3 dysbiotic bacteria, no yeast

low sIgA, pancreatic enzymes, butyrate

GI360™; stool

3 bacteria sensitivities

DOCTOR'S DATA INC

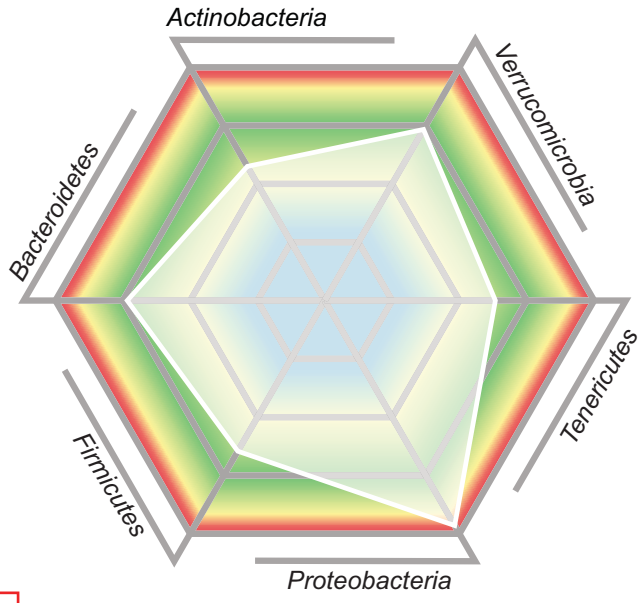
Order: 200516-0047
Client #: 32029
Doctor: Michael Cheikin, MD
Wynd Moore Rehab Association
832 Germantown Pike #3
Plymouth Meeting, PA 19462 USA

Patient:
Id: P201
Age: 35
Sex: Female

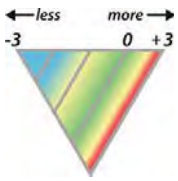
Sample Collection	Date/Time
Date Collected	05/15/2020
Date Received	05/16/2020
Date Reported	05/28/2020
Specimens Collected	3

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



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.

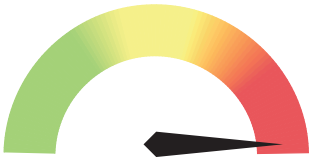
30% of cases score 5, plus you have 3 dysbiotic bacteria.

Dysbiosis Index

The Dysbiosis Index (DI) is a calculation with scores from 1 to 5 based on the overall bacterial abundance and profile within the patient's sample as compared to a reference population. Values above 2 indicate a microbiota profile that differs from the defined normobiotic reference population (i.e., dysbiosis). The higher the DI above 2, the more the sample is considered to deviate from normobiosis.

DI Score

5



Key Findings

Proteobacteria, Very High	↑	*Citrobacter freundii* complex, Cultured
Escherichia spp., Very High	↑	*Morganella morganii*, Cultured
Actinobacteria, Low	↓	*Proteus vulgaris* group, Cultured
Faecalibacterium prausnitzii, Low	↓	Secretory IgA, Low
Lachnospiraceae, Low	↓	Butyrate, Very Low
		Total SCFA's, Very Low
		β-glucuronidase, Low
		Occult Blood, Detected

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Microbiome Bacterial Abundance;Multiplex PCR

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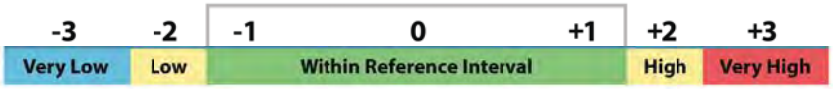

Results are graphed as deviations from a normobiotic population. Normobiosis or a normobiotic state characterizes a composition of the microbiota profile in which microorganisms with potential health benefits predominate in abundance and diversity over potentially harmful ones.

