Comprehensive Digestive Stool Analysis

Patient: **JOHN DOE**

DOB: July 17, 2006

Sex: M

MRN:
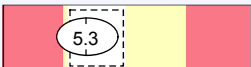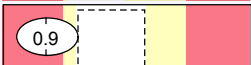
Order Number: E2140541

Completed: October 26, 2011
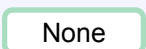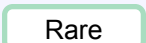
Received: October 14, 2011

Collected: October 12, 2011

Digestion

	Value	Reference Range
Chymotrypsin	5.3	0.9-26.8 U/g
Putrefactive SCFAs (Total*)	0.9	1.3-8.6 micromol/g

* Total values equal the sum of all measurable parts.

	Inside	Outside	Reference Range
Meat Fibers ♦	None		None
Vegetable Fibers	Rare		None - Few

Absorption

	Value	Reference Range
Triglycerides	0.3	0.2-3.3 mg/g
Long Chain Fatty Acids	12.4	1.3-23.7 mg/g
Cholesterol	0.5	0.2-3.5 mg/g
Phospholipids	1.5	0.2-8.8 mg/g
Fecal Fat (Total*)	14.7	2.6-32.4 mg/g

* Total values equal the sum of all measurable parts.

Metabolic Markers

	Value	Reference Range
Beneficial SCFAs (Total*)	21.3	>= 13.6 micromol/g
n-Butyrate	3.9	>= 2.5 micromol/g
Beta-Glucuronidase	1,019	337-4,433 U/g
pH ♦	6.9	6.1-7.9

* Total values equal the sum of all measurable parts.

SCFA distribution

	Value	Reference Range
Acetate %	61.0	44.5-72.4 %
Propionate %	20.8	<= 32.1 %
n-Butyrate %	18.3	10.8-33.5 %

Immunology

	Inside	Outside	Reference Range
Fecal Lactoferrin ♦	Negative		Negative

Macroscopic

	Inside	Outside	Reference Range
Color	Brown		Brown
Mucus	Negative		Negative
Occult blood ♦	Negative		Negative

Microbiology

Bacteriology

Beneficial Bacteria

Lactobacillus species	*NG	
Escherichia coli		4+
Bifidobacterium		4+

Additional Bacteria

alpha haemolytic Streptococcus	NP		4+
gamma haemolytic Streptococcus	NP		4+
Mucoid Escherichia coli	NP		4+
Klebsiella pneumoniae	PP		4+
Enterobacter asburiae	NP		4+
Staphylococcus aureus	PP		4+

Mycology

Yeast, not Candida albicans	NP	1+	
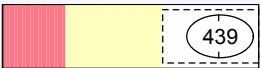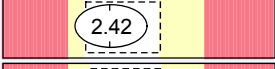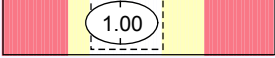
*NG	NP	PP	P
*NG			
No Growth	Non-Pathogen	Possible Pathogen	Pathogen

Additional Tests (if indicated)

		Reference Range		In Range	Out of Range
Pancreatic Elastase ◆	439	>= 201 mcg/g	Campylobacter specific antigen ◆	Negative	
Eosinophil Protein X	<0.7	<= 7.0 mcg/g	Shiga-like Toxin E. coli ◆	Negative	
Calprotectin ◆	110	<=50 mcg/g	Clostridium difficile ◆	Negative	

Bile Acids

|				In Range	Out of Range
Lithocholic Acid (LCA)	2.41	0.65-5.21 mg/g	HpSA- H.pylori (ELISA IgG)	Negative	
Deoxycholic Acid (DCA)	2.42	0.67-6.76 mg/g			
LCA/DCA Ratio	1.00	0.39-2.07			

Commentary

The performance characteristics of all assays have been verified by Genova Diagnostics, Inc. Unless otherwise noted with ◆ as cleared by the U.S. Food and Drug Administration, assays are For Research Use Only.

Commentary is provided to the practitioner for educational purposes, and should not be interpreted as diagnostic or treatment recommendations. Diagnosis and treatment decisions are the responsibility of the practitioner.

The **Reference Range** is a statistical interval representing 95% or 2 Standard Deviations (2 S.D.) of the reference population.

