

Comprehensive Stool Analysis + Parasitology

BACTERIOLOGY CULTURE

Expected/Beneficial flora

4+ *Bacteroides* family
 4+ *Bifidobacterium* family
 4+ *Escherichia coli*
 NG *Lactobacillus* family
 3+ *Enterococcus* family
 4+ *Clostridium* family

Commensal (Imbalanced) flora

2+ *Klebsiella/Raoultella* complex
 1+ *Kocuria* spp.
 3+ *Streptococcus anginosus*
 3+ *Streptococcus parasanguinis*

Dysbiotic flora

3+ *Citrobacter freundii* complex

NG = No Growth



BACTERIA INFORMATION

Expected / Beneficial bacteria make up a significant portion of the total microflora in a healthy & balanced GI tract. These beneficial bacteria have many health-protecting effects in the GI tract including manufacturing vitamins, fermenting fibers, digesting proteins and carbohydrates, and propagating anti-tumor and anti-inflammatory factors.

Clostridia are prevalent flora in a healthy intestine. *Clostridium* spp. should be considered in the context of balance with other expected/beneficial flora. Absence of clostridia or over abundance relative to other expected/beneficial flora indicates bacterial imbalance. If *C. difficile* associated disease is suspected, review the *Clostridium difficile* toxin A/B results from the GI Pathogens PCR section of this report.

Commensal (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 known pathogenic bacteria and those that have the potential to cause disease in the GI tract. They can be present due to a number of factors including: consumption of contaminated water or food, 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. *Aeromonas*, *Plesiomonas*, *Salmonella*, *Shigella*, *Vibrio*, *Yersinia*, & *Edwardsiella* have been specifically tested for and found absent unless reported.

YEAST CULTURE

Normal flora

No yeast isolated

Dysbiotic flora



YEAST INFORMATION

Yeast may normally be present in small quantities in the skin, mouth, and GI tract as a component of the resident microbiota. Their presence is generally benign. Recent studies, however, show that high levels of yeast colonization is associated with several inflammatory diseases of the GI tract. Animal models suggest that yeast colonization delays healing of inflammatory lesions and that inflammation promotes colonization. These effects may create a cycle in which low-level inflammation promotes fungal colonization and this colonization promotes further inflammation. Consideration of clinical intervention for yeast should be made in the context of other findings and presentation of symptoms.

SPECIMEN DATA

Comments:

Date Collected: 08/20/2023
Date Received: 08/28/2023
Date Reported: 09/05/2023

Specimens Collected: 2

Methodology: Culture and identification by MALDI-TOF and conventional biochemicals





MOSAIC
DIAGNOSTICS
Formerly Great Plains Laboratory

ORDER: 230828-0124
CLIENT REF: 1226764-3
PATIENT: Isaac Franca
ID: P232400096
SEX: Male
AGE: 4
DOB: 11/06/2018

CLIENT #: 24510
Mosaic Diagnostics LLC
9221 Quivira Road
Overland Park, KS 66215 USA

GI Pathogen Profile, Multiplex PCR; stool

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

SPECIMEN DATA

Comments:

Date Collected: 08/20/2023
Date Received: 08/28/2023
Date Reported: 09/05/2023
Methodology: Multiplex PCR

