018).
- **Non-steroidal anti-inflammatory drugs (NSAIDs):** Disrupt mucosal integrity, reduce microbial diversity, and increase pro-inflammatory signaling.
- **Antipsychotics (e.g., olanzapine, risperidone):** Shift microbiota toward increased Firmicutes and reduced *Bifidobacterium* and *Lactobacillus* spp., patterns associated with metabolic dysregulation.

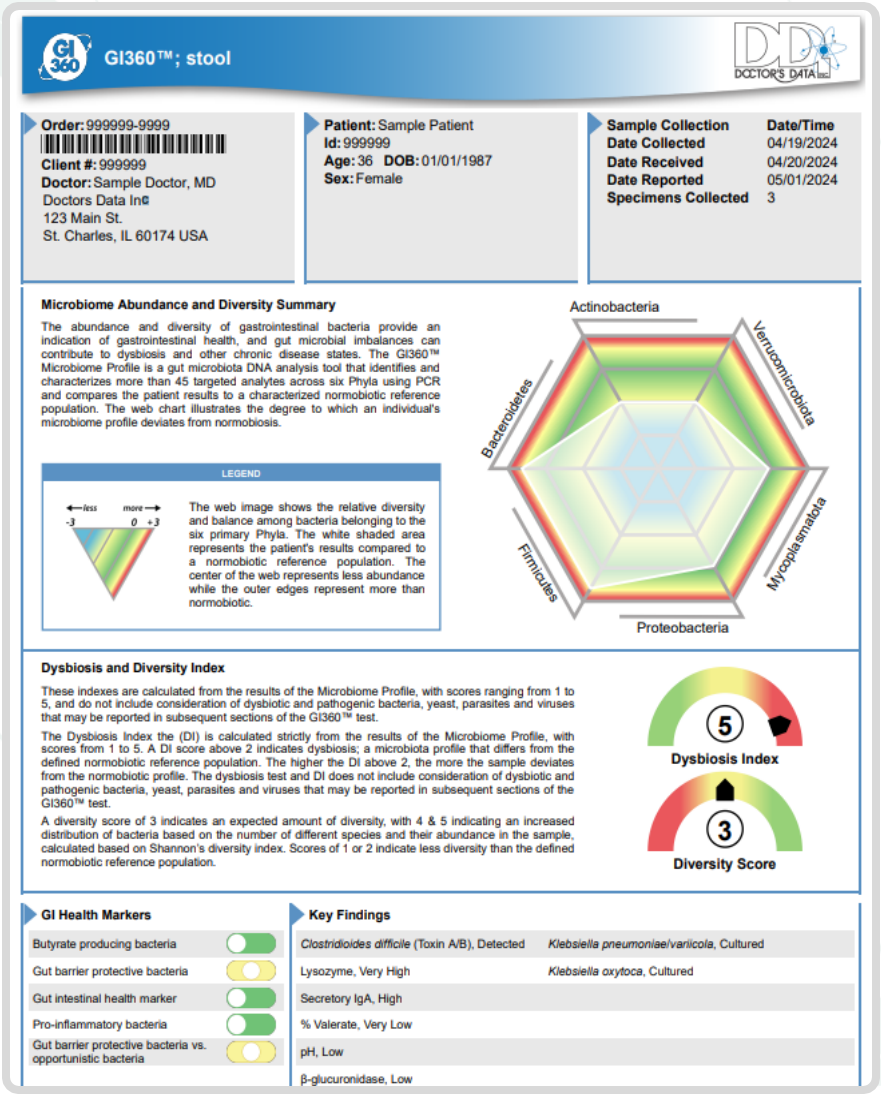
Pharmacomicrobiomic Effects (cont'd)

- **Statins (HMG-CoA reductase inhibitors):** Modulate bile acid metabolism and microbial enzymatic activity, influencing drug metabolism and trimethylamine N-oxide (TMAO) production.
- **Selective serotonin reuptake inhibitors (SSRIs):** Exhibit antimicrobial activity and can disrupt microbial membrane integrity, leading to shifts in community structure and oxidative stress responses.
- **Hormonal contraceptives (BCPs):** Emerging evidence suggests gut microbiome composition and timing of exposure may influence susceptibility to mood-related and metabolic effects.
- **Cannibus (CBD), Tetrahydrocannabinol (THC):** Strongly bidirectional; may increase *Akkermansia spp.*, *Faecalibacterium prausnitzii spp.*

GI360™

Bridging the diagnostic gap

- **PCR analysis** for the abundance and diversity of key bacterial populations of the **microbiome**
  - **Standardized testing and scoring system** to differentiate normobiotic vs. dysbiotic
- Reliable **PCR detection** of clinically relevant **pathogenic bacteria, viruses and parasites**
- **Microbiology culture** using MALDI-ToF ID allows Standardized susceptibility testing of dysbiotic bacteria and yeast
- **Comprehensive parasitology** by microscopy
- **Advanced stool chemistry analysis** to assess gastrointestinal function



GI360™; stool

Order: 999999-9999
Client #: 999999
Doctor: Sample Doctor, MD
Doctors Data Inc
123 Main St.
St. Charles, IL 60174 USA

Patient: Sample Patient
Id: 999999
Age: 36 DOB: 01/01/1987
Sex: Female

Sample Collection	Date/Time
Date Collected	04/19/2024
Date Received	04/20/2024
Date Reported	05/01/2024
Specimens Collected	3

Microbiome Abundance and Diversity Summary

The abundance and diversity of gastrointestinal bacteria provide an indication of gastrointestinal health, and gut microbial imbalances can contribute to dysbiosis and other chronic disease states. The GI360™ Microbiome Profile is a gut microbiota DNA analysis tool that identifies and characterizes more than 45 targeted analytes across six Phyla using PCR and compares the patient results to a characterized normobiotic reference population. The web chart illustrates the degree to which an individual's microbiome profile deviates from normobiosis.

LEGEND

less ← more → (-3, 0, +3)

The web image shows the relative diversity and balance among bacteria belonging to the six primary Phyla. The white shaded area represents the patient's results compared to a normobiotic reference population. The center of the web represents less abundance while the outer edges represent more than normobiotic.

Actinobacteria, Verrucomicrobiota, Mycoplasmatota, Proteobacteria, Firmicutes, Bacteroidetes

Dysbiosis and Diversity Index

These indexes are calculated from the results of the Microbiome Profile, with scores ranging from 1 to 5, and do not include consideration of dysbiotic and pathogenic bacteria, yeast, parasites and viruses that may be reported in subsequent sections of the GI360™ test.

The Dysbiosis Index the (DI) is calculated strictly from the results of the Microbiome Profile, with scores from 1 to 5. A DI score above 2 indicates dysbiosis; a microbiota profile that differs from the defined normobiotic reference population. The higher the DI above 2, the more the sample deviates from the normobiotic profile. The dysbiosis test and DI does not include consideration of dysbiotic and pathogenic bacteria, yeast, parasites and viruses that may be reported in subsequent sections of the GI360™ test.

A diversity score of 3 indicates an expected amount of diversity, with 4 & 5 indicating an increased distribution of bacteria based on the number of different species and their abundance in the sample, calculated based on Shannon's diversity index. Scores of 1 or 2 indicate less diversity than the defined normobiotic reference population.

5 Dysbiosis Index

3 Diversity Score

GI Health Markers

Butyrate producing bacteria	
Gut barrier protective bacteria	
Gut intestinal health marker	
Pro-inflammatory bacteria	
Gut barrier protective bacteria vs. opportunistic bacteria	

Key Findings

Clostridioides difficile (Toxin A/B), Detected	*Klebsiella pneumoniae/variicola*, Cultured
Lysozyme, Very High	*Klebsiella oxytoca*, Cultured
Secretory IgA, High	
% Valerate, Very Low	
pH, Low	
β-glucuronidase, Low	

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PCR for Clinical Microbiology

Validated, targeted, and clinically actionable

- Amplifies specific DNA targets ("barcodes")
- Requires DNA extraction; results depend on validated primer/probe sets
- High analytical sensitivity and specificity
- FDA-cleared platforms provide standardized, reliable, reproducible detection
- Ideal for quickly identifying pathogenic bacteria, parasites, and viruses

Multiplex PCR, Laboratory Validations

Technical verification	
Parameter	**Results**
Repeatability	2.6% CV
Reproducibility	4.2% CV

DDI's PCR Platform Reliability & Standards

- Rapid, reproducible results within and across labs
- **FDA-approved & CE-marked probes** ensure clinical validity
- <5% variability between runs, confirmed in international labs
- Minimizes **false positives and false negatives** for reliable interpretation

Evidence-Based Microbiome Testing

- PCR-based microbial detection methods vary in **accuracy** across the industry.
- DDI provides **validated** assay performance, including sensitivity, specificity, reproducibility, and clinical relevance. Published validation and independent peer review ensure scientific rigor, defensible targets, and reliable reporting algorithms.
- Peer-reviewed validation **elevates** microbiome testing from informational to clinically actionable, supporting more precise care and therapeutic planning

EVALUATION OF GUT BACTERIA: SEQUENCING VS. qPCR

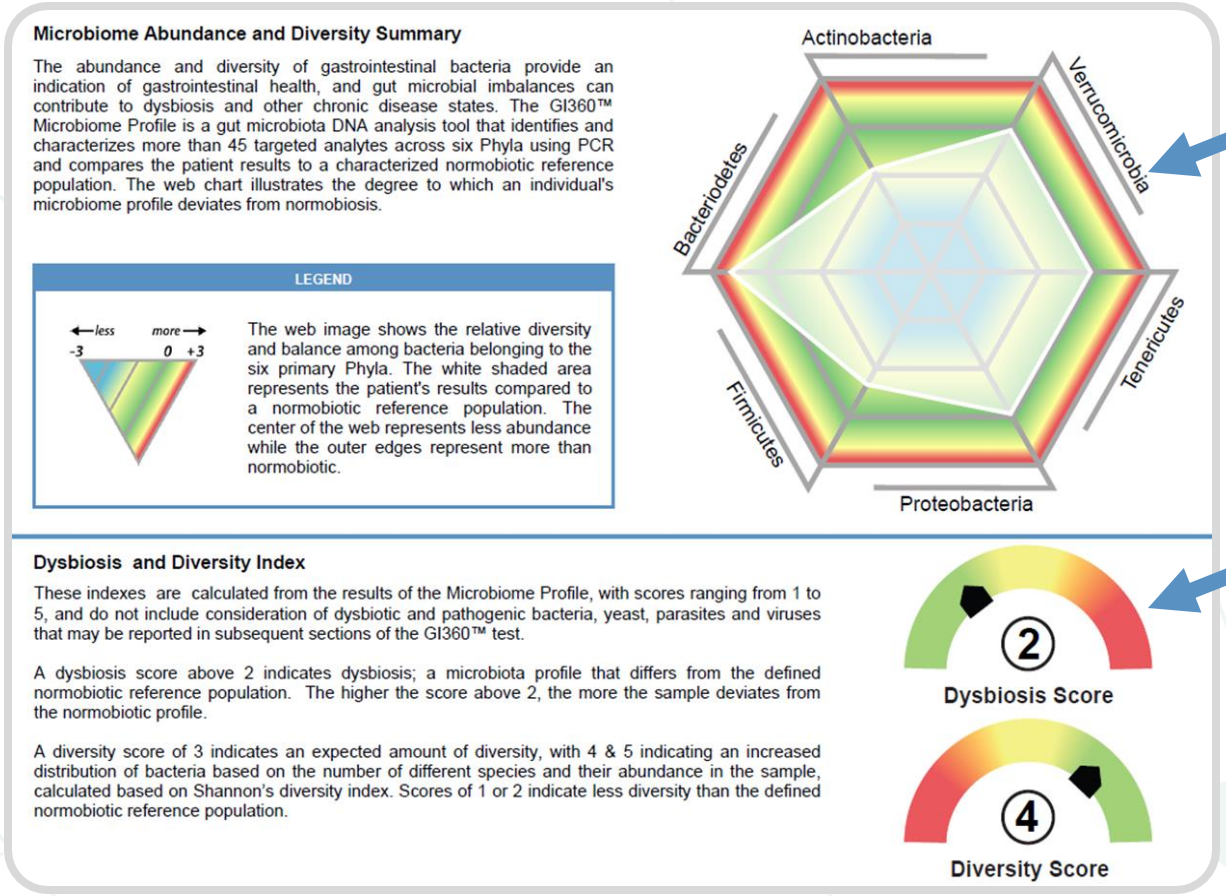
Sequencing

- Broad view of all DNA
- **Answers *"Who's all there?"***
- Sequences random DNA fragments to assemble entire genomes
- Ideal for discovering new genes or genetic potential
- *Not diagnostic*
- *Lack established reference ranges*