Actinobacteria	Result	Reference Interval
Actinobacteria	-2	-1 to +1
Actinomycetales	0	0 to +1
Bifidobacterium spp.	-1	-1 to +1

Bacteroidetes	Result	Reference Interval
Alistipes spp.	-1	-1 to +1
Alistipes onderdonkii	0	-1 to +1
Bacteroides fragilis	+1	0 to +1
Bacteroides spp. & *Prevotella* spp.	0	-1 to +1
Bacteroides stercoris	+1	0 to +1
Bacteroides zoogleoformans	0	0 to +1
Parabacteroides johnsonii	0	0 to +1
Parabacteroides spp.	-1	-1 to +1

Firmicutes	Result	Reference Interval
Firmicutes	0	-1 to +1
Bacilli Class	-1	-1 to +1
Catenibacterium mitsuokai	0	-1 to +1
Clostridia Class	+1	-1 to +1
Clostridium L2-50	0	0 to +1

Notes:
The gray-shaded area of the bar graph represents reference values outside the reporting limits for this test.
*This test was developed and its performance characteristics determined by Doctor's Data Laboratories in a manner consistent with CLIA requirements. The U. S. Food and Drug Administration (FDA) has not approved or cleared this test; however, FDA clearance is not currently required for clinical use. The results are not intended to be used as a sole means for clinical diagnosis or patient management decisions.
Methodology: Multiplex PCR

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Microbiome Bacterial Abundance;Multiplex PCR

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Firmicutes	Result	-3 -2 -1 0 +1 +2 +3	Reference Interval
Dialister invisus	0		0 to +1
Dialister invisus & Megasphaera micronuciformis	0		0 to +1
Dorea spp.	0		0 to +1
Eubacterium biforme	0		0 to +1
Eubacterium hallii	-1		-1 to +1
Eubacterium rectale	0		0 to +1
Eubacterium siraeum	0		-1 to +1
Faecalibacterium prausnitzii	-2		-1 to +1
Lachnospiraceae	-2		-1 to +1
Lactobacillus ruminis & Pediococcus acidilactici	0		0 to +1
Lactobacillus spp.	0		0 to +1
Phascolarctobacterium spp.	0		0 to +1
Ruminococcus albus & R. bromii	0		0 to +1
Ruminococcus gnavus	+1		0 to +1
Streptococcus agalactiae & Eubacterium rectale	0		0 to +1
Streptococcus salivarius ssp. *thermophilus & S. sanguinis*	0		0 to +1
Streptococcus salivarius ssp. *thermophilus*	-1		-1 to +1
Streptococcus spp.	+1		0 to +1
Veillonella spp.	0		-1 to +1

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Microbiome Bacterial Abundance;Multiplex PCR

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dna testing,

Proteobacteria	**Result**	**Reference Interval**
Proteobacteria	+3	0 to +1
Escherichia spp.	+3	-1 to +1

Tenericutes	**Result**	**Reference Interval**
Mycoplasma hominis	-1	-1 to +1

Verrucomicrobia	**Result**	**Reference Interval**
Akkermansia muciniphila	0	0 to +1

Microbiome Abundance Information:

The GI360™ Microbiome Profile is a gut microbiota profiling test that characterizes patient results by determining deviation from a well-defined state of normobiosis using PCR. The profiling approach contrasts to direct diagnosis of a particular disease by detecting one organism. Characteristic sets of bacteria are required in a healthy normobiotic gut, and deviation will represent a potentially dysbiotic state. Measurement of deviation in bacterial microbiota makes it possible to characterize differences in the patient's results based on an established algorithm that defines normobiosis. By combining information from a well-defined set of predetermined PCR probes, this test enables highly reproducible and standardized information to be derived from the complex human microbiota. A summary web graphic chart is provided to represent bacterial abundance and diversity within a stool sample.

Notes:
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Methodology: Multiplex PCR

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GI Pathogens;Multiplex PCR

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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
Clostridium difficile (Toxin A/B)	Negative
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

Notes:
Methodology: Multiplex PCR

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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
Clonorchis sinensis	Not Detected
Fasciola hepatica/Fasciolopsis buski	Not Detected
Heterophyes heterophyes	Not Detected
Paragonimus westermani	Not Detected

Nematodes - Roundworms	Result
Ascaris lumbricoides	Not Detected

Notes:
Methodology: Microscopy

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Parasitology; Microscopy

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Nematodes - Roundworms	Result
Capillaria hepatica	Not Detected
Capillaria philippinensis	Not Detected
Enterobius vermicularis	Not Detected
Hookworm	Not Detected
Strongyloides stercoralis	Not Detected
Trichuris trichiura	Not Detected

Other Markers	Result	Reference Interval
Yeast	Not Detected	Not Detected – Rare
RBC	Not Detected	Not Detected – Rare
WBC	Not Detected	Not Detected – Rare
Muscle fibers	Not Detected	Not Detected – Rare
Vegetable fibers	Rare	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

Parasitology Information:

- This test is not designed to detect *Cyclospora cayetanensis* or *Microsproridia* spp.
- Intestinal parasites are abnormal inhabitants of the gastrointestinal tract that have the potential to cause damage to their host. The presence of any parasite within the intestine generally confirms that the patient has acquired the organism through fecal-oral contamination. Damage to the host includes parasitic burden, migration, blockage and pressure. Immunologic inflammation, hypersensitivity reactions and cytotoxicity also play a large role in the morbidity of these diseases. The infective dose often relates to severity of the disease and repeat encounters can be additive.
- There are two main classes of intestinal parasites, they include protozoa and helminths. The protozoa typically have two stages; the trophozoite stage that is the metabolically active, invasive stage and the cyst stage, which is the vegetative inactive form resistant to unfavorable environmental conditions outside the human host. Helminths are large, multicellular organisms. Like protozoa, helminths can be either free-living or parasitic in nature. In their adult form, helminths cannot multiply in humans.

Notes:
Methodology: Microscopy, Macroscopic Observation

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Parasitology; Microscopy

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Parasitology Information:

- In general, acute manifestations of parasitic infection may involve diarrhea with or without mucus and or blood, fever, nausea, or abdominal pain. However these symptoms do not always occur. Consequently, parasitic infections may not be diagnosed or eradicated. If left untreated, chronic parasitic infections can cause damage to the intestinal lining and can be an unsuspected cause of illness and fatigue. Chronic parasitic infections can also be associated with increased intestinal permeability, irritable bowel syndrome, irregular bowel movements, malabsorption, gastritis or indigestion, skin disorders, joint pain, allergic reactions, and decreased immune function.
- In some instances, parasites may enter the circulation and travel to various organs causing severe organ diseases such as liver abscesses and cysticercosis. In addition, some larval migration can cause pneumonia and in rare cases hyper infection syndrome with large numbers of larvae being produced and found in every tissue of the body.
- **Red Blood Cells** (RBC) in the stool may be associated with a parasitic or bacterial infection, or an inflammatory bowel condition such as ulcerative colitis. Colorectal cancer, anal fistulas, and hemorrhoids should also be ruled out.
- **White Blood Cells** (WBC) and **Mucus** in the stool can occur with bacterial and parasitic infections, with mucosal irritation, and inflammatory bowel diseases such as Crohn's disease or ulcerative colitis
- **Muscle fibers** in the stool are an indicator of incomplete digestion. Bloating, flatulence, feelings of "fullness" may be associated with increase in muscle fibers.
- **Vegetable fibers** in the stool may be indicative of inadequate chewing, or eating "on the run".

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Microbiology

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Pathogenic Bacteria	Result	Reference Interval
Aeromonas spp.	NG	No Growth
Edwardsiella tarda	NG	No Growth
Plesiomonas shigelloides	NG	No Growth
Salmonella group	NG	No Growth
Shigella group	NG	No Growth
Vibrio cholerae	NG	No Growth
Vibrio spp.	NG	No Growth
Yersinia spp.	NG	No Growth

Imbalance Bacteria	Result	Reference Interval
Alpha hemolytic strep	4+	No Growth

Dysbiotic Bacteria	Result	Reference Interval
Citrobacter freundii complex	3+	No Growth
Morganella morganii	3+	No Growth
Proteus vulgaris group	4+	No Growth

Yeast	Result	Reference Interval
No yeast isolated	NG	

Microbiology Information:

- **Pathogenic bacteria** consist of known pathogenic bacteria that can cause disease in the GI tract. They are present due to the consumption of contaminated food or water, exposure to animals, fish, or amphibians known to harbor the organism. These organisms can be detected by either Multiplex PCR or microbiology culture.
- **Imbalanced bacteria** are usually neither pathogenic nor beneficial to the host GI tract. Imbalances can occur when there are insufficient levels of beneficial bacteria and increased levels of commensal bacteria. Certain commensal bacteria are reported as dysbiotic at higher levels.
- **Dysbiotic bacteria** consist of those bacteria that have the potential to cause disease in the GI tract. They can be present due to a number of factors including: exposure to chemicals that are toxic to beneficial bacteria; the use of antibiotics, oral contraceptives or other medications; poor fiber intake and high stress levels.
- **Yeast** may normally be present in small quantities on the skin, in the mouth and intestine. While small quantities of yeast may be normal, yeast observed in higher quantities is considered abnormal.

