ORDER: SAMPLE REPORT
PATIENT: Sample Patient
ID:
SEX: Female
AGE: 35

CLIENT #: 12345
DOCTOR: Sample Doctor
Doctor's Data, Inc.
3755 Illinois Ave.
St. Charles, IL 60174

CSA+P

DDI DOCTOR'S DATA INC

Comprehensive Stool Analysis + Parasitology

BACTERIOLOGY CULTURE

Expected/Beneficial flora		Commensal (Imbalanced) flora		Dysbiotic flora	
NG	*Bacteroides fragilis* group	2+	Alpha hemolytic strep	4+	*Enterobacter cloacae* complex
1+	*Bifidobacterium* spp.	1+	*Bacillus* spp., not *cereus* or *anthracis*		
NG	*Escherichia coli*	2+	Beta hemolytic strep, group B		
2+	*Lactobacillus* spp.				
NG	*Enterococcus* spp.				
3+	*Clostridium* spp.				

MALDI-TOF

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 or overabundance of clostridia relative to other expected/beneficial flora may indicate 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 tarda have been specifically tested for and found absent unless reported.

YEAST CULTURE

Normal flora		Dysbiotic flora
1+	*Candida parapsilosis*	
1+	*Saccharomyces cerevisiae/boulardii*	

MALDI-TOF

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: 05/10/2021
Date Received: 05/11/2021
Date Reported: 05/12/2021
Specimens Collected: 3
Methodology: Culture and identification by MALDI-TOF and conventional biochemicals

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GI Pathogens; Multiplex PCR

Viruses	Result	Reference Interval
Adenovirus F40/41	Positive	Negative
Norovirus GI/GII	Negative	Negative
Rotavirus A	Negative	Negative

Pathogenic Bacteria	Result	Reference Interval
Campylobacter (*C. jejuni*, *C. coli* and *C. lari*)	Positive	Negative
Clostridioides difficile (Toxin A/B)	Negative	Negative
Escherichia coli O157	Negative	Negative
Enterotoxigenic *Escherichia coli* (ETEC) lt/st	Negative	Negative
Salmonella spp.	Negative	Negative
Shiga-like toxin-producing *Escherichia coli* (STEC) stx1/stx2	Negative	Negative
Shigella (*S. boydii*, *S. sonnei*, *S. flexneri* & *S. dysenteriae*)	Negative	Negative
Vibrio cholerae	Negative	Negative

Parasites	Result	Reference Interval
Cryptosporidium (*C. parvum* and *C. hominis*)	Negative	Negative
Entamoeba histolytica	Negative	Negative
Giardia duodenalis (AKA *intestinalis & lamblia*)	Negative	Negative

SPECIMEN DATA

Comments:

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Methodology: Multiplex PCR

Specimens Collected: 3

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Parasitology; Microscopy

Protozoa	Result
Balantidium coli	Rare
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	Few
Entamoeba polecki	Not Detected
Enteromonas hominis	Not Detected
Giardia duodenalis	Moderate
Iodamoeba bütschlii	Not Detected
Isospora belli	Not Detected
Pentatrichomonas hominis	Not Detected
Retortamonas intestinalis	Not Detected
Nematodes - Roundworms	
Ascaris lumbricoides	Not Detected
Capillaria hepatica	Not Detected
Capillaria philippinensis	Not Detected
Enterobius vermicularis	Not Detected
Strongyloides stercoralis	Not Detected
Trichuris trichiura	Not Detected
Hookworm	Not Detected
Cestodes - Tapeworms	
Diphyllobothrium latum	Not Detected
Dipylidium caninum	Not Detected
Hymenolepis diminuta	Not Detected
Hymenolepis nana	Not Detected
Taenia	Not Detected

SPECIMEN DATA

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Methodology: Microscopy

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Parasitology; Microscopy

Trematodes - Flukes	Result
Clonorchis sinensis	Not Detected
Fasciola hepatica/Fasciolopsis buski	Not Detected
Heterophyes heterophyes	Not Detected
Paragonimus westermani	Not Detected

Other Markers		Reference Interval
Yeast	Many	None – Rare
RBC	Not Detected	None – Rare
WBC	Not Detected	None – Rare
Muscle fibers	Not Detected	None – Rare
Vegetable fibers	Not Detected	None – Few
Charcot-Leyden Crystals	Not Detected	None
Pollen	Not Detected	None

Macroscopic Appearance	
Mucus	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.