qPCR

- Targeted amplification of specific DNA
- **Answers "*Is it there?*"**
- High sensitivity**, specificity**
  - Pathogen identification
- Validated PCR methods support precision care and improve confidence in clinical planning

GI360™ Microbiome Abundance and Diversity



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LEGEND

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Patients results at a glance compared to the normobiotic reference population. Deviation from a hexagonal shape indicates variant abundance and diversity within the microbial community.

There are different types of dysbiosis. The Dysbiosis Index is calculated strictly from the Microbiota Abundance analytes, and does not include specific pathogenic and dysbiotic bacteria, yeast, parasites and viruses that may be identified in subsequent sections of the GI360™.

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PCR Detection of Clinically Relevant Species

Actinobacteria Phyla

- Bifidobacteria family

Bacteriodetes Phyla

- Pro-inflammatory
- Diet driven

Firmicutes Phyla

- Butyragenic species
- Lactobacillus family
- Phascolarctobacteria spp.

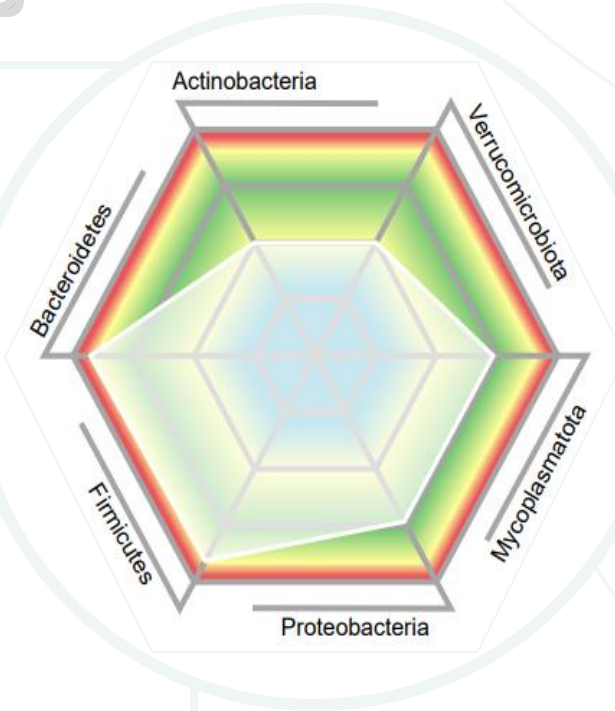
Proteobacteria Phyla

- Pro-inflammatory
- Diet driven

Mycoplasmatota Phyla

Verrucomicrobiota Phyla

- *Akkermansia spp.*



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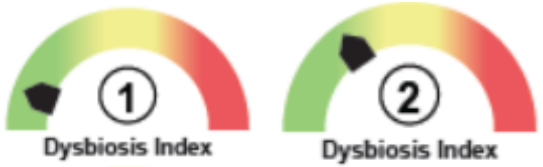
Dysbiosis Index (DI) Score: Clinical Interpretation

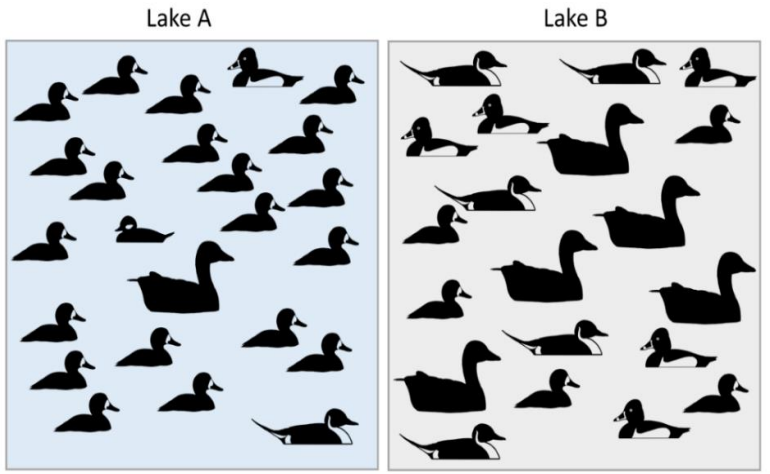
DI Score	Interpretation	Clinical Significance	Clinical Action
	Normobiotic	Microbiome composition consistent with a healthy reference population; balanced diversity and abundance	Expected adaptation or minimal support
	Borderline	Minor deviations from normobiosis	Probiotic, soluble fiber, diet intervention
	Moderate Dysbiosis	Significant deviation from normobiosis; functional collapse; increased inflammation markers	Address inflammation, probiotic, soluble fiber, diet intervention
	Severe Dysbiosis	Major deviation from normobiosis; likelihood of pathogenic or opportunistic overgrowth; mucosal risk	All the above, escalate evaluation

Diversity Score: Clinical Interpretation

Measures (Microbiome) Diversity: Combines **richness** (number of species) and **evenness** (distribution of individuals across species).

Sensitive to Rare Species: Particularly responsive to changes in the abundance of **low-prevalence species**, making it a sensitive indicator of microbial shifts.

Clinical Benchmark: Normobiotic: High Diversity Score (4–5) indicates a balanced and resilient gut microbiome.



Functional Interpretation

Dysbiosis Index: Measures divergence from a healthy normobiotic profile

Diversity Score: Reflects overall microbiome resilience, richness, and ecosystem depletion

A dysbiotic or non-diverse microbiome may explain a struggle with tolerability, plateaus early, or an incomplete metabolic response.

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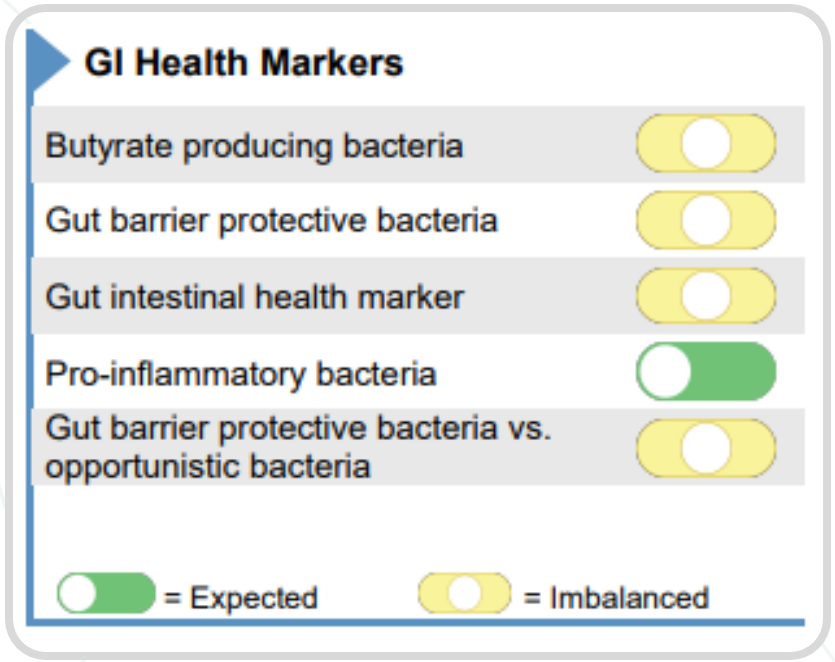
FUNCTIONAL GUILD CRITERIA



Functional Marker	Bacteria	Profile criteria for imbalance	Description
Butyrate producing bacteria	*Eubacterium hallii* *Eubacterium rectale* *Faecalibacterium prausnitzii*	At least two of the butyrate producers below healthy range	Insufficient levels of butyrate are associated with an impaired gastrointestinal health. Butyrate is a short-chain fatty acid produced by microbial fermentation in the large intestine of humans. It is important for regulating multiple functions of gut cells, may be important for regulating inflammatory and immunological responses and plays a role in the maintenance of intestinal barrier function. Beneficial bacteria belonging to the phylum Firmicutes are major butyrate producers.
Gut mucosa protective bacteria	*Faecalibacterium prausnitzii* *Akkermansia muciniphila*	Both mucosa protective below healthy range	Mucus and mucosa-associated bacteria form a specific protective environment in the gut. A disruption of the mucosa layer may promote specific bacterial colonization and immunological responses and enhance the development of gastrointestinal diseases. Imbalance of gut mucosa protective bacteria has been associated with various gastrointestinal disorders.
Gut intestinal health marker	*Faecalibacterium prausnitzii*	*F. prausnitzii* below healthy range with at least two (-2)	Faecalibacterium prausnitzii is one of the most prevalent bacteria within the human gastrointestinal tract. It is recognized as a major butyrate producer and can promote anti-inflammatory processes and intestinal barrier function. Lower levels of Faecalibacterium prausnitzii in the intestine have been associated with gastrointestinal and metabolomic disorders.
Gut barrier protective vs.opportunistic bacteria	*Faecalibacterium prausnitzii* *Ruminococcus gnavus* Proteobacteria *Shigella spp. & Escherichia spp.*	*F. prausnitzii* below healthy range and at least one of the opportunists above healthy range.	The intestinal epithelial barrier is not a static physical barrier but one that can interact with the gut microbiome and cells of the immune system. An imbalance between the gut barrier protective bacteria and potentially harmful bacteria may lead to gut barrier disruption and is associated with an increased susceptibility to certain diseases.
Pro-inflammatory bacteria	Proteobacteria *Shigella spp. & Escherichia spp.*	Both pro-inflammatory above healthy range, and of which at least one +2 above	Elevated Proteobacteria species are associated with inflammation in various - mainly gastrointestinal - disorders. In a healthy gut microbiota, their increase may promote intestinal inflammation due to molecules present on their surface which are potent triggers of inflammatory responses. Inflammation in itself may also promote the growth of Proteobacteria species. Pro-inflammatory bacteria levels may thus give indications of the susceptibility of the patient to intestinal inflammation and to the possible development of gastrointestinal disorders.