Notes:
NG = No Growth
Methodology: Culture and identification by MALDI-TOF and conventional biochemicals

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Stool Chemistries

DOCTOR'S DATA INC

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Digestion / Absorption	Result	Unit	L / WRI / H	Reference Interval
Elastase	>500	µg/mL		> 200
Fat Stain	None			None – Few
Carbohydrates†	Negative			Negative

Inflammation	Result	Unit	L / WRI / H	Reference Interval
Lactoferrin	2.2	µg/mL		< 7.3
Lysozyme*	129	ng/mL		≤ 500
Calprotectin	13	µg/g		≤ 50

Immunology	Result	Unit	L / WRI / H	Reference Interval
Secretory IgA*	23.5	mg/dL		30 – 275

Short Chain Fatty Acids	Result	Unit	L / WRI / H	Reference Interval
% Acetate‡	69	%		50 – 72
% Propionate‡	11	%		11 – 25
% Butyrate‡	16	%		11 – 32
% Valerate‡	3.4	%		0.8 – 5.0
Butyrate‡	0.43	mg/mL		0.8 – 4.0
Total SCFA's‡	2.6	mg/mL		5.0 – 16.0

5-10 gm fiber, chickpeas (inulin)

Intestinal Health Markers	Result	Unit	L / WRI / H	Reference Interval
pH	7.0			5.8 – 7.0
β-glucuronidase*	97	U/L		100 – 1200
Occult Blood	Positive			Negative

some foods can trigger fresh blood, esp asparagus, chia

Chemistry Information:

- **Elastase** findings can be used for the diagnosis or the exclusion of exocrine pancreatic insufficiency. Correlations between low levels and chronic pancreatitis and cancer have been reported.

Notes:
RI= Reference Interval, L (blue)= Low (below RI), WRI (green)= Within RI (optimal), WRI (yellow)= Within RI (not optimal), H (red)= High (above RI)
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†This test has been modified from the manufacturer's instructions and its performance characteristics determined by Doctor's Data Laboratories in a manner consistent with CLIA requirements.
‡This test was developed and its performance characteristics determined by Doctor's Data Laboratories in a manner consistent with CLIA requirements. The U.S. Food and Drug Administration (FDA) has not approved or cleared this test; however, FDA clearance is not currently required for clinical use.
Methodology: Elisa, Microscopy, Colormetric, Gas Chromotography, ph Electrode, Guaiac

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Stool Chemistries

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Chemistry Information:

- **Fat Stain:** Microscopic determination of fecal fat using Sudan IV staining is a qualitative procedure utilized to assess fat absorption and to detect steatorrhea.
- **Carbohydrates:** The presence of reducing substances in stool specimens can indicate carbohydrate malabsorption.
- **Lactoferrin** and **Calprotectin** are reliable markers for differentiating organic inflammation (IBD) from function symptoms (IBS) and for management of IBD. Monitoring levels of fecal lactoferrin and calprotectin can play an essential role in determining the effectiveness of therapy, are good predictors of IBD remission, and can indicate a low risk of relapse.
- **Lysozyme** is an enzyme secreted at the site of inflammation in the GI tract and elevated levels have been identified in IBD patients.
- **Secretory IgA** (sIgA) is secreted by mucosal tissue and represents the first line of defense of the GI mucosa and is central to the normal function of the GI tract as an immune barrier. Elevated levels of sIgA have been associated with an upregulated immune response.
- **Short chain fatty acids (SCFAs):** SCFAs are the end product of the bacterial fermentation process of dietary fiber by beneficial flora in the gut and play an important role in the health of the GI as well as protecting against intestinal dysbiosis. Lactobacilli and bifidobacteria produce large amounts of short chain fatty acids, which decrease the pH of the intestines and therefore make the environment unsuitable for pathogens, including bacteria and yeast. Studies have shown that SCFAs have numerous implications in maintaining gut physiology. SCFAs decrease inflammation, stimulate healing, and contribute to normal cell metabolism and differentiation. Levels of **Butyrate** and **Total SCFA** in mg/mL are important for assessing overall SCFA production, and are reflective of beneficial flora levels and/or adequate fiber intake.
- **pH:** Fecal pH is largely dependent on the fermentation of fiber by the beneficial flora of the gut.
- **Occult blood:** A positive occult blood indicates the presence of free hemoglobin found in the stool, which is released when red blood cells are lysed.
- **β-glucuronidase** is an enzyme that breaks the tight bond between glucuronic acid and toxins in the intestines. The binding of toxins in the gut is protective by way of blocking their absorption and facilitating excretion.