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

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Methodology: Microscopy

Specimens Collected: 3

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Parasitology; Microscopy

SPECIMEN DATA

Comments:

Date Collected: 05/10/2021
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Methodology:

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Stool Chemistries

Digestion / Absorption	Result	Unit	Reference Interval
Elastase	300	µg/mL	> 200
Fat Stain	Not Detected		None – Few
Carbohydrates†	Negative		Negative

Inflammation	Result	Unit	Reference Interval
Lactoferrin	5.0	µg/mL	< 7.3
Calprotectin	16	µg/g	≤ 50
Lysozyme*	225	ng/mL	≤ 500

Immunology	Result	Unit	Reference Interval
Secretory IgA*	124	mg/dL	30 – 275

Short Chain Fatty Acids	Result	Unit	Reference Interval
% Acetate‡	50	%	50 – 72
% Propionate‡	27	%	11 – 25
% Butyrate‡	32	%	11 – 32
% Valerate‡	2.4	%	0.8 – 5.0
Butyrate‡	4.2	mg/mL	0.8 – 4.0
Total SCFA's‡	16	mg/mL	5.0 – 16.0

Intestinal Health Markers	Result	Unit	Reference Interval
pH	7.0		5.8 – 7.0
Occult Blood	Negative		Negative

Macroscopic Appearance	Result	Unit	Reference Interval
Color	Brown		Brown
Consistency	Soft		Soft

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.

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.

SPECIMEN DATA

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Date Received: 05/11/2021
Date Reported: 05/12/2021

Specimens Collected: 3

Methodology: Elisa, Microscopy, Colormetric, Gas Chromotography, ph Electrode, Guaiac, Macroscopic Observation

*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.

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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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Methodology:

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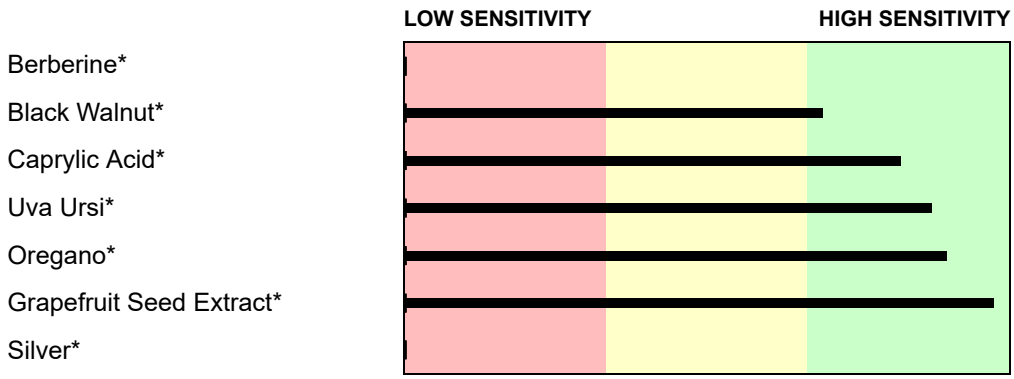
Bacterial Susceptibilities

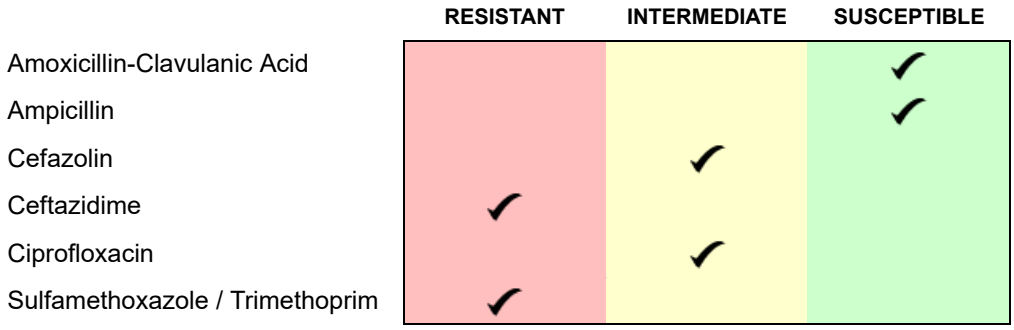
Enterobacter cloacae complex

NATURAL ANTIBACTERIALS



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.