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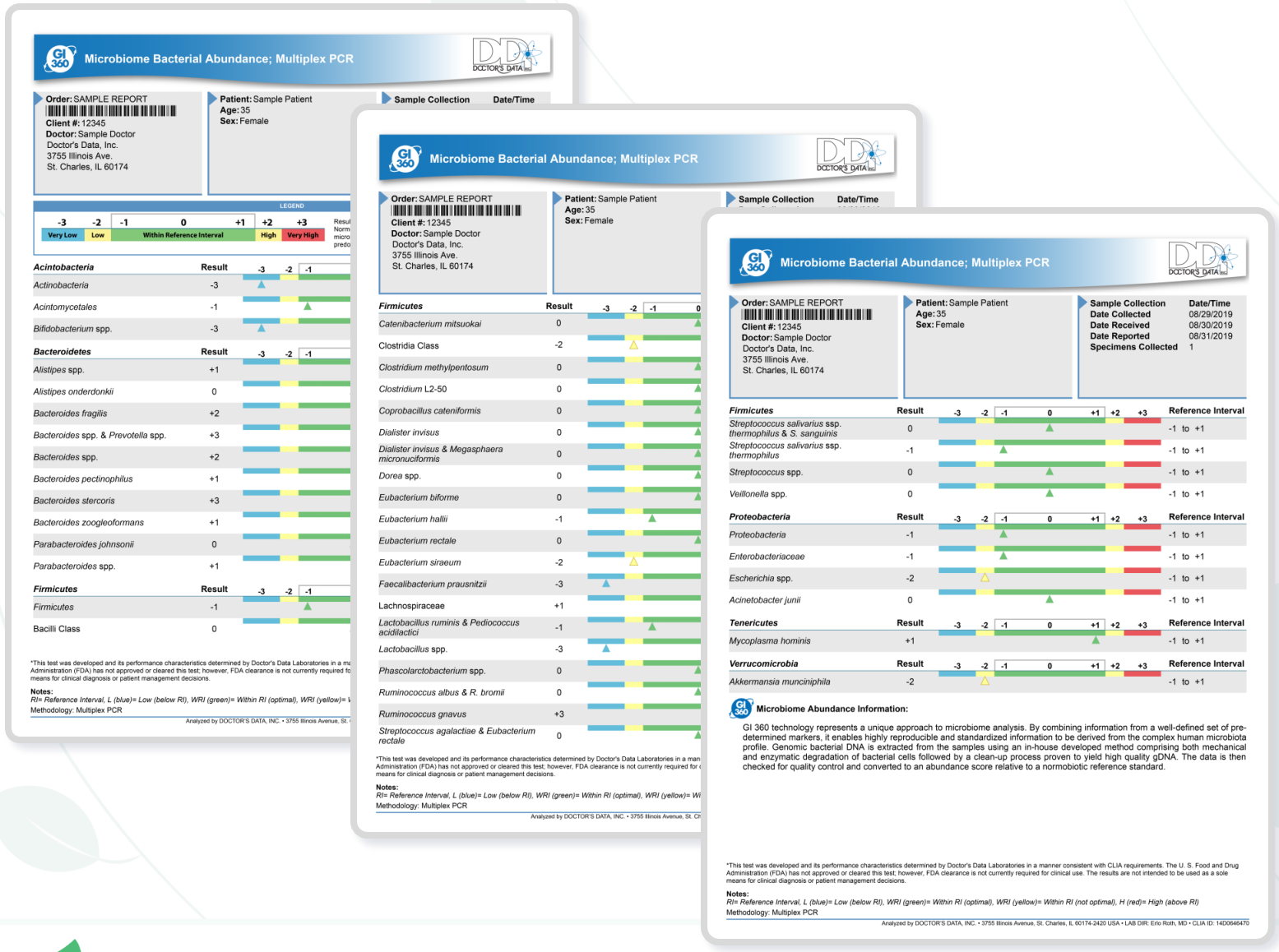

Beyond the initial summary page

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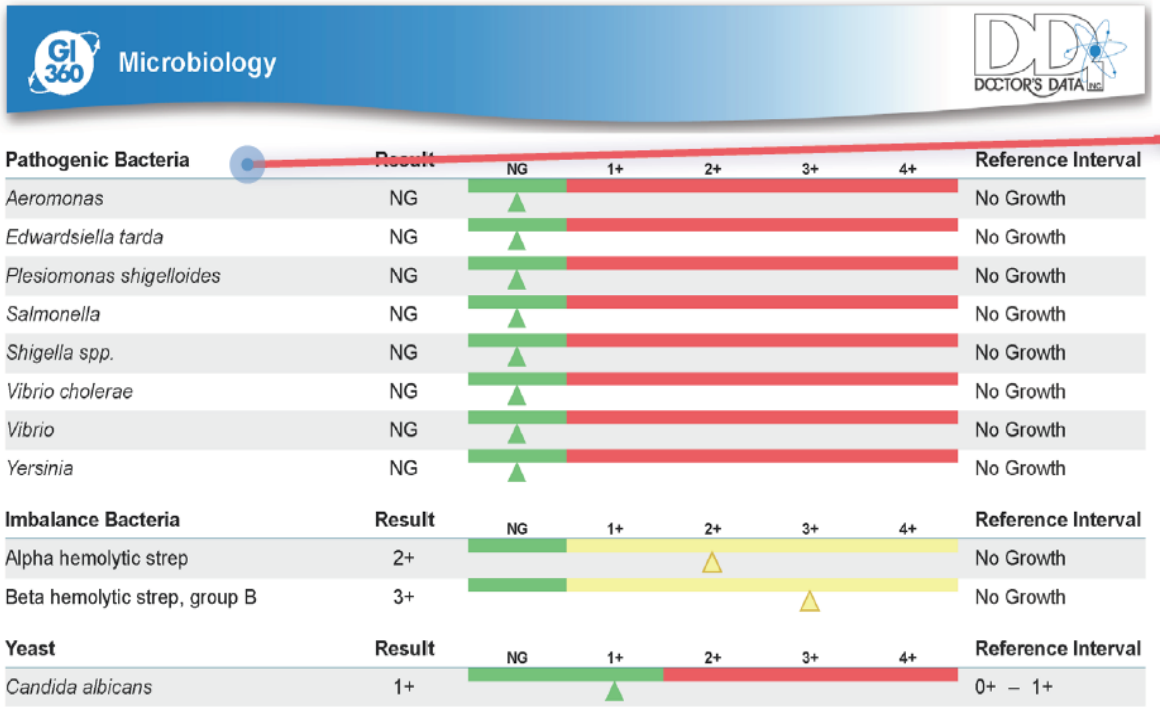
State of the Art Culturomics: MALDI-TOF

- Aerobic and Anaerobic culturing
- Ability to identify organisms outside of molecular DNA primer set
- Reports are specific to the individual, expandable fields



Culture complements PCR detection of dysbiotic and pathogenic bacteria and yeast. All sections within Microbiology are expandable fields. The greater the number of detected bacteria and yeast, the more expansive the reporting.

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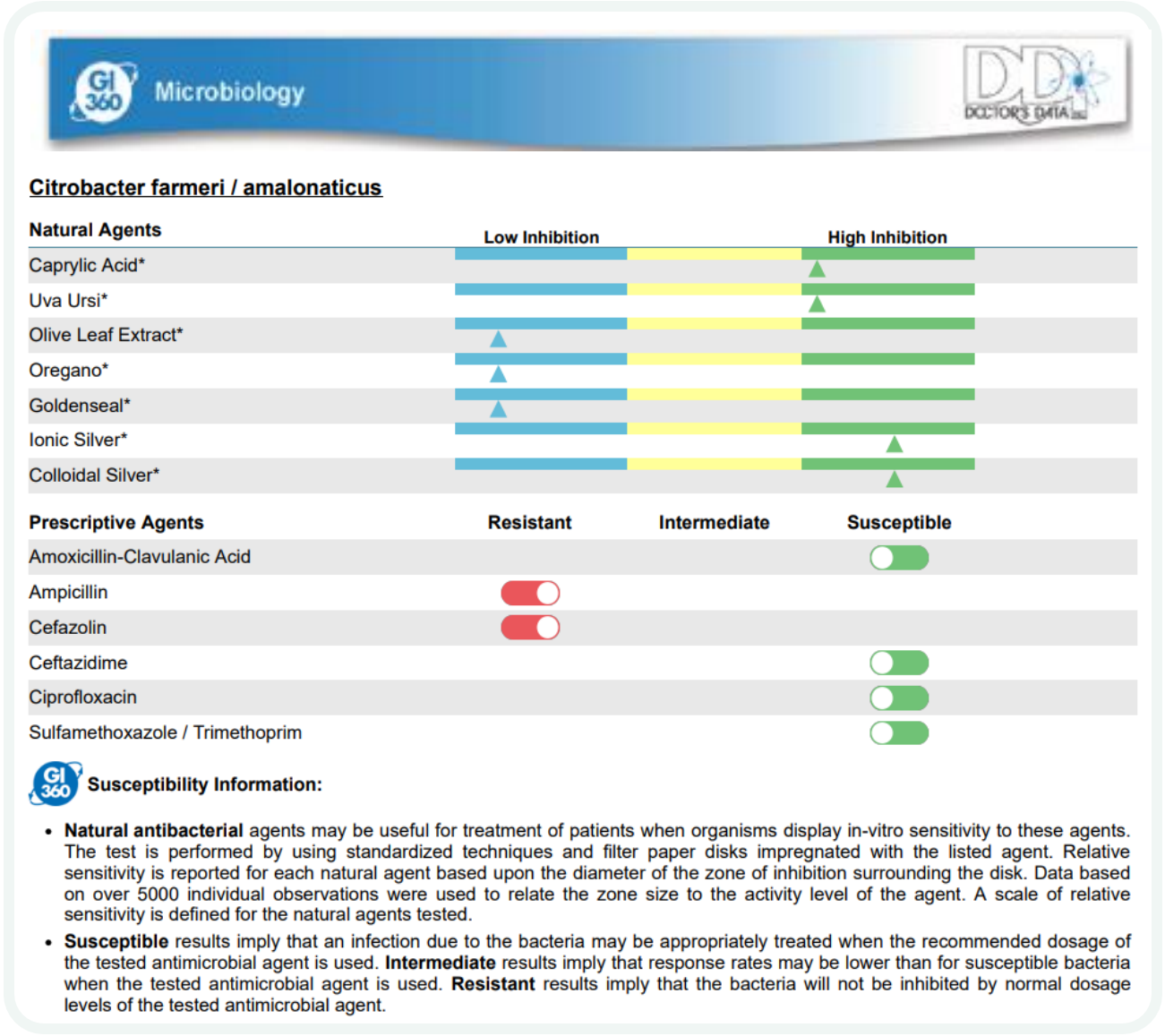
Inhibition Results: Natural Agents/Rx



GI 360 Microbiology

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Citrobacter farmeri / amalonaticus