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Bacterial Susceptibilities

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Citrobacter freundii complex

Natural Agents	Low Susceptibility	High Susceptibility
Berberine*		
Black Walnut*		
Caprylic Acid*		
Uva Ursi*		
Oregano*		
Grapefruit Seed Extract*		
Silver*		

taking some

taking some

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 susceptibility to these agents. The test is performed by using standardized techniques and filter paper disks impregnated with the listed agent. Relative susceptibility 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 susceptibility 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.

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Bacterial Susceptibilities

Order: 200516-0047
Client #: 32029
Doctor: Michael Cheikin, MD
Wynd Moore Rehab Association
832 Germantown Pike #3
Plymouth Meeting, PA 19462 USA

Patient:
Id: P201
Age: 35
Sex: Female

Sample Collection	Date/Time
Date Collected	05/15/2020
Date Received	05/16/2020
Date Reported	05/28/2020
Specimens Collected	3

Morganella morganii

Natural Agents	Low Susceptibility	High Susceptibility
Berberine*		
Black Walnut*		
Caprylic Acid*		
Uva Ursi*		
Oregano*		
Grapefruit Seed Extract*		
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 susceptibility to these agents. The test is performed by using standardized techniques and filter paper disks impregnated with the listed agent. Relative susceptibility 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 susceptibility 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.

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Proteus vulgaris group

Natural Agents	Low Susceptibility	High Susceptibility
Berberine*		
Black Walnut*		
Caprylic Acid*		
Uva Ursi*		
Oregano*		
Grapefruit Seed Extract*		
Silver*		

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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.

Bacteriodetes (phylum)

Bacteroidetes make up approximately 28% of the gut microbiota in healthy human adults. They are early colonizers of the infant gut and are amongst the most stable, at a species and strain level, in the healthy host. A low preponderance of Bacteriodetes relation to Firmicutes has been associated with obesity, though this can increase with weight loss and restricted calorie intake.

Firmicutes (phylum)

The phylum Firmicutes constitutes the most diverse and abundant group of gastrointestinal microbiota which are grouped into four classes, Bacilli, Clostridia, Erysipelotrichia, and Negativicutes. They make up approximately 39% of the gut microbiota, on average, in healthy adults, but can comprise as much as 80% of the community.

Faecalibacterium prausnitzii (species)

Faecalibacterium prausnitzii is one of the most abundant butyrate producing bacteria in a healthy gastrointestinal tract. As such, F. prausnitzii is a protective factor for the intestinal mucosa and supports very important intestinal barrier functions. F. prausnitzii exerts anti-inflammatory effects via metabolites such as short-chain fatty acids, and a specific surface coat protein (Amuc-1100). F. prausnitzii is reduced in inflammatory bowel disease, irritable bowel syndrome, celiac disease and gastrointestinal inflammation in general. It is reduced in patients diagnosed with Parkinson's disease, bipolar disorder, colorectal cancer, diabetes and chronic idiopathic diarrhea. Diminished levels of F. prausnitzii were found in patients with major depressive disorder. The abundance of F. prausnitzii together with E. coli has been proposed as a discrimination tool between ulcerative colitis and Crohn's disease. F. prausnitzii has been correlated with pediatric obesity in instances of high consumption of foods that are rich in unabsorbed carbohydrate (banana, maize, rice). The prebiotic inulin has been shown to increase the proportion of F. prausnitzii in the human intestinal microbiota. Low FODMAP diets have been observed to reduce the abundance of F. prausnitzii and butyrate production.

Lachnospiraceae (family)

The Lachnospiraceae family is a diverse group of butyric acid producers, which have been associated with beneficial microbial and epithelial cell growth. Consumption of a Mediterranean diet decreased levels of species belonging to Lachnospiraceae. Lachnospiraceae are known to increase with intake of cruciferous vegetables and wheat bran, and decrease with a resistant starch diet.

Proteobacteria (phylum)

Proteobacteria include a wide variety of pathogens, including species within the Escherichia, Shigella Salmonella, Vibrio, and Helicobacter genera. The phylum includes a number of species that are permanent residents of the microbiota and capable of inducing nonspecific inflammation and diarrhea when their presence is increased. Proteobacteria make up approximately 2% of the gut microbiota in healthy adults.