Specimens Collected: 2





Parasitology; Microscopy

Protozoa	Result	
<i>Balantidium coli</i>	Not Detected	<input type="checkbox"/>
<i>Blastocystis spp.</i>	Not Detected	<input type="checkbox"/>
<i>Chilomastix mesnili</i>	Not Detected	<input type="checkbox"/>
<i>Dientamoeba fragilis</i>	Not Detected	<input type="checkbox"/>
<i>Endolimax nana</i>	Not Detected	<input type="checkbox"/>
<i>Entamoeba coli</i>	Not Detected	<input type="checkbox"/>
<i>Entamoeba hartmanni</i>	Not Detected	<input type="checkbox"/>
<i>Entamoeba histolytica/Entamoeba dispar</i>	Not Detected	<input type="checkbox"/>
<i>Entamoeba polecki</i>	Not Detected	<input type="checkbox"/>
<i>Enteromonas hominis</i>	Not Detected	<input type="checkbox"/>
<i>Giardia duodenalis</i>	Not Detected	<input type="checkbox"/>
<i>Iodamoeba bütschlii</i>	Not Detected	<input type="checkbox"/>
<i>Isospora belli</i>	Not Detected	<input type="checkbox"/>
<i>Pentatrichomonas hominis</i>	Not Detected	<input type="checkbox"/>
<i>Retortamonas intestinalis</i>	Not Detected	<input type="checkbox"/>
Nematodes - Roundworms		
<i>Ascaris lumbricoides</i>	Not Detected	<input type="checkbox"/>
<i>Capillaria hepatica</i>	Not Detected	<input type="checkbox"/>
<i>Capillaria philippinensis</i>	Not Detected	<input type="checkbox"/>
<i>Enterobius vermicularis</i>	Not Detected	<input type="checkbox"/>
<i>Strongyloides stercoralis</i>	Not Detected	<input type="checkbox"/>
<i>Trichuris trichiura</i>	Not Detected	<input type="checkbox"/>
Hookworm	Not Detected	<input type="checkbox"/>
Cestodes - Tapeworms		
<i>Diphyllobothrium latum</i>	Not Detected	<input type="checkbox"/>
<i>Dipylidium caninum</i>	Not Detected	<input type="checkbox"/>
<i>Hymenolepis diminuta</i>	Not Detected	<input type="checkbox"/>
<i>Hymenolepis nana</i>	Not Detected	<input type="checkbox"/>
Taenia	Not Detected	<input type="checkbox"/>

SPECIMEN DATA

Comments:

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Date Received: 08/28/2023

Date Reported: 09/05/2023

Methodology: Microscopy

Specimens Collected: 2



Parasitology; Microscopy

Trematodes - Flukes			
<i>Clonorchis sinensis</i>	Not Detected	<input checked="" type="checkbox"/>	
<i>Fasciola hepatica/Fasciolopsis buski</i>	Not Detected	<input checked="" type="checkbox"/>	
<i>Heterophyes heterophyes</i>	Not Detected	<input checked="" type="checkbox"/>	
<i>Paragonimus westermani</i>	Not Detected	<input checked="" type="checkbox"/>	
Other Markers			Reference Interval
Yeast	Not Detected	<input checked="" type="checkbox"/>	None – Rare
RBC	Not Detected	<input checked="" type="checkbox"/>	None – Rare
WBC	Not Detected	<input checked="" type="checkbox"/>	None – Rare
Muscle fibers	Not Detected	<input checked="" type="checkbox"/>	None – Rare
Vegetable fibers	Rare	<input checked="" type="checkbox"/>	None – Few
Charcot-Leyden Crystals	Not Detected	<input checked="" type="checkbox"/>	None
Pollen	Not Detected	<input checked="" type="checkbox"/>	None
Macroscopic Appearance		Result	
Mucus	Negative	<input checked="" type="checkbox"/>	

This test is not designed to detect *Cyclospora cayentanensis* or *Microsporidia* 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.

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".

SPECIMEN DATA

Comments:

Date Collected: 08/20/2023

Specimens Collected: 2

Date Received: 08/28/2023

Date Reported: 09/05/2023

Methodology: Microscopy, Macroscopic Observation



MOSAIC
DIAGNOSTICS
Formerly Great Plains Laboratory

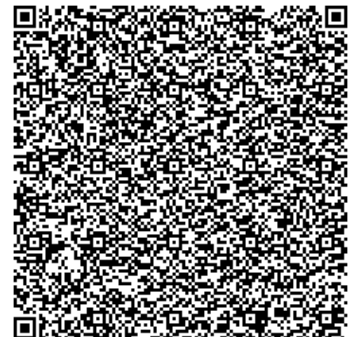
ORDER: 230828-0124
CLIENT REF: 1226764-3
PATIENT: Isaac Franca
ID: P232400096
SEX: Male
AGE: 4
DOB: 11/06/2018

CLIENT #: 24510
Mosaic Diagnostics LLC
9221 Quivira Road
Overland Park, KS 66215 USA

Parasitology; Microscopy

SPECIMEN DATA


















Comments:



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Date Reported: 09/05/2023
Methodology:

Specimens Collected: 2

Stool Chemistries

Digestion / Absorption	Result	Unit		Reference Interval
Elastase	335	µg/g		> 200
Fat Stain	Not Detected			None – Moderate
Carbohydrates [†]	Negative			Negative
Inflammation	Result	Unit		Reference Interval
Lactoferrin	2.0	µg/mL		< 7.3
Calprotectin	<10	µg/g		< 80
Lysozyme*	800	ng/mL		≤ 500
Immunology	Result	Unit		Reference Interval
Secretory IgA*	51.8	mg/dL		30 – 275
Short Chain Fatty Acids	Result	Unit		Reference Interval
% Acetate [‡]	63	%		50 – 72
% Propionate [‡]	15	%		11 – 25
% Butyrate [‡]	18	%		11 – 32
% Valerate [‡]	3.2	%		0.8 – 5.0
Butyrate [‡]	2.1	mg/mL		0.8 – 4.0
Total SCFA's [‡]	12	mg/mL		5.0 – 16.0
Intestinal Health Markers	Result	Unit		Reference Interval
pH	5.5			5.8 – 7.0
Occult Blood	Negative			Negative
Macroscopic Appearance	Result	Unit		Reference Interval
Color	Brown			Brown
Consistency	Soft			Soft

SPECIMEN DATA

Comments:

Date Collected: 08/20/2023

Specimens Collected: 2

Date Received: 08/28/2023

Date Reported: 09/05/2023

Methodology: Turbidimetric immunoassay, Microscopy, Colorimetric, Elisa, Gas Chromatography, pH Electrode, Guaiac, Macroscopic Observation

RI= Reference Interval, Toggles: Green = within RI, Yellow = moderately outside RI, Red = outside RI

*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.

†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.

Stool Chemistries

Chemistry Information

Elastase findings can be used for assessing pancreatic exocrine function and insufficiency.

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.

Color: Stool is normally brown because of pigments formed by bacteria acting on bile introduced into the digestive system from the liver. While certain conditions can cause changes in stool color, many changes are harmless and are caused by pigments in foods or dietary supplements.

Consistency: Stool normally contains about 75% water and ideally should be formed and soft. Stool consistency can vary based upon transit time and water absorption.

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Comments:

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Date Reported: 09/05/2023
Methodology:

Specimens Collected: 2





Citrobacter freundii complex

NATURAL ANTIBACTERIALS		
	LOW SENSITIVITY	HIGH SENSITIVITY
Black Walnut*		
Caprylic Acid*		
Uva Ursi*		
Olive Leaf Extract*		
Oregano*		
Goldenseal*		
Ionic Silver*		
Colloidal Silver*		

PRESCRIPTIVE AGENTS		
	RESISTANT	SUSCEPTIBLE
Amoxicillin-Clavulanic Acid	✓	
Ampicillin	✓	
Cefazolin	✓	
Ceftazidime		✓
Ciprofloxacin		✓
Sulfamethoxazole / Trimethoprim		✓

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.

SPECIMEN DATA	
Comments:	
Date Collected: 08/20/2023 Date Received: 08/28/2023 Date Reported: 09/05/2023 Methodology: Disk Diffusion	Specimens Collected: 2

*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.

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.

Microbiology

Beneficial Flora

One or more of the expected or beneficial bacteria are low in this specimen. Normally abundant bacteria include *Lactobacillus* spp, *Bifidobacteria* spp, *Clostridium* spp, *Bacteroides fragilis* group, *Enterococcus* spp, and *Escherichia coli*. The beneficial flora have many health-protecting effects in the gut, and as a consequence, are crucial to the health of the whole organism. Some of the roles of the beneficial flora include digestion of proteins and carbohydrates, manufacture of vitamins and essential fatty acids, increase in the number of immune system cells, break down of bacterial toxins and the conversion of flavonoids into anti-tumor and anti-inflammatory factors. *Lactobacilli*, *bifidobacteria*, *clostridia*, and *enterococci* secrete lactic acid as well as other acids including acetate, propionate, butyrate, and valerate. This secretion causes a subsequent decrease in intestinal pH, which is crucial in preventing an enteric proliferation of microbial pathogens, including bacteria and yeast. Many GI pathogens thrive in alkaline environments. *Lactobacilli* also secrete the antifungal and antimicrobial agents lactocidin, lactobacillin, acidolin, and hydrogen peroxide. The beneficial flora of the GI tract have thus been found useful in the inhibition of microbial pathogens, prevention and treatment of antibiotic associated diarrhea, prevention of traveler's diarrhea, enhancement of immune function, and inhibition of the proliferation of yeast.