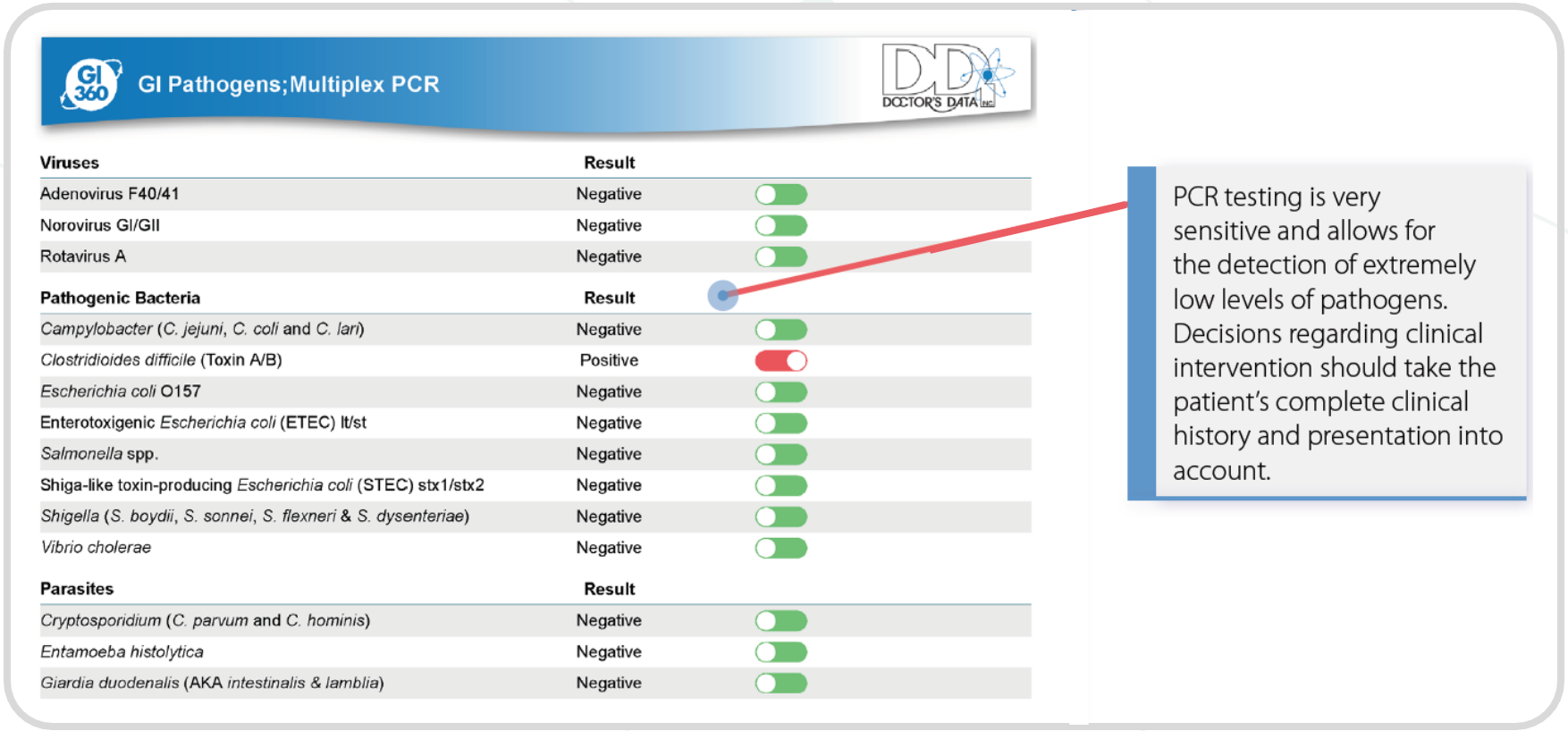
Natural Agents	Low Inhibition	High Inhibition
Caprylic Acid*		
Uva Ursi*		
Olive Leaf Extract*		
Oregano*		
Goldenseal*		
Ionic Silver*		
Colloidal Silver*		

Prescriptive Agents	Resistant	Intermediate	Susceptible
Amoxicillin-Clavulanic Acid			
Ampicillin			
Cefazolin			
Ceftazidime			
Ciprofloxacin			
Sulfamethoxazole / Trimethoprim			

Susceptibility Information:

- **Natural antibacterial** agents may be useful for treatment of patients when organisms display in-vitro sensitivity to these agents. The test is performed by using standardized techniques and filter paper disks impregnated with the listed agent. Relative sensitivity is reported for each natural agent based upon the diameter of the zone of inhibition surrounding the disk. Data based on over 5000 individual observations were used to relate the zone size to the activity level of the agent. A scale of relative sensitivity is defined for the natural agents tested.
- **Susceptible** results imply that an infection due to the bacteria may be appropriately treated when the recommended dosage of the tested antimicrobial agent is used. **Intermediate** results imply that response rates may be lower than for susceptible bacteria when the tested antimicrobial agent is used. **Resistant** results imply that the bacteria will not be inhibited by normal dosage levels of the tested antimicrobial agent.

GI Pathogens Profile: multiplex PCR detection

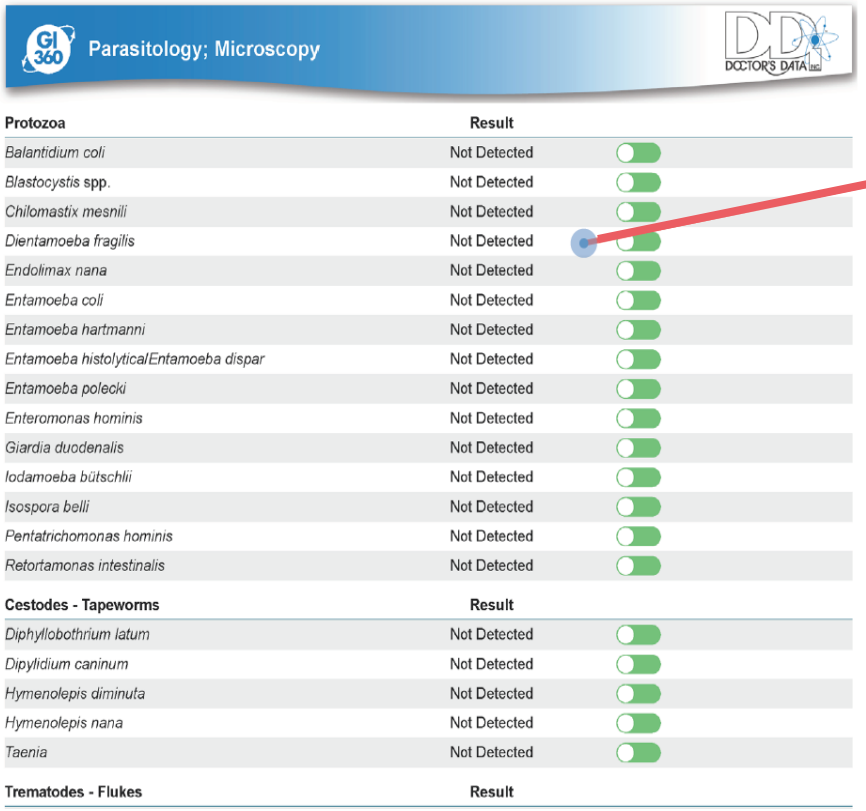


GI Pathogens;Multiplex PCR

Viruses	Result
Adenovirus F40/41	Negative
Norovirus GI/GII	Negative
Rotavirus A	Negative
Pathogenic Bacteria	**Result**
Campylobacter (*C. jejuni*, *C. coli* and *C. lari*)	Negative
Clostridioides difficile (Toxin A/B)	Positive
Escherichia coli O157	Negative
Enterotoxigenic *Escherichia coli* (ETEC) lt/st	Negative
Salmonella spp.	Negative
Shiga-like toxin-producing *Escherichia coli* (STEC) stx1/stx2	Negative
Shigella (*S. boydii*, *S. sonnei*, *S. flexneri* & *S. dysenteriae*)	Negative
Vibrio cholerae	Negative
Parasites	**Result**
Cryptosporidium (*C. parvum* and *C. hominis*)	Negative
Entamoeba histolytica	Negative
Giardia duodenalis (AKA *intestinalis* & *lamblia*)	Negative

PCR testing is very sensitive and allows for the detection of extremely low levels of pathogens. Decisions regarding clinical intervention should take the patient's complete clinical history and presentation into account.

Parasitology via Microscopy, O&P



GI 360 Parasitology; Microscopy

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Protozoa	Result
Balantidium coli	Not Detected
Blastocystis spp.	Not Detected
Chilomastix mesnili	Not Detected
Dientamoeba fragilis	Not Detected
Endolimax nana	Not Detected
Entamoeba coli	Not Detected
Entamoeba hartmanni	Not Detected
Entamoeba histolytica/Entamoeba dispar	Not Detected
Entamoeba polecki	Not Detected
Enteromonas hominis	Not Detected
Giardia duodenalis	Not Detected
Iodamoeba bütschlii	Not Detected
Isospora belli	Not Detected
Pentatrichomonas hominis	Not Detected
Retortamonas intestinalis	Not Detected

Cestodes - Tapeworms	Result
Diphyllobothrium latum	Not Detected
Dipylidium caninum	Not Detected
Hymenolepis diminuta	Not Detected
Hymenolepis nana	Not Detected
Taenia	Not Detected

Trematodes - Flukes	Result

Microscopy (O&P) permits detection of many additional parasites not detected using PCR.

- CDC standard of care for parasitology
- Three stool collections on three separate days
- Identification of O&P (>30 common parasites);
- Macroscopy ID profile can be ordered separately

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Parasitology via Microscopy, Other Markers

Other Markers	Result		Reference Interval
Yeast	Few		Not Detected – Rare
RBC	Not Detected		Not Detected – Rare
WBC	Not Detected		Not Detected – Rare
Muscle fibers	Not Detected		Not Detected – Rare
Vegetable fibers	Moderate		Not Detected – Few
Charcot-Leyden Crystals	Not Detected		Not Detected
Pollen	Not Detected		Not Detected
Macroscopic Appearance	**Result**		**Reference Interval**
Color	Brown		Brown
Consistency	Soft		Soft
Mucus	Negative		Negative

Visualization of moderate to many yeast microsopically in the absence of cultured yeast may be consistent with small intestinal fungal overgrowth. Consider symptomology for the patient.