Proteobacteria

A high-fat diet is positively associated with an abundance of Proteobacteria. Slightly increased abundance of Proteobacteria may associated with low-grade inflammation. Proteobacteria are increased in inflammatory bowel disease and irritable bowel syndrome. Higher abundance of Proteobacteria has been associated with a moderate to severe disease course in newly discovered ulcerative colitis patients. They are associated with diarrhea in IBS.

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Microbiome Abundance Information continued...

Escherichia (genus)

Clinically, Escherichia has been reported to contribute in irritable bowel syndrome. Escherichia spp. are commonly recovered from inflamed tissues of both Crohn's disease and ulcerative colitis patients. Untreated inflammatory bowel disease patients were shown to have higher abundance of Escherichia and lower abundance of Faecalibacterium prausnitzii. Increased levels of Escherichia were observed in colorectal cancer patients. Patients diagnosed with nonalcoholic steatohepatitis have higher abundance of Escherichia. Consumption of a Western diet is positively associated with Escherichia levels. Increased levels of E. coli were observed in people on a gluten-free diet. A non-pathogenic strain of Escherichia, Escherichia nissle, is a widely used probiotic for treating gut related diseases such as chronic constipation.

Tenericutes (phylum)

Tenericutes are cell wall-less bacteria that do not synthesize precursors of peptidoglycan. Tenericutes species consist of four main clades designated as the Acholeplasma, Spiroplasma, Pneumoniae and Hominis clusters. Tenericutes are typically parasites or commensals of eukaryotic hosts.

Verrucomicrobia (phylum)

Verrucomicrobia is a less common phylum in the human gut microbiota, but one with increasing recognition with regards to health. Verrucomicrobia includes Akkermansia muciniphila. The obligate anaerobe Akkermansia constitutes up 3-5% of total bacteria in a healthy microbiome, and has a protective or anti-inflammatory role in the intestine mucosa.

GI Pathogens

Introduction

The GI Pathogen profile is performed using an FDA-cleared multiplex PCR system. It should be noted that PCR testing is much more sensitive than traditional techniques and allows for the detection of extremely low numbers of pathogens. PCR testing does not differentiate between viable and non-viable pathogens and should not be repeated until 21 days after completion of treatment or resolution to prevent false positives due to lingering traces of DNA. PCR testing can detect multiple pathogens in the patient's stool but does not differentiate the causative pathogen. All decisions regarding the need for treatment should take the patient's complete clinical history and presentation into account.

Microbiology

Pathogenic/Dysbiotic Flora

In a healthy balanced state of intestinal flora, the beneficial bacteria make up a significant proportion of the total microflora. However, in many individuals there is an imbalance or deficiency of beneficial flora and an overgrowth of non-beneficial (imbalance) or even pathogenic microorganisms (dysbiosis). This can be due to a number of factors including: consumption of contaminated water or food; daily exposure of chemicals that are toxic to beneficial bacteria; the use of antibiotics, oral contraceptives or other medications; poor fiber intake and high stress levels.

A number of toxic substances can be produced by the dysbiotic bacteria including amines, ammonia, hydrogen sulfide, phenols, and secondary bile acids which may cause inflammation or damage to the brush border of the intestinal lining. If left unchecked, long-term damage to the intestinal lining may result in leaky gut syndrome, allergies, autoimmune disease (e.g. rheumatoid arthritis), irritable bowel syndrome, fatigue, chronic headaches, and sensitivities to a variety of foods. In addition, pathogenic bacteria can cause acute symptoms such as abdominal pain, nausea, diarrhea, vomiting, and fever in cases of food poisoning.

Bacterial sensitivities to a variety of prescriptive and natural agents have been provided for the pathogenic bacteria that were cultured from this patient's specimen. This provides the practitioner with useful information to help plan an appropriate treatment regimen. Supplementation with probiotics or consumption of foods (yogurt, kefir, miso, tempeh, tamari sauce) containing strains of lactobacilli, bifidobacteria, and enterococci can help restore healthy flora levels. Polyphenols in green and ginseng tea have been found to increase the numbers of beneficial bacteria. Hypochlorhydria may also predispose an individual to bacterial overgrowth, particularly in the small intestine. Nutritional anti-inflammatories can aid in reversing irritation to the GI lining. These include quercetin, vitamin C, curcumin, gamma-linoleic acid, omega-3 fatty acids (EPA, DHA), and aloe vera. Other nutrients such as zinc, beta-carotene, pantothenic acid, and L-glutamine provide support for regeneration of the GI mucosa. A comprehensive program may be helpful in individuals in whom a dysbiotic condition has caused extensive GI damage.