PRESCRIPTIVE AGENTS



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: 05/10/2021
Date Received: 05/11/2021
Date Reported: 05/12/2021
Methodology: Disk Diffusion

Specimens Collected: 3

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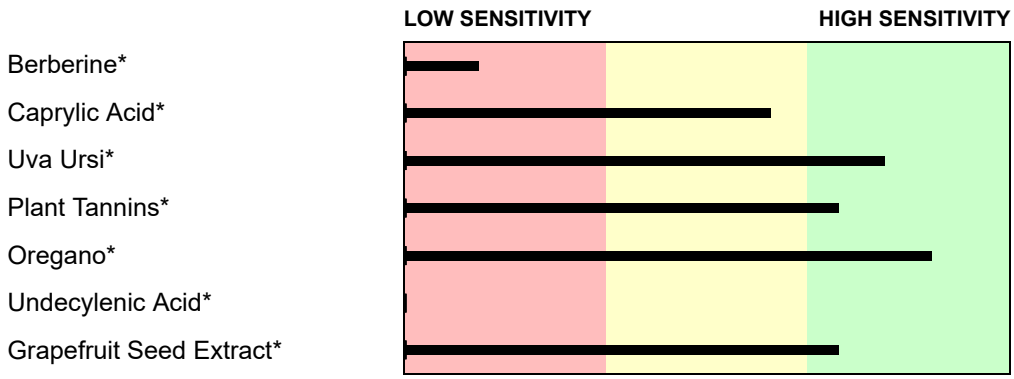
DOCTOR'S DATA INC.

Yeast Susceptibilities

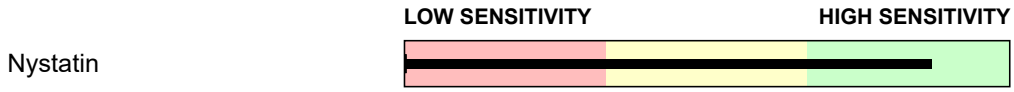
Candida parapsilosis

NATURAL ANTIFUNGALS



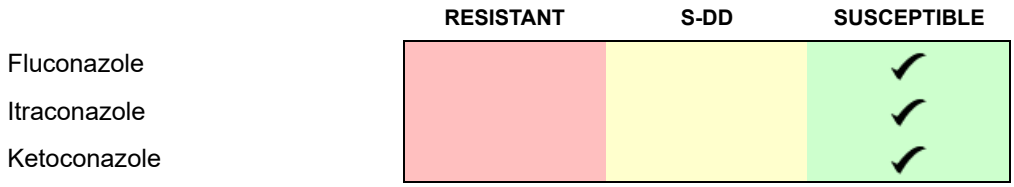
Natural antifungal agents may be useful for treatment of patients when organisms display in-vitro susceptibility to these agents. The test is performed by using standardized techniques and filter paper disks impregnated with the listed agent. Relative activity is reported for each natural agent based upon the diameter of the zone of inhibition or no growth zone 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 activity is defined for the natural agents tested.

NON-ABSORBED ANTIFUNGALS



Non-absorbed antifungals may be useful for treatment of patients when organisms display in-vitro susceptibility to these agents. The test is performed using standardized commercially prepared disks impregnated with Nystatin. Relative activity is reported based upon the diameter of the zone of inhibition or no growth zone surrounding the disk.

AZOLE ANTIFUNGALS



Susceptible results imply that an infection due to the fungus may be appropriately treated when the recommended dosage of the tested antifungal agent is used. **Susceptible - Dose Dependent (S-DD)** results imply that an infection due to the fungus may be treated when the highest recommended dosage of the tested antifungal agent is used. **Resistant** results imply that the fungus will not be inhibited by normal dosage levels of the tested antifungal agent.