Stool Chemistries

Digestion / Absorption	Result	Unit	L WRI H	Reference Interval
Elastase	>500	µg/g		>200
Fat Stain	Few			None – Moderate
Carbohydrates†	Negative			Negative
Inflammation	**Result**	**Unit**	**L WRI H**	**Reference Interval**
Lactoferrin	1.2	µg/mL		<7.3
Lysozyme*	221	ng/mL		≤500
Calprotectin	<10	µg/g		<80
Immunology	**Result**	**Unit**	**L WRI H**	**Reference Interval**
Secretory IgA*	25.5	mg/dL		30 – 275
Short Chain Fatty Acids	**Result**	**Unit**	**L WRI H**	**Reference Interval**
% Acetate‡	61	%		50 – 72
% Propionate‡	17	%		11 – 25
% Butyrate‡	18	%		11 – 32
% Valerate‡	3.7	%		0.8 – 5.0
Butyrate‡	1.5	mg/mL		0.8 – 4.0
Total SCFA's‡	8.3	mg/mL		5.0 – 16.0
Intestinal Health Markers	**Result**	**Unit**	**L WRI H**	**Reference Interval**
pH	6.5			5.8 – 7.0
β-glucuronidase*	5020	U/h*g		4000 – 9400
Occult Blood	Negative			Negative

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Commentary Section

Commentary

Order: 999999-9999
Client #: 999999
Doctor: Sample Doctor, MD
Doctors Data Inc
123 Main St.
St. Charles, IL 60174 USA

Patient: Sample Patient
Id: 999999
Age: 64 **DOB:** 00/00/1959
Sex: Female

Sample Collection	Date/Time
Date Collected	08/19/2023
Date Received	08/21/2023
Date Reported	08/31/2023
Specimens Collected	3

Introduction

This analysis of the stool specimen provides fundamental information about the overall gastrointestinal health of the patient. When abnormal microflora or significant aberrations in intestinal health markers are detected, specific commentaries are presented. If no significant abnormalities are found, commentaries are not presented.

Microbiome Abundance Information

Actinobacteria (phylum)

Actinobacteria is one of the largest bacterial phyla, comprised of Gram-positive bacteria. This phylum includes a wide range of species, with different morphological and physiological characteristics. Significant groups in the human colon include Actinomycetales and Bifidobacteriales. Actinomycetales were inversely associated with clinically significant depression in IBS patients, suggesting these bacteria may be depleted in depressed IBS patients. A strict vegetarian diet may increase the total count of *Actinomyces* spp. compared to following a Western diet.

Actinomycetales (order)

Actinomycetales are considered low abundance colonizers of the gastrointestinal tract with primary residence on the skin. Intake of proton-pump inhibitor drugs has been shown to increase the abundance of Actinomycetales in the gut, possibly by reducing gastric acidity and enabling intestinal colonization by oral microbes. Actinomycetales may be depleted in depressed irritable bowel syndrome patients. The abundance of *Actinomyces* spp. was shown to be higher with a strict vegetarian diet compared to a common Western diet.

***Bifidobacterium* (genus)**

Considered amongst the most beneficial commensal bacteria in the human gut, *Bifidobacterium* spp. are able to degrade monosaccharides, galacto-, manno-, and fructo-oligosaccharides, as well as some complex carbohydrates. Many of the non-digestible oligosaccharides, found as natural components in mother's milk, select for colonization of these species which dominate the infant gut shortly after birth. Bifidobacteria may provide health benefits directly through interactions with the host, and indirectly through interactions with other microorganisms. *Bifidobacterium* spp. take part in production and adsorption of vitamins, such as vitamins K and B12, biotin, folate, thiamine, riboflavin, and pyridoxine. They are also involved in lipid absorption and metabolism, glucose and energy homeostasis, and regulating intestinal barrier function. Although *Bifidobacterium* produce acetate over butyrate, healthy levels of *Bifidobacterium* spp. facilitate colonization of *Faecalibacterium. prausnitzii*. Polyphenols derived from chocolate, green tea, blackcurrant, red wine and grape seed extracts have been shown to increase *Bifidobacterium* species. The increased abundance of *Bifidobacterium* species has been associated with amelioration of inflammation. Multiple published studies have suggested that there is an association between obesity and a lower abundance of bifidobacteria. They may also be less abundant in elderly populations, patients with rheumatoid arthritis, and in individuals diagnosed with Alzheimer's disease. Patients with active inflammatory bowel disease (IBD) have a lower abundance of *Bifidobacterium* spp. than patients whose IBD is in remission. Taking a probiotic containing bifidobacteria, lactobacilli, and streptococci might help in controlling ulcerative colitis symptoms and preventing their recurrence. Some *Bifidobacterium* strains have been shown to have beneficial effects in irritable bowel syndrome (IBS). *Bifidobacterium* spp. abundance has been shown to be diminished with IBD and with long term use of macrolide antibiotics. Luminal bifidobacteria is reduced with restriction of fermentable carbohydrates, i.e. a low FODMAP diet. High fat dietary feeding is also associated with reduced abundance of bifidobacteria. Consumption of maize and barley-based whole grain products and red berries, which are comprised of anthocyans, are known to increase levels of bifidobacteria.

DDI Retesting Stool Profiles
Post GI Therapy

- **GI360™ Microbiome, GI360 ™ Essentials**
- **GI Pathogens Profile**
- **Microbiology, Bacteriology, Yeast**
- **Parasitology**
- **Stool Chemistries Profile**
- ***H. pylori* Antigen Profile**

- **Separate Stool Chemistry marker profiles:**
  - Elastase
  - Calprotectin
  - Lysozyme
  - Lactoferrin
  - Secretory IgA
  - β-glucuronidase

2-3 months “feed and seed”
Targeted probiotic + soluble fiber

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Moving From Assessment to Application

Applying GI360™ Findings to Incretin-based Therapy

- Interpreting microbiome influences on metabolic signaling
- Identifying barriers to treatment response
- Implementing targeted interventions
- Monitoring outcomes through testing and retesting

Incretin-Based Therapies Overview

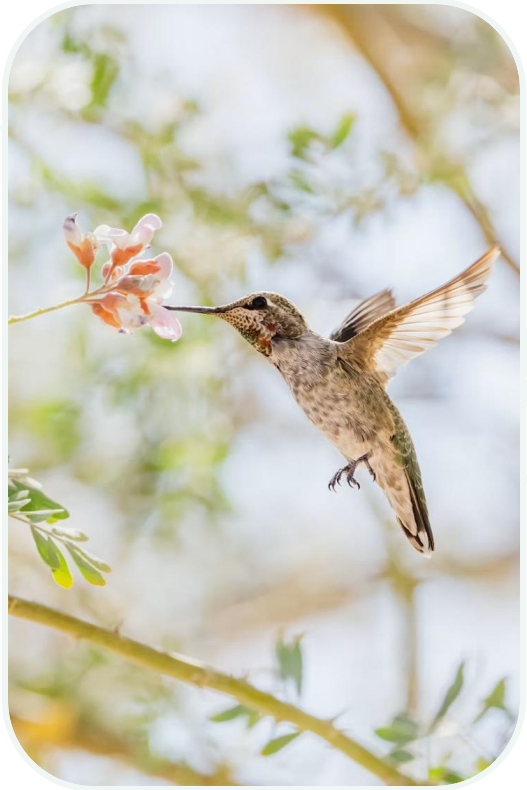
- **GLP-1 receptor agonists**
  - **Liraglutide** (injectable)
  - **Dulaglutide** (injectable)
  - **Semaglutide** (injectable, oral)
- **Dual incretin (GIP/GLP-1) receptor agonist**
  - Tirzepatide (injectable)

- **Clinical use considerations:**
  - Current use: Type 2 diabetes, obesity / weight management
  - Expanding cardiometabolic indications
  - Emerging multi-system interest (neurologic, hepatic, renal, behavioral)
  - Transition from injectable to emerging oral formulations, with evolving understanding of direct gastrointestinal exposure effects

Other proglucagon-derived peptides (e.g., GLP-2, GLP-3) exist but are not currently therapeutic targets in clinical practice.

Endogenous GLP-1 Physiology Gut–Brain Axis

- **Secreted by L-cells** (distal ileum & colon) in response to nutrients
- **Gut–brain signaling**
  - Enteric and vagal pathways **signal to the hypothalamus**, supporting satiety and appetite regulation.
- **GI effects**
  - Slows gastric emptying and intestinal transit
- **Influences glycemic, bile acid, and gut hormone signaling pathways**
  - Increased Glucose-dependent insulin secretion
  - Decreased Glucagon & hepatic gluconeogenesis



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Zhao X, Wang M, Wen Z, et al. GLP-1 Receptor Agonists: Beyond Their Pancreatic Effects.*Front Endocrinol (Lausanne)*. 2021;12:721135. Published 2021 Aug 23. doi:10.3389/fendo.2021.721135, site-akiajqrf22xmaqzsiz6q.s3.amazonaws.com/DDI+Website/News/html/A+Gut+Microbiome+Alternative.html

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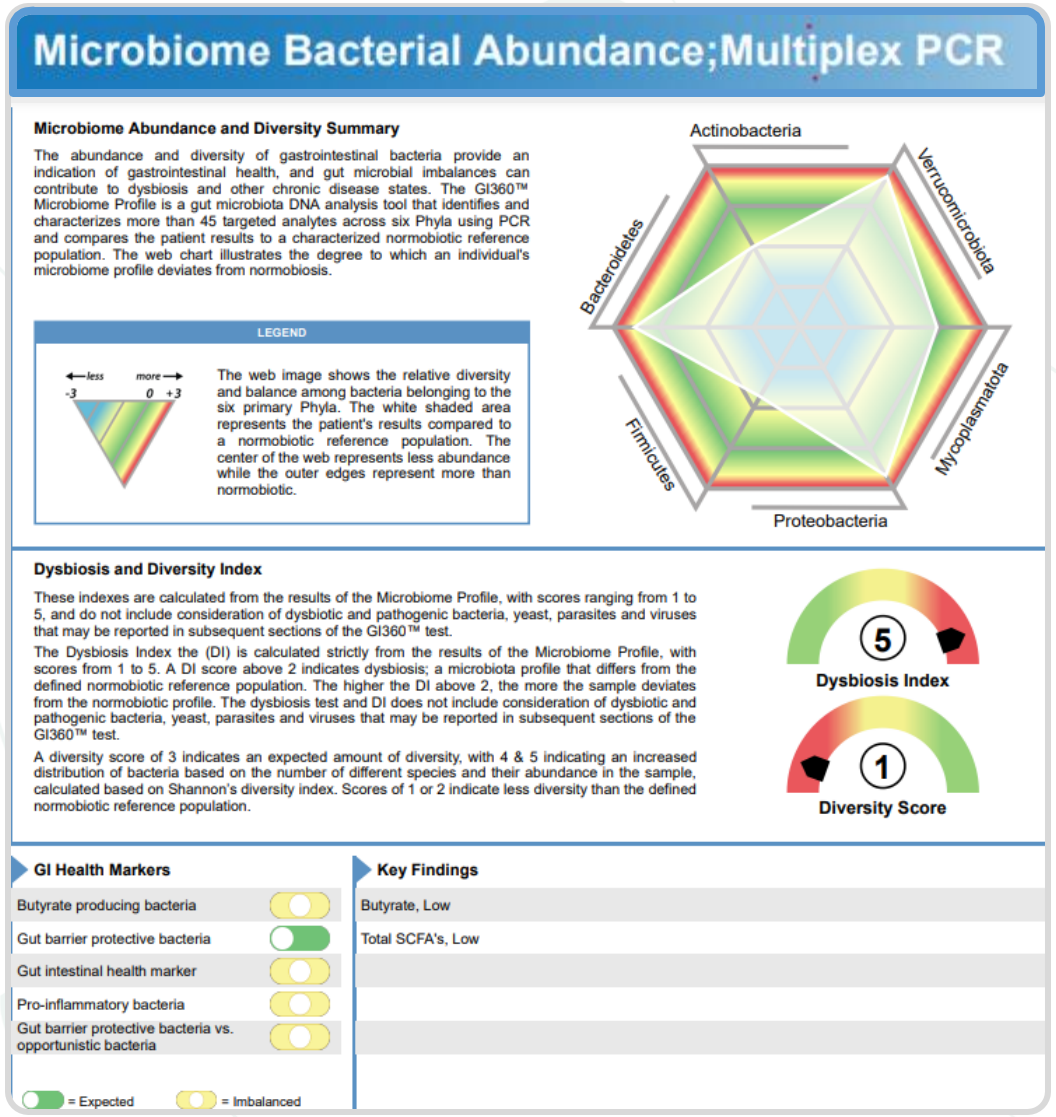
Microbiome + Incretin-based therapy Metabolic Outcomes