In a healthy balanced state of intestinal flora, the beneficial bacteria make up a significant proportion of the total microflora. Healthy levels of each of the beneficial bacteria are indicated by either a 2+, 3+ or 4+ (0 to 4 scale). However, in some 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, 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.

Antibacterial and antifungal susceptibility testing to a variety of prescriptive and natural agents may be provided for the pathogenic organisms that are cultured from this patient's specimen. This testing is intended to provide the practitioner with useful information to help plan an appropriate treatment regimen. A comprehensive program may be helpful in individuals in whom a dysbiotic condition has caused extensive GI damage.

Note: Not all genera or species can be tested for susceptibilities in the laboratory due to their specific growth requirements. In addition, the Centers for Disease Control and Prevention recommend not testing certain organisms such as those associated with food poisoning. If a practitioner has specific questions, please contact customer service.

Clostridium spp

Clostridia are expected inhabitants of the human intestine. Although most *clostridia* in the intestine are not virulent, certain species have been associated with disease. *Clostridium perfringens* is a major cause of food poisoning and is also one cause of antibiotic-associated diarrhea. *Clostridioides difficile* is a causative agent in antibiotic-associated diarrhea and pseudomembranous colitis. Other species reported to be prevalent in high amounts in patients with Autistic Spectrum Disorder include *Clostridium histolyticum* group, *Clostridium* cluster I, *Clostridium boltea*, and *Clostridium tetani*.

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. Imbalanced bacteria are commonly more abundant in association with insufficiency dysbiosis, and/or a fecal pH more towards the alkaline end of the reference range (5.8 - 7.0). Treatment with antimicrobial agents is unnecessary unless bacteria appear under the dysbiotic category.

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 (insufficiency dysbiosis) and an overgrowth of non-beneficial (imbalance) or even pathogenic microorganisms. 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.

Microbiology continued...

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 may help restore healthy flora levels. Soluble fiber and polyphenols derived from chocolate, green tea, blackcurrant, red wine and grape seed extracts 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.

Citrobacter spp

Citrobacter spp., 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. murlinae*, *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 spp. 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.

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.

Stool Chemistries

Lysozyme

The level of lysozyme is elevated in this sample. Lysozyme is a biomarker of an inflammatory immune response in the gut. Moderate elevations in lysozyme are commonly associated with significant overgrowth of enteropathogens such as yeast, dysbiotic or pathogenic bacteria. Markedly elevated levels of lysozyme may occur with inflammatory bowel disease (IBD), such as Crohn's disease and Ulcerative colitis as well as other non-IBD intestinal diseases with diarrhea. If lysozyme is markedly elevated check the levels of calprotectin and lactoferrin. If either or both are very elevated reassess the levels in about four weeks. Lysozyme is commonly elevated for actively breast-feeding infants due to high maternal milk content.

Lysozyme is helpful in the determination of pathogen-induced inflammatory activity rather than IBD. Slightly-to moderately elevated levels of lysozyme may be remediated with elimination of an offending enteroinvasive microorganism and use of anti-inflammatory nutraceuticals.

pH low

The pH of this stool sample is more acidic (<6.0) than expected. The pH of the stool, reflective of colonic pH, is normally slightly acidic. An acidic pH is commonly associated with rapid transit time, e.g. diarrhea or loose stools, more than three bowel movements per day. Check stool consistency. Further investigation of the cause of rapid transit such as food intolerance, and viral, bacterial, parasitic infection, may be warranted. An acidic pH is common in individuals with lactose malabsorption/intolerance. Unabsorbed lactose in the gut can be hydrolyzed by colonic bacteria forming volatile fatty acids which cause the stool to become acidic, often times accompanied by a sweet, sickly stool odor.