Standardized test interpretive categories established for *Candida* spp. are used for all yeast isolates.

SPECIMEN DATA

Comments:

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Date Reported: 05/12/2021
Methodology: Disk Diffusion

Specimens Collected: 3

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CSA-P

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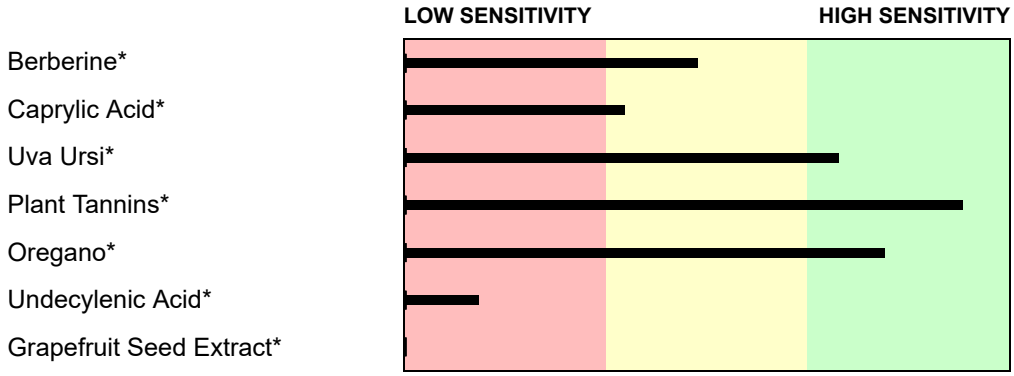
Yeast Susceptibilities

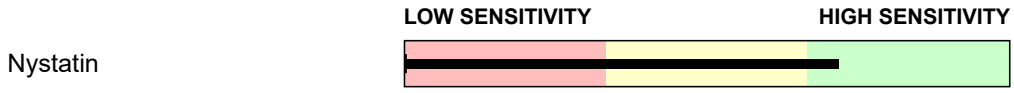
Saccharomyces cerevisiae/boulardii

NATURAL ANTIFUNGALS



Natural antifungal 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 activity is reported for each natural agent based upon the diameter of the zone of inhibition or no growth zone 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 activity is defined for the natural agents tested.

NON-ABSORBED ANTIFUNGALS



Non-absorbed antifungals may be useful for treatment of patients when organisms display in-vitro susceptibility to these agents. The test is performed using standardized commercially prepared disks impregnated with Nystatin. Relative activity is reported based upon the diameter of the zone of inhibition or no growth zone surrounding the disk.

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Methodology: Disk Diffusion

Specimens Collected: 3

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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.

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 bolteae, 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.

Enterobacter cloacae complex

Enterobacter cloacae complex is part of the *Enterobacteriaceae* family. *E cloacae* complex is a group of six closely related species with similar resistance patterns: *E. cloacae, E. asburiae, E. hormaechei, E. kobei, E. ludwigii,* and *E. nimipressuralis*. This gram-negative bacterium is considered dysbiotic at levels of 3+ or greater. *E. cloacae* complex is considered an opportunistic pathogen associated with diarrhea in children. A Shiga-like toxin-producing *E. cloacae* was isolated from the feces of an infant with hemolytic-uremic syndrome. However, *E. cloacae* complex is most often involved in extraintestinal infections including the urinary tract, respiratory tract, and cutaneous wounds.

Widely distributed in the environment, *Enterobacter* spp. is commonly isolated from both human and animal feces. Environmental strains of *Enterobacter* spp. are capable of growth in foods at refrigeration temperature.

E. cloacae complex is known to possess inducible ß-lactamases. Isolates may become resistant to all cephalosporins after initiation of therapy. Avoid ß-lactam-inhibitor drugs such as amoxicillin/ clavulanate, ampicillin/sulbactam, and piperacillin/tazobactam.