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Microbiology continued...

Citrobacter species

Citrobacter species, a gram-negative bacterium and member of the Enterobacteriaceae family, is considered dysbiotic at 3+ or greater. Citrobacter freundii complex (including C. freundii, C. braakii, C. gullenii, C. murliniae, C. rodentium, C. wermanii, C. youngae) C. koseri and C. farmeri, can cause diarrheal disease. Symptoms are the result of an E. coli-like heat-stable enterotoxin and hydrogen sulfide. Citrobacter freundii complex has been implicated as a cause of gastrointestinal infection and inflammation, acute dysentery, and dyspepsia. Acute symptoms can include profuse, watery diarrhea without abdominal pain, fecal blood, or white blood cells.

Citrobacter species thrive on Fructooligosaccharides (FOS), a common ingredient in artificial or alternative sweetener.

Antibiotics may be indicated if symptoms are prolonged. Refer to the antimicrobial susceptibilities to identify the most appropriate agent.

Morganella morganii

The bacterial genus Morganella includes only one species, M. morganii, recognized in 1906 as an organism isolated from infant diarrheal samples. This gram-negative bacterium is considered dysbiotic in the amount of 3 - 4+. Morganella morganii is a gram-negative rod commonly found in the environment and in the intestinal tracts of humans, mammals, and reptiles as normal flora. It is the cause of both urinary tract and wound infections and has been implicated as a cause of diarrhea. Enterotoxigenic strains of M. morganii have been implicated in two cases of gastrointestinal disease, of which one of the two individuals presented with loose stools only while the second person had clinically defined gastroenteritis.

Antibiotics may be indicated if symptoms are prolonged and in systemic infections. Refer to the antimicrobial susceptibilities for treatment.

Proteus species

Proteus species are gram-negative bacilli of the Enterobacteriaceae family. Proteus species are normal flora of the gut but are listed as dysbiotic flora at 3 - 4+. P. vulgaris and P. mirabilis are the best-known species of the genus Proteus, with P. mirabilis being the most common infectious species. Proteus is commonly found in contaminated meat, soil, polluted water, sewage, manure, and in the intestinal contents of wild and domestic animals. This bacterium is often found in higher numbers in those who have received antibiotics.

Some Proteus isolates can produce an enterotoxin. Organisms often localize in already damaged tissues in various parts of the body where they may produce an exudative inflammatory reaction. Proteus has been associated with diarrheal disease in susceptible individuals and has been implicated as a possible cause of epidemic diarrhea in infants. In addition, Proteus mirabilis is a urease-producing organism that contributes to the formation of kidney stones. Urinary tract infections, most common in patients with long-term catheterizations, may lead to kidney failure and may be the source of bacteremia. Infection has been linked to rheumatoid arthritis (antigenic cross-reactivity). There is also evidence for osteomyelitis caused by Proteus bacteria.

For the otherwise healthy individual, antimicrobial therapy is often unnecessary. Antibiotics may be indicated if symptoms are prolonged and in systemic infections. Refer to the antimicrobial susceptibilities for treatment options.

Imbalanced Flora

Imbalanced flora are those bacteria that reside in the host gastrointestinal tract and neither injure nor benefit the host. Certain dysbiotic bacteria may appear under the imbalanced category if found at low levels because they are not likely pathogenic at the levels detected. When imbalanced flora appear, it is not uncommon to find inadequate levels of one or more of the beneficial bacteria and/or a fecal pH more towards the alkaline end of the reference range (6 - 7.8). It is also not uncommon to find hemolytic or mucoid E. coli with a concomitant deficiency of beneficial E. coli and alkaline pH, secondary to a mutation of beneficial E. coli in alkaline conditions (DDI observations). Treatment with antimicrobial agents is unnecessary unless bacteria appear under the dysbiotic category.

Stool Chemistries

Secretory IgA (sIgA)

The concentration of sIgA is abnormally low in this fecal specimen. Secretory IgA represents the first line of defense of the gastrointestinal (GI) mucosa and is central to the normal function of the GI tract as an immune barrier. Immunological activity in the gastrointestinal tract can be accessed via fecal sIgA levels in a formed stool sample. However, sIgA may be artefactually low due to fluid dilution effects in a watery or loose/watery stool sample.