- **SCFAs (butyrate, propionate, acetate)**
  - Fiber fermentation products
  - Less stimulation of intestinal L-cells leading to increased incretin therapy agents
- **Dysbiosis effect**
  - Lower SCFA-producing bacteria leads to lower GLP-1 response
  - Increased permeability + LPS leads to inflammation, insulin resistance
- **Gut–brain signaling**
  - Microbial metabolites modulate satiety/vagal pathways
  - Impacts appetite and glycemic control
- **Clinical relevance**
  - Microbiome may influence GLP-1 receptor agonist response
  - Targeting diet/prebiotics may enhance outcomes



Patterns in the Incretin-based therapy Gut Microbiome

- **Web: Microbiome Abundance & Diversity**
  - Low Actinobacteria phylum (i.e. Bifidobacterium family)
  - Higher Proteobacteria, Verrumicrobiota, and Bacteroidetes phyla
    - Due to imbalanced, inflammatory diet, metabolic disease
- **Dysbiosis Index: 5**
  - Severe imbalanced membership associated with IBS, IBD, Obesity, Diabetes Mellitus
- **Diversity Score: 1**
  - Low diversity may suggest a reduced “support system” for endogenous GLP-1 signaling, even when pharmacologic GLP-1 agonists are used

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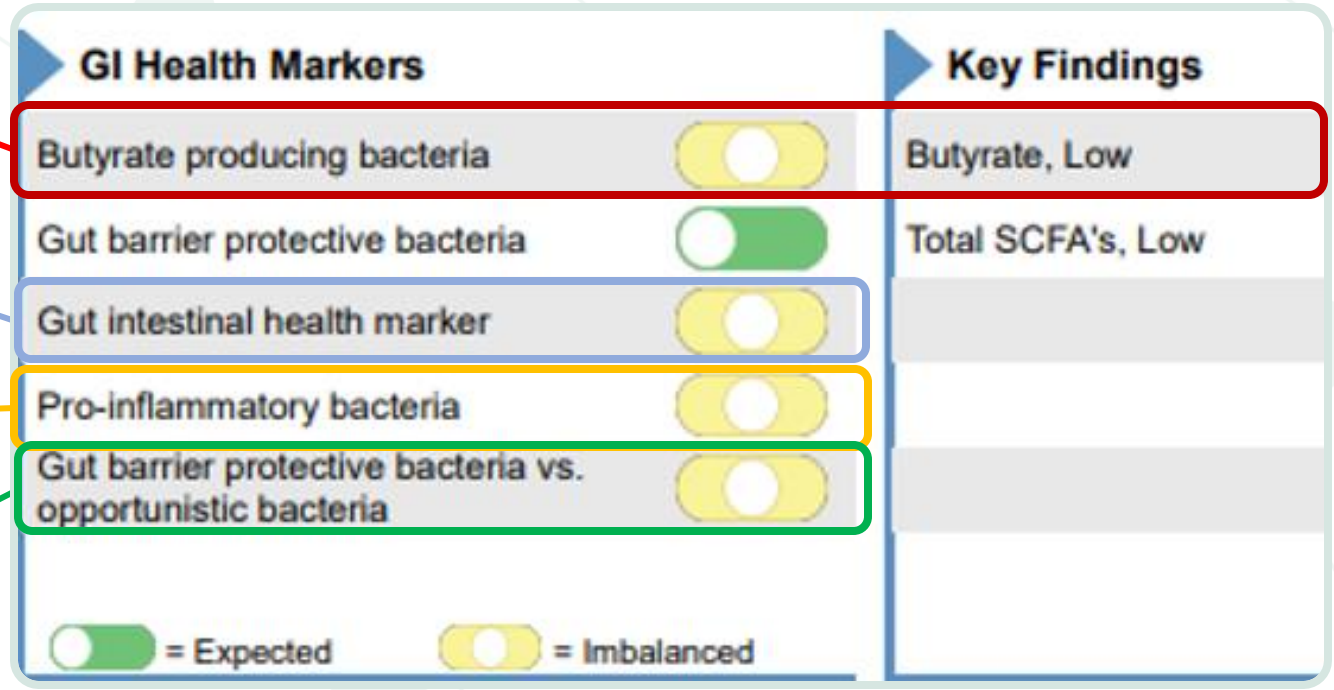
Patterns in Incretin-based Agonist Gut Microbiome

Need support for members and soluble fiber 8-15g QD

Low *F. prausnitzii*, key butyrogenic species, indicates microbiome is in poor health & inflammation risk

Associated with excess protein & fat dietary pattern, low fiber and inflammation

Fiber & mucosal barrier protocol needed, consider zonulin test & systemic inflammation (hsCRP)



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Microbiome Bacterial Abundance;Multiplex PCR

LEGEND

-3	-2	-1	0	+1	+2	+3
Very Low		Low	Within Reference Interval	High	Very High	

Results are graphed as deviations from a normobiotic population. Normobiosis or a normobiotic state characterizes a composition of the microbiota profile in which microorganisms with potential health benefits predominate in abundance and diversity over potentially harmful ones.

Actinobacteria	Result	Reference Interval
Actinobacteria	-1	0
Actinomycetales	0	0
Bifidobacterium family	-1	0

Proteobacteria	Result	Reference Interval
Proteobacteria	+2	0
Enterobacteriaceae	+1	0
Escherichia spp.	0	0

Mycoplasmatota	Result	Reference Interval
Metamycoplasma hominis	0	0

Associated with longevity, metabolism, overall health, immune function, intrinsic K2, B-Vitamin production

Elevated in dysbiosis, high fat/protein diet. Inflammation and IBS

Wellness Wednesday

Microbiome Bacterial Abundance;Multiplex PCR

Dialister invisus	+2	0
Dialister invisus & Megasphaera micronuciformis	0	0
Dorea spp.	0	0
Holdemanella biformis	0	0
Anaerobutyricum hallii	-1	0
Agathobacter rectalis	0	0
Eubacterium siraeum	0	0
Faecalibacterium prausnitzii	-2	0
Lachnospiraceae	0	0
Ligilactobacillus ruminis & Pediococcus acidilactici	-1	0
Lactobacillus family	-2	0
Phascolarctobacterium spp.	0	0
Ruminococcus albus & R. bromii	0	0
Mediterraneibacter gnavus	-1	0

Lower levels associated with poor soluble fiber, inflammation

Associated with longevity, metabolism, overall health, immune function

Associated with mucosal barrier, intestinal permeability

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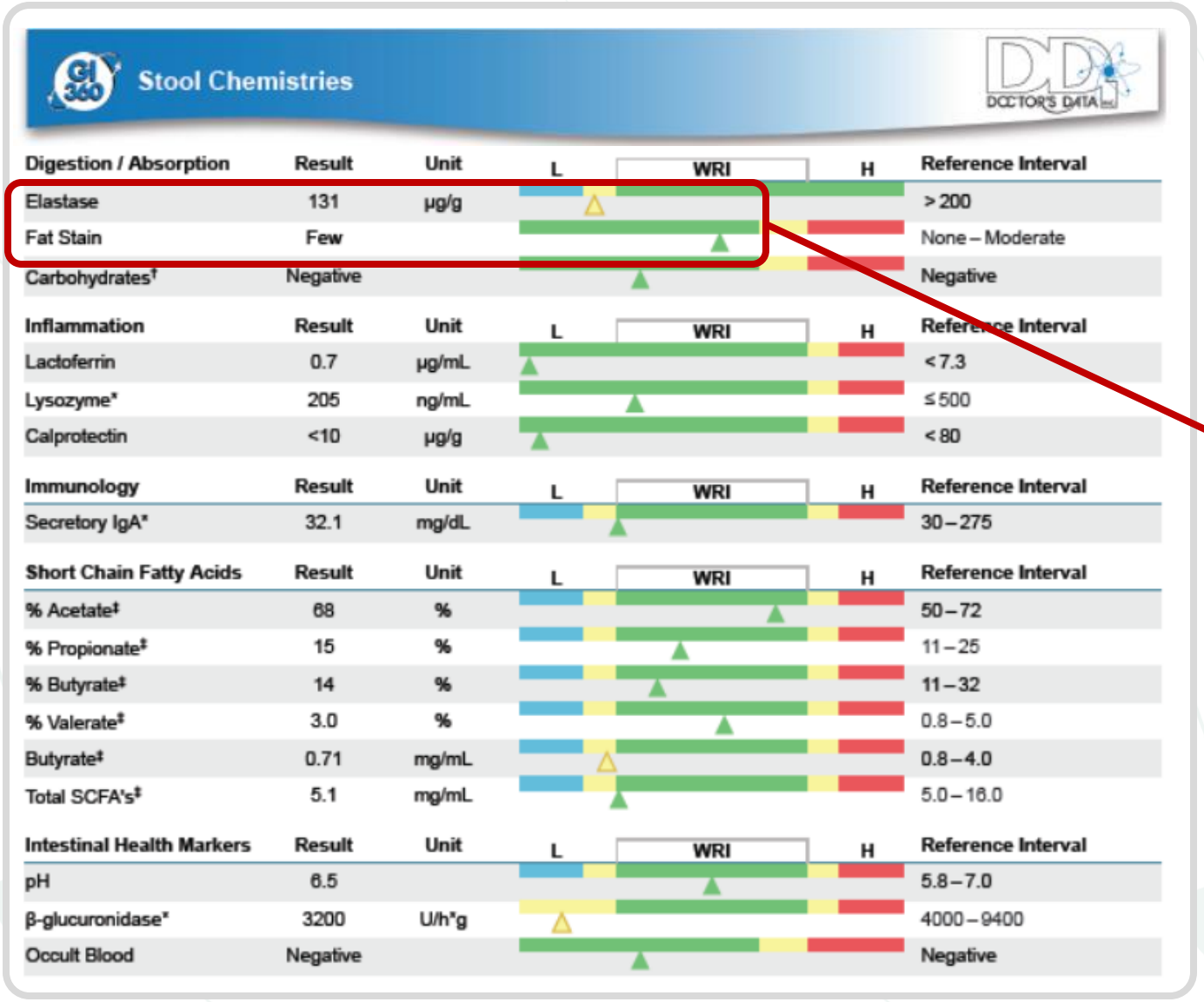
Akkermansia muciniphila spp.