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

Microscopic yeast

Microscopic examination has revealed more yeast in this sample than normal. While small quantities of yeast (reported as rare) may be normal, yeast observed in higher amounts (moderate to many) is considered abnormal. Yeast does not appear to be dispersed uniformly throughout the stool. Yeast may therefore be observed microscopically, but not grow out on culture even when collected from the same bowel movement. Further, some yeast may not survive transit through the intestines rendering it unviable for culturing. Therefore, both microscopic examination and culture are helpful in determining if abnormally high levels of yeast are present. If significant yeast are reported by microscopy, but not by culture, consider the presentation of patient symptoms.

Cultured Yeast

Small amounts of yeast (+1) may be present in a healthy GI tract. However higher levels of yeast (> +1) are considered to be dysbiotic. A positive yeast culture and sensitivity to prescriptive and natural agents may help guide decisions regarding potential therapeutic intervention for yeast overgrowth. When investigating the presence of yeast, disparity may exist between culturing and microscopic examination. Yeast grows in colonies and is typically not uniformly dispersed throughout the stool. Further, some yeast may not survive transit through the intestines rendering it unviable for culturing. This may lead to undetectable or low levels of yeast identified by culture, despite a significant amount of yeast visualized microscopically. Therefore, both microscopic examination and culture are helpful in determining if abnormally high levels of yeast are present.

Parasitology

Parasites

Parasites were detected by microscopic examination in this stool specimen. Intestinal parasites are abnormal inhabitants of the GI tract that live off and have the potential to cause damage to their host. Factors such as contaminated food and water supplies, day care centers, increased international travel, pets, carriers such as mosquitoes and fleas, and sexual transmission have contributed to an increased prevalence of intestinal parasites.

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 and 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, decreased immune function, and fatigue.

Parasitology continued...

Entamoeba dispar/histolytica/moshkovskii/bangladeshi

Entamoeba dispar/histolytica/moshkovskii/bangladeshi, an amoeba, was detected in this specimen. The World Health Organization (WHO) defines amebiasis as infection with *Entamoeba histolytica* regardless of the symptomology. It is one of the most common parasitic diseases worldwide, infecting about 50 million people. Humans can be infected with three other species of *Entamoeba, E. dispar, E. moshkovskii and E. bangladeshi*, which are microscopically indistinguishable from *E. histolytica*. Among the 4 species that infect humans, *Entamoeba histolytica* unequivocally causes disease; *Entamoeba dispar* is a harmless commensal; *Entamoeba moshkovskii* seems to be an emerging pathogen; and the pathogenicity of *Entamoeba bangladeshi* remains to be investigated. This parasite normally infects the lumen of the large intestine, where it feeds on bacteria. In some cases, *E. histolytica* can invade the intestinal mucosa. Migration to the liver, lung, brain, skin, or other tissues can also occur. Infection occurs when cysts are ingested in food or water contaminated with feces. There is a high prevalence of *E. histolytica* in Mexico, China, and South East Asia.

Entamoeba histolytica infection is asymptomatic in about 90% of patients. Acute symptoms most commonly occur 1 to 4 weeks after exposure. Symptoms often are quite mild and can include loose stools and abdominal discomfort. Mucosal invasion and ulceration results in amebic dysentery, associated with severe abdominal pain, bloody stools, and fever. Elevated fecal lysozyme, a biomarker of GI inflammation, can indicate more invasive infection. Rarely, *E. histolytica* invades the liver and forms an abscess. Even less commonly, it spreads to other parts of the body, such as the lung or brain.

For asymptomatic infection paromomycin (500 mg tid x 7 days, adult dose) or iodoquinol (650 mg tid x 20 days, adult dose) is recommended. For mild/moderate disease metronidazole (500-750 mg tid x 10 days, adult dose) or tinidazole (2 gm qid x 3 days, adult dose), followed by paromomycin or iodoquinol as described above. For severe disease or extraintestinal infection intravenous antiparasitic therapy may be warranted. Anti-diarrheal medications should not be used. Natural agents include berberine, grapefruit seed extract, *Saccharomyces boulardii*, quassia, and curcumin. Limiting refined carbohydrates in the diet, repairing injured intestinal mucosa, and preventing constipation can also be beneficial.