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Stool Chemistries continued...

Chronic mental and physical stress as well as inadequate nutrition have been associated with low fecal sIgA concentrations. This includes dietary restrictions, excessive alcohol intake, body mass loss, negative moods, and anxiety. One study found decreased levels of sIgA in malnourished children, particularly protein malnourishment, which responded well to nutritional rehabilitation with a significant increase in sIgA. A possible explanation for this may be the synthesis and expression of sIgA requires adequate intake of the amino acid L-glutamine. An increase of dietary L-glutamine may restore GI immune function by protection of cells that synthesize sIgA. Saccharomyces boulardii is a nonpathogenic yeast that has been used for the treatment of acute infectious enteritis and antibiotic-associated diarrhea. Restored levels of sIgA and subsequent enhanced host immune response have been found following S. boulardii administration (animal models). With low sIgA one might consider a salivary cortisol test.

Short Chain Fatty Acids (SCFAs)

The total concentration and/or percentage distribution of the primary short chain fatty acids (SCFAs) are abnormal in this specimen. Beneficial bacteria that ferment non-digestible soluble fiber produce SCFAs that are pivotal in the regulation of intestinal health and function. Restoration of microbial abundance and diversity, and adequate daily consumption of soluble fiber can improve SCFA status.

The primary SCFAs butyrate, propionate and acetate are produced by predominant commensal bacteria via fermentation of soluble dietary fiber and intestinal mucus glycans. Key producers of SCFAs include Faecalibacterium prausnitzii, Akkermansia muciniphila, Bacteroides fragilis, Bifidobacterium, Clostridium and Lactobacillus species. The SCFAs provide energy for intestinal cells, and regulate the actions of specialized mucosal cells that produce anti-inflammatory and antimicrobial factors, mucins that constitute the mucus barriers, and gut active peptides that facilitate appetite regulation and euglycemia. The SCFAs also contribute to a more acidic and anaerobic microenvironment that disfavors dysbiotic bacteria and yeast. Abnormal SCFAs may be associated with dysbiosis (including insufficiency dysbiosis), compromised intestinal barrier function (intestinal permeability) and inappropriate immune and inflammatory conditions.

“Seeding” with supplemental probiotics may contribute to improved production and status of SCFAs, but it is imperative to “feed” the beneficial microbes. Sources of soluble fiber that are available to the microbes include chick peas, beans, lentils, oat and rice bran, fructo- and galacto- oligosaccharides, and inulin.

β-glucuronidase

A low level of fecal β-glucuronidase (β-G) is not known to be of any direct clinical consequence. Low β-G is an indicator of abnormal metabolic activity among the intestinal microbiota that may be influenced by dietary extremes, diminished abundance and diversity of the intestinal microbiota, or heavy probiotic and/or prebiotic supplementation. A low fat, low meat and high fiber diet, such as consumed by strict vegetarians, may be associated with lower β-G compared to a typical “Western diet.” High-end consumption of soluble fiber (e.g. inulin) and supplementation with *Lactobacillus acidophilus* may be associated with lower fecal β-G. Low fecal β-G may be associated with an imbalanced intestinal microbiota profile, specifically low levels of certain bacteria that produce the enzyme. Some major bacterial producers of β-G include *Bifidobacterium*, *Lactobacillus*, *Escherichia coli*, *Clostridium*, *Bacteroides fragilis* and other *Bacteroides* species, *Ruminococcus gnavus*, and species that belong to the genera *Staphylococcus* and *Eubacterium*.

The liver and intestine bind toxins, steroid hormones and some dietary components to glucuronic acid which blocks their absorption and enhances excretion. β-glucuronidase is an enzyme produced by the intestinal epithelium and certain intestinal bacteria, which breaks down the tight bond between glucuronic acid and many different chemical entities. In premenopausal women, lower fecal β-G has been associated with lower circulating levels of estrogens and higher fecal excretion of estrogens.

Occult Blood

Occult blood was detected in this specimen. In many cases, a positive occult blood results from gastrointestinal bleeding from the upper small intestine or higher. Gastric ulceration could, for example, result in a finding of occult blood rather than blood in the feces. However, a positive finding of occult blood may also be associated with colon cancer, ulcerative colitis (check fecal calprotectin and lactoferrin levels), ulceration of the esophagus, stomach or duodenum, diverticulitis, and gastric carcinoma. Positive occult blood findings require confirmation and further investigation may be indicated.

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