Elevated *Akkermansia*

Verrucomicrobiota	Result	-3	-2	-1	0	+1	+2	+3	Reference Interval
Akkermansia muciniphila	+2						▲		0

- Links microbial activity with **barrier integrity and host metabolic signaling**
- Mucin-degrading organism involved in **mucus layer turnover and barrier dynamics**
- Implicated in:
  - **Immune modulation** via mucosal signaling pathways
  - **Metabolic signaling**, including associations with GLP-1–related physiology (endogenous)
  - **Gut–metabolic cross-talk** influencing inflammatory and energy balance states
- Context dependent, influenced by diet, microbial balance, and overall gut ecosystem function



Stool Chemistries

Digestion / Absorption	Result	Unit	L WRI H	Reference Interval
Elastase	131	µg/g		> 200
Fat Stain	Few			None – Moderate
Carbohydrates†	Negative			Negative
Inflammation	**Result**	**Unit**	**L WRI H**	**Reference Interval**
Lactoferrin	0.7	µg/mL		< 7.3
Lysozyme*	205	ng/mL		≤ 500
Calprotectin	<10	µg/g		< 80
Immunology	**Result**	**Unit**	**L WRI H**	**Reference Interval**
Secretory IgA*	32.1	mg/dL		30 – 275
Short Chain Fatty Acids	**Result**	**Unit**	**L WRI H**	**Reference Interval**
% Acetate‡	68	%		50 – 72
% Propionate‡	15	%		11 – 25
% Butyrate‡	14	%		11 – 32
% Valerate‡	3.0	%		0.8 – 5.0
Butyrate‡	0.71	mg/mL		0.8 – 4.0
Total SCFA's‡	5.1	mg/mL		5.0 – 16.0
Intestinal Health Markers	**Result**	**Unit**	**L WRI H**	**Reference Interval**
pH	6.5			5.8 – 7.0
β-glucuronidase*	3200	U/h*g		4000 – 9400
Occult Blood	Negative			Negative

Low Elastase

- Exocrine pancreatic sufficiency marker
- Support with pancreatin
- Repeat marker in 4-6 weeks
- Refer out for diagnostics if still low

Fat Malabsorption

- Possible gallbladder implications to investigate

Wellness Wednesday

Incretin-based therapy - Fecal Elastase Interpretation

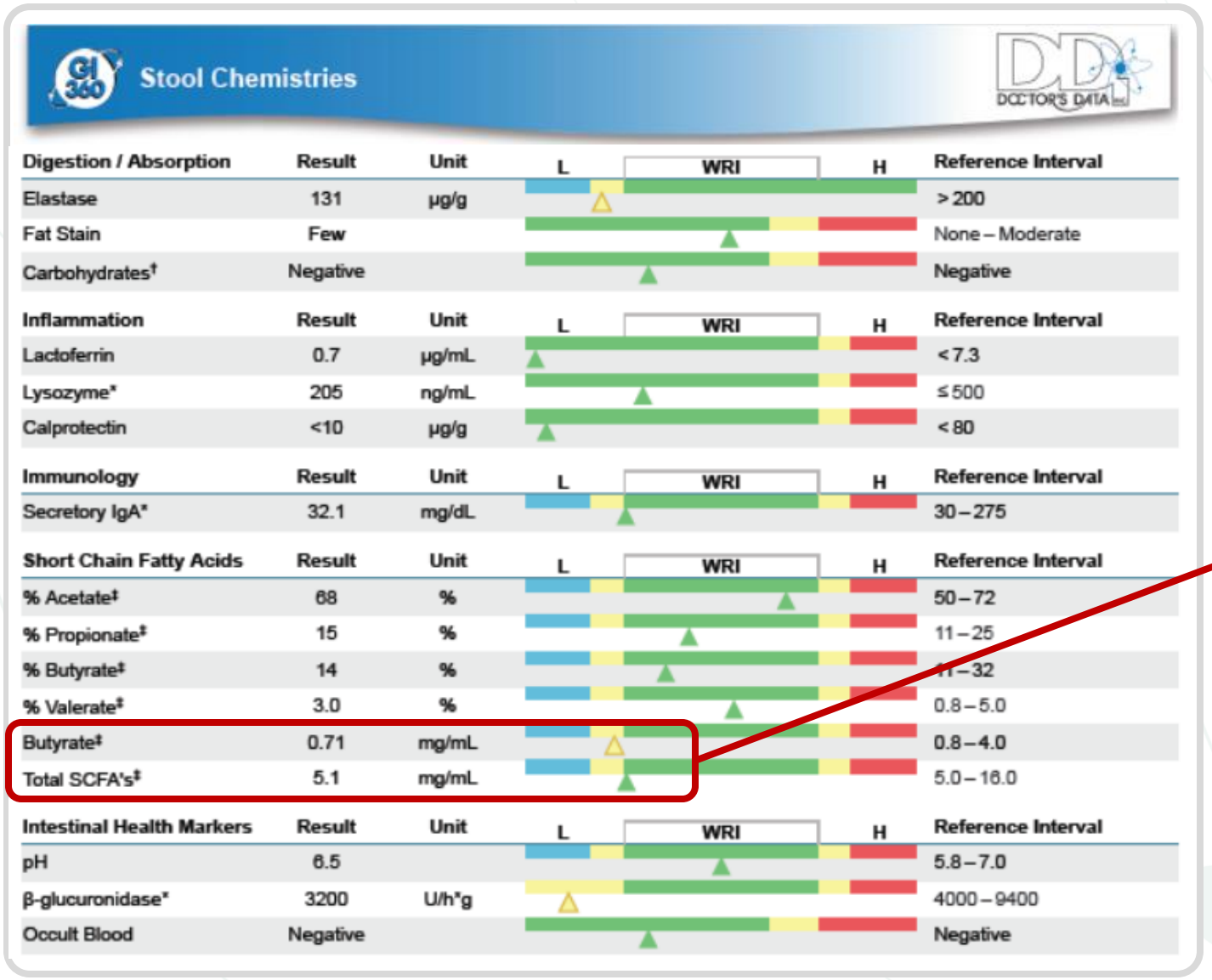
Incretin-based therapy may indirectly influence fecal elastase results. Mechanisms may include:

- Delayed gastric emptying
- Reduced caloric intake
- Chronis stress/sympathetic dominance
- Altered entero-pancreatic signaling
- Changes in GI transit time

Interpretation should be correlated with:

- Stool consistency
- Malabsorption symptoms
- Nutrient deficiencies
- Weight loss pattern
- Clinical history

Mildly low elastase does not always indicate true pancreatic insufficiency



Stool Chemistries

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Digestion / Absorption	Result	Unit	L	WRI	H	Reference Interval
Elastase	131	µg/g				> 200
Fat Stain	Few					None – Moderate
Carbohydrates†	Negative					Negative
Inflammation	**Result**	**Unit**	**L**	**WRI**	**H**	**Reference Interval**
Lactoferrin	0.7	µg/mL				< 7.3
Lysozyme*	205	ng/mL				≤ 500
Calprotectin	<10	µg/g				< 80
Immunology	**Result**	**Unit**	**L**	**WRI**	**H**	**Reference Interval**
Secretory IgA*	32.1	mg/dL				30 – 275
Short Chain Fatty Acids	**Result**	**Unit**	**L**	**WRI**	**H**	**Reference Interval**
% Acetate‡	68	%				50 – 72
% Propionate‡	15	%				11 – 25
% Butyrate‡	14	%				11 – 32
% Valerate‡	3.0	%				0.8 – 5.0
Butyrate‡	0.71	mg/mL				0.8 – 4.0
Total SCFA's‡	5.1	mg/mL				5.0 – 16.0
Intestinal Health Markers	**Result**	**Unit**	**L**	**WRI**	**H**	**Reference Interval**
pH	6.5					5.8 – 7.0
β-glucuronidase*	3200	U/h*g				4000 – 9400
Occult Blood	Negative					Negative

Low Butyrate & Total SCFAs

- Reduced colonic energy supply and impaired mucosal integrity
- Increases gut inflammation due to reduced epithelial fuel and impaired barrier integrity
- Weakens metabolic signaling, including GLP-1/PYY and AMPK pathways
  - Reflects dysbiosis + low diversity, often worsened by incretin therapy induced low-fiber intake (poor weight loss response)

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Butyrate, SCFAS, and Fiber

Types of Fiber:

- **Soluble Fiber (fermentable):** primary driver of SCFA and butyrate production
  - Therapeutic Dose: 8-15g/QD
  - Inulin, psyllium husk, legumes, bananas, artichoke, chia seeds
- **Resistant Starch:** fermented by specific colonic microbial communities
- **Insoluble Fiber (non-fermentable)**: supports stool bulk and transit; indirect gut health benefits
  - Vegetables, fruits, flax, bran

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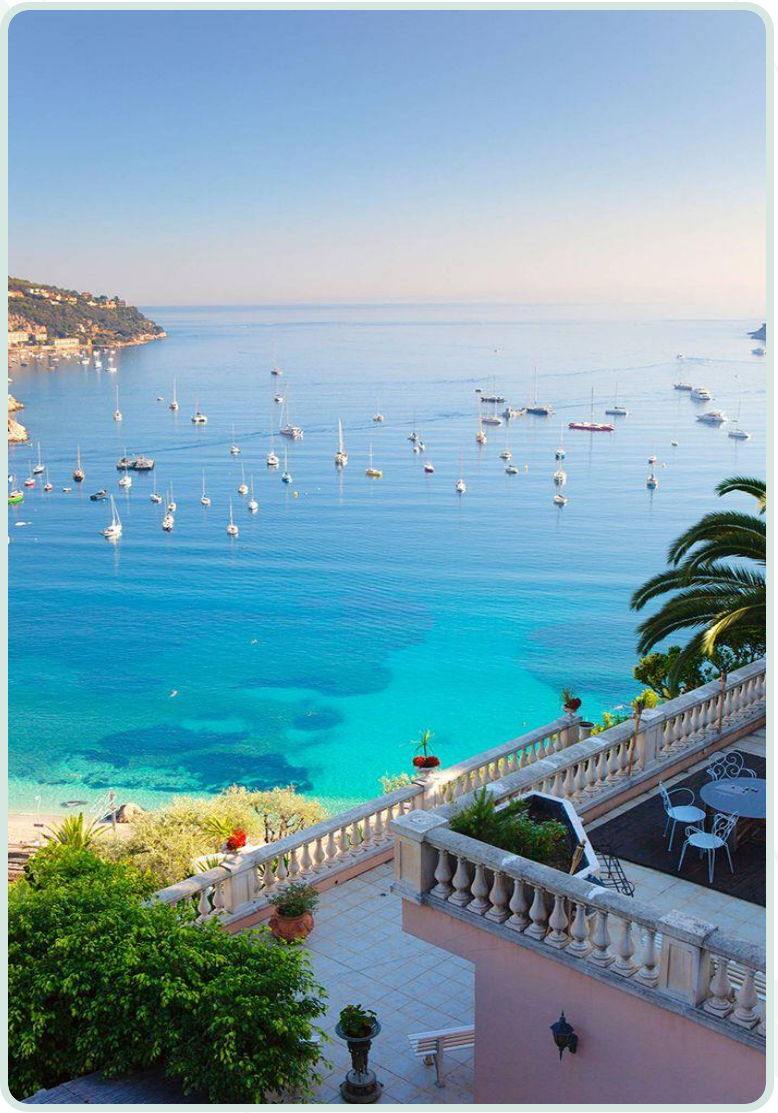
Incretin-based therapy + Low Food Volume