***Giardia duodenalis* (*intestinalis*, *lamblia*)**

Giardia duodenalis was detected in this specimen. *G. duodenalis*, a single celled protozoa, is the most frequent cause of non-bacterial diarrhea in the United States. The Centers for Disease Control and Prevention (CDC) estimates as many as 2.5 million cases of *Giardia* infection occur annually in the U.S. Symptomatic individuals may experience diarrhea, abdominal cramps, dehydration, malabsorption, loss of appetite, anemia, and weight loss 1-2 weeks following the ingestion of cysts. Typically, symptoms will last 1-2 weeks and infections are self-limiting. Most individuals will be completely asymptomatic. Prevalence of giardiasis in adults has been estimated to be 4-7%. Higher prevalence rates have been reported in children. According to the Food and Drug administration, the higher prevalence of giardiasis in children versus adults suggests that many individuals have a lasting immunity following infection. Approximately 40% of patients diagnosed with giardiasis will demonstrate disaccharide (particularly lactose) intolerance that may last up to six months. Chronic cases of giardiasis may last months to years and are difficult to treat. Chronic giardiasis may lead to a malabsorption syndrome, weight loss, and general weakness and fatigue.

Giardia lives in the intestines of infected humans or animals. Contamination with *Giardia* from soil, food, water, or surfaces can occur from contact with feces from infected sources. Person to person transmission is common in day-care centers where diapering is done, as well as in institutions for persons with special needs. Resistance to drug treatment is common; however, Metronidazole (Flagyl) is effective. Paromomycin is the alternative for treating *Giardia* during pregnancy. Other therapeutic alternatives include nitazoxanide, furazolidone, and quinacrine. Natural substances include berberine, grapefruit seed extract, and quassia. Fatty foods should be avoided, as *Giardia* feeds on bile salts.

Stool Chemistries

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 and polyphenols 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* spp. 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.

GI Pathogens

Adenoviruses

Adenoviruses are non-enveloped DNA viruses. Adenovirus is a cause of acute gastroenteritis in infants, young children, the elderly and immuno-compromised patients. The Adenovirus serotypes most frequently associated with gastroenteritis are Adenovirus 40 and 41. Adenovirus gastroenteritis generally causes watery diarrhea lasting one to two weeks. Usual symptoms include onset of fever and vomiting followed by diarrhea and abdominal pain with occasional respiratory symptoms. Asymptomatic carriage may occur in children who may shed the virus. Adenoviral infection occurs throughout the year and primarily affects children four years of age and younger. Route of infection is via fecal-oral route or aerosol droplets from respiratory infection. Prevent spread of virus by cleaning environs with 1:5 bleach dilution or ultraviolet light (serotype F40). The scientific literature does not currently support any specific herbal or nutritional antiviral therapies for this virus type. Small studies indicate that zinc may reduce severity of illness. Oral rehydration therapy and symptomatic treatment is indicated.

Campylobacter

Most *Campylobacter* infections in industrialized countries are caused by *C. jejuni, C. coli*, and *C. lari* with an estimated 1.5 million cases of foodborne illness due to *Campylobacter* per year in the US. *Campylobacter* spp. are responsible for approximately 15% of hospitalizations resulting from foodborne infections. Generally, campylobacteriosis presents as one to three days of fever, vomiting, and headaches followed by three to seven days of watery or bloody diarrhea and may include abdominal pain, cramping, nausea, headache, and/ or muscle pain within 2-5 days of infection. Contaminated water, pets, food, unpasteurized milk and undercooked poultry, are sources of infection. Use of antibiotics is controversial but may benefit children whom have had symptoms for less than 7 days, and immunocompromised individuals. Recommendations potentially include Azithromycin 500 mg daily for 3 days or Fluoroquinolone for 3 days, but infection may resist fluoroquinolones. Extracts of *Acacia nilotiac* show in vitro antibacterial activities against *Campylobacter* spp. isolated from sheep. Oral rehydration therapy is recommended to prevent dehydration, along with symptomatic treatment of fever and muscle aches.