One Standard Deviation (1 S.D.) is a statistical interval representing 68% of the reference population. Values between 1 and 2 S.D. are not necessarily abnormal. Clinical correlation is suggested. (See example below)

Result within Ref Range, but outside 1-SD

Analyte	9.8	2.3 - 12.2 U/g
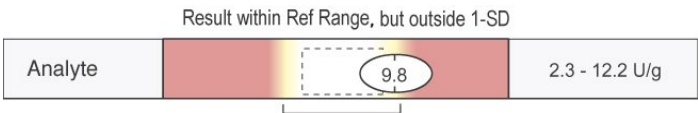
Human microflora is influenced by environmental factors and the competitive ecosystem of the organisms in the GI tract. Pathological significance should be based upon clinical symptoms and reproducibility of bacterial recovery.

Triglycerides constitute the major component of dietary fat and are normally broken down by pancreatic lipase into glycerol and free fatty acids. Triglycerides are within the reference range, indicating adequate fat digestion or a lack of dietary fat.

Chymotrypsin is within the reference range. Chymotrypsin is a key pancreatic enzyme that catalyzes protein digestion. Thus, the fecal level is a measure of proteolytic activity and a marker for pancreatic enzyme output as a whole. A value within the reference range suggests normal enzyme production. Levels are also influenced by transit time, such that faster transit results in higher fecal levels.

Valerate, iso-valerate and iso-butyrate are "putrefactive" short chain fatty acids produced when anaerobic bacteria ferment undigested protein. While low levels of Short Chain Fatty Acids are statistically significant, the clinical relevance is doubtful. Low Putrefactive SCFAs appear to be a variant of normal.

Commentary

Long chain fatty acids (LCFAs) are within the reference range, suggesting adequate absorption of fats by the mucosa of the small intestine or a lack of dietary fat.

Cholesterol is within the reference range, suggesting adequate absorption of cholesterol by the small intestine or low dietary intake.

Phospholipids are normal. 50% of phospholipids are derived from bile, with 25% coming from mucosal desquamation and 25% from dietary sources. Nearly 85% of intestinal phospholipids are absorbed. Normal levels of fecal phospholipids indicate average dietary fat intake and adequate digestion/ absorption.

Total fecal fats are within the reference range. The total fecal fat is calculated as the sum of fecal triglycerides, phospholipids, cholesterol and long chain fatty acids.

Beneficial (Total) short chain fatty acids (SCFAs) are acetate, propionate and n-butyrate. They are the end products of anaerobic microbial fermentation of dietary fiber. Levels thus reflect the concentration of intestinal flora as well as soluble fiber in the diet. These beneficial SCFAs are crucial to the health of the intestine, serving as sources of fuel for the cells and the rest of the body. They also help to regulate the fluid balance in the colon.

n-Butyrate is the most important of the beneficial SCFAs, and is the primary energy source for colonic epithelial cells. Adequate amounts are necessary for the healthy metabolism of the colonic mucosa, and have been shown to have protective effects against colorectal cancers.

Beta-glucuronidase is within the reference range. This is an inducible enzyme, produced by E. coli and anaerobes Bacteroides, and Clostridia. Its activity reverses the detoxication of compounds processed in the hepatic Phase II glucuronidation pathway (including many pharmaceuticals, carcinogens, bile acids, and estrogen).

Fecal pH is within the reference range. The pH of the stool is a reflection of several factors in the GI tract, such as gastric acid, pancreatic bicarbonate, short chain fatty acids, ammonia, bile, organic acids, and acids produced by beneficial flora. Proper levels enhance colonization by beneficial flora, deter possible pathogens, promote normal digestive processes, and promote SCFA production.

The SCFA Distribution reflects the relative proportions of the beneficial SCFAs (n-butyrate, propionate, and acetate), thus providing an indirect measure of balance among the anaerobic organisms in the colon.

Sufficient amounts of Bifidobacteria and E. coli appear to be present in the stool, however Lactobacilli is below optimal levels. Ample amounts of E. coli have been associated with a balanced gut flora. The "friendly bacteria", Lactobacilli and Bifidobacteria, are important for gastrointestinal function, as they are involved in vitamin synthesis, natural antibiotic production, immune defense, digestion, detoxification of pro-carcinogens and a host of other activities. Ideally, levels of Lactobacillus and E. coli should be 2+ or greater.   Bifidobacteria being a predominate anaerobe should be recovered at levels of 4+.