- **Goal:** Preserve diversity + SCFA production **despite** reduced intake
- **Soluble fiber (8-15g QD)**
  - Inulin, psyllium husk, PHGG, oats, cooled starches, legumes
  - Supports Bifidobacterium, F. prausnitzii, A. muciniphila to increase SCFAs
- **Polyphenols**
  - Berries, pomegranate, green/red teas, colorful plants
  - Support diversity + barrier integrity
- **Fermented foods**
  - Yogurt, kefir, kimchi, sauerkraut
  - Increases microbial diversity, immune modulation
- **Clinical intent**
  - Counter dysbiosis + SCFA decline during appetite suppression
  - Trend towards a Mediterranean-style diet



Microbiome requirements are non-negotiable biology

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DDI Complementary Profiles

Gastrointestinal Health testing

- *H. pylori* Antigen, stool
- Celiac & Gluten Sensitivity, bloodspot, serum
- Zonulin Family Protein, stool, serum

Endocrinology testing

- HuMap, urine
- Neurotransmitters, urine
- Cortisol, saliva, urine

Environmental Exposure & Detox testing

- Hepatic Detox, blood

Nutritional Status testing

- **NAD, whole blood**
- **Fatty Acid, while blood**
- Vitamin D, blood spot, serum
- **Amino Acids, blood, urine**
- Iodine/Halides, urine

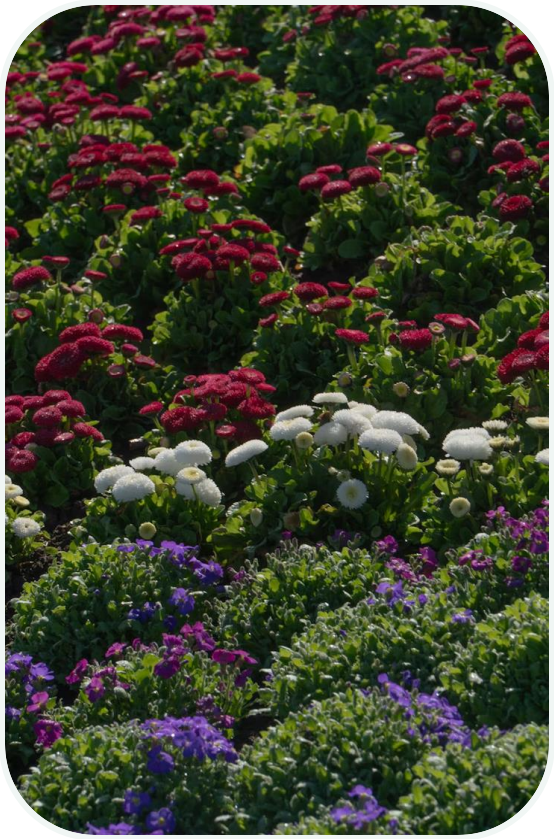
Toxic and Essential Elements testing

- Toxic and Essential Elements, hair, urine
- Oxidative Stress, urine

Methylation Testing

- **DNA Weight Control (SNPS), buccal swab**
- **Methylation Profile, plasma**

Cardiometabolic profile, serum



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NAD Profile; whole blood

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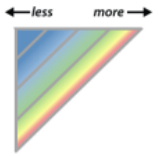
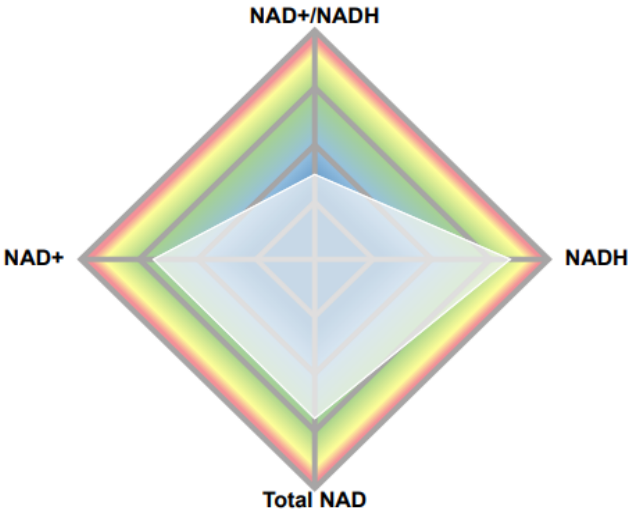
NADs: Metabolic Powerhouses

In the body, B3 vitamins manifest as NADs (nicotinamide adenine dinucleotides). NADs are crucial molecules central to diverse cellular processes, notably energy metabolism. Additionally, NADs are key players in regulatory pathways, influencing processes such as DNA repair and cell survival. For the clearest assessment of mitochondrial and metabolic function, it is essential to measure both the reduced and oxidized forms of NAD: NAD+ and NADH. Their significance in cellular activities makes them targets for research and interventions related to health, longevity, and disease.

LEGEND



The web image shows the relative levels among NADs and their ratios to each other. The white shaded area represents the patient's results compared to a reference population. The blue center of the web represents lower levels while the red outer edges represent higher levels.



Analytes	Result	Unit	L WRI H	Reference Interval
NAD+*	28	µmol		20 – 36
NADH*	1.7	µmol		0.6 – 1.8

Calculations	Result	Unit	L WRI H	Reference Interval
Total NAD	29.7	µmol		20.5 – 38.0
NAD+/NADH	16.5			16.3 – 46.0

Collection Type

- Cellular energy status
- Redox balance
- Metabolic efficiency
- **Incretin therapy relevance:**
  - Weight loss, caloric reduction, and metabolic shift affect changes in NAD demand/turnover

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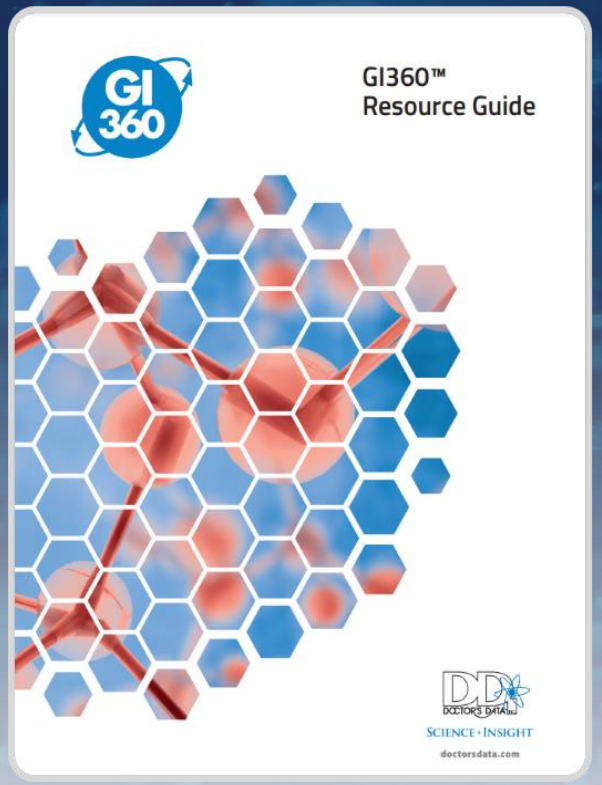
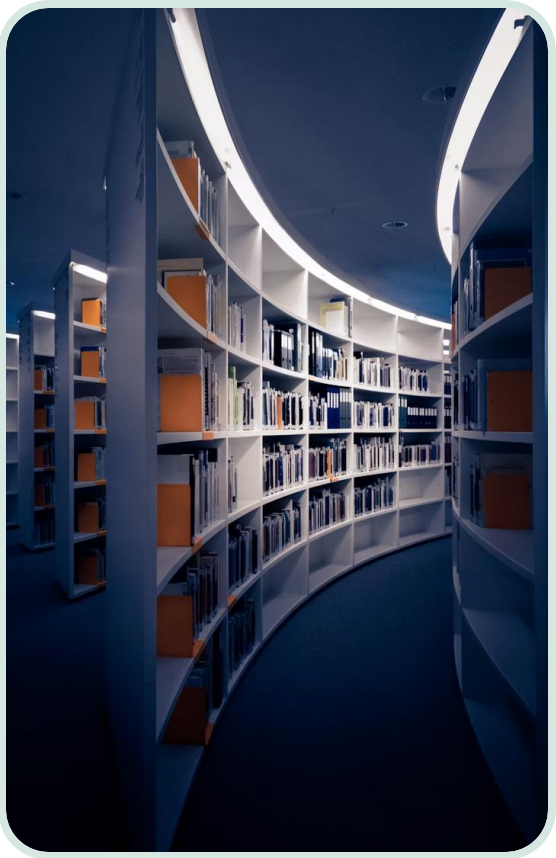
THANK YOU!



QUESTIONS?

References



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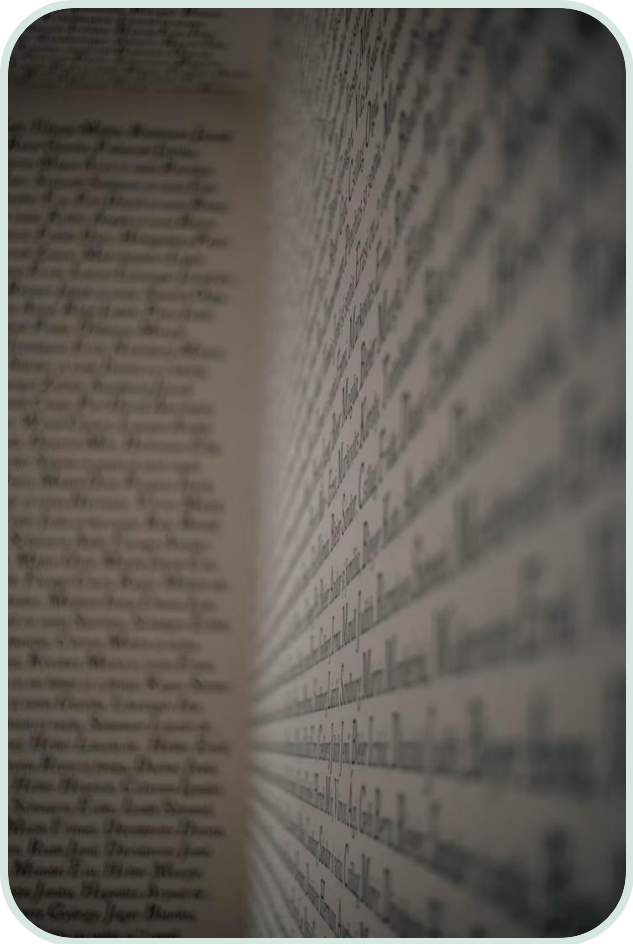

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- Human microbiome intervention literature emphasizing functional vs taxonomic interpretation (multiple studies summarized in *Surg Obes Relat Dis.* and *Obes Rev.*)
- Human dietary and metabolic intervention studies demonstrating dynamic microbiome adaptation (*Obesity Surgery*, *Nature Reviews Gastroenterology & Hepatology*, multiple reviews)