Klebsiella has been associated with diarrhea in humans, and is capable of translocating from the gut when in high numbers. Klebsiella appears to thrive in individuals on a high starch diet. Avoiding carbohydrates such as rice, potatoes, flour products and sugary foods reduces the amount of Klebsiella in the gut.

 Staphylococcus aureus had been associated with food poisoning, and symptoms are usually attributed to the enterotoxin produced by the organism. Symptoms usually appear within 1 to 6 hours after ingestion, though the individual response to the toxin may vary and depends upon the amount of contaminated food eaten, the amount of toxin ingested, and general health status. Foods that require considerable handling during preparation and/or are kept at slightly elevated temperatures after preparation are frequently involved in staphylococcal food poisoning.

There is no detection of fecal lactoferrin. This indicates no active intestinal inflammation. However, non-inflammatory diarrhea caused by irritable bowel syndrome, small intestinal viral infections, non-invasive parasitic infections, or other etiologies may still be present even in the absence of lactoferrin.

A 1+ quantity of yeast is considered an acceptable amount of yeast in the stool. It may, however, reflect a condition of yeast overgrowth, especially when moderate or many yeast are reported on the microscopic (parasitology) exam, or may lead to symptoms in individuals showing deficient beneficial bacteria.

Commentary

Pancreatic Elastase 1 (PE1) is a simple, noninvasive method of assessing exocrine pancreatic function, contributing to a prompt and reliable diagnosis in suspected cases of pancreatic insufficiency. Reduced PE1 has been found in patients with diabetes, cholelithiasis and osteoporosis. PE1 has been shown to decline with age and can be used to monitor/adjust the dosage of pancreatic enzyme supplementation.

Eosinophil Protein X (EPX) reflects inflammation and tissue damage, and can be elevated in celiac disease, collagenous colitis, helminthic/parasitic infection, and IgE mediated food allergies. Elevated EPX requires further diagnostic testing to determine the cause.

Calprotectin is a neutrophilic marker specific for inflammation in the gastrointestinal tract. It is elevated with infection, post-infectious IBS, and NSAID enteropathy. Fecal calprotectin can be used to differentiate IBD vs. IBS, to monitor treatment in IBD, and to determine which patients should be referred for endoscopy and/or colonoscopy. Levels between 50-120 should be repeated at 4-6 weeks and confirmed.

Bile Acids: Colonic bacteria metabolize primary bile acids to secondary bile acids. Dietary fiber and bacteria flora determine the rates of metabolism for the secondary bile acids, lithocholic acid (LCA) and deoxycholic acid (DCA). The LCA:DCA ratio may be an important discriminating marker in colorectal cancer susceptibility. An elevated secondary bile acid ratio is associated with an increased risk of breast and colorectal cancer. Elevated levels may also occur in patients with gall stones and after cholecystectomy.

Clostridium difficile is an anaerobic, spore-forming gram-positive bacterium that can be part of the normal intestinal flora. After a disturbance of the gut flora (usually with antibiotics), colonization with toxin producing Clostridium difficile can take place.   Diarrhea, as a result of Clostridium difficile infection and toxin production may be much more common as a cause of diarrhea than once thought.

HpSA (Helicobacter pylori stool antigen): Helicobacter pylori is a bacterium which causes peptic ulcer disease and plays a role in the development of gastric cancer. Direct stool testing of the antigen (HpSA) is highly accurate and is appropriate for diagnosis and follow-up of infection.

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Prescriptive Agents

KLEBSIELLA PNEUMONIAE

	S	I	R
Ampicillin			R
Amox./Clavulanic Acid	S		
Cephalothin	S		
Ciprofloxacin	S		
Tetracycline	S		
Trimethoprim/Sulfa			R

S Indicates susceptibility to prescriptive agents

I Indicates intermediate susceptibility to prescriptive agents

R Indicates resistance to prescriptive agents

Natural Agents

KLEBSIELLA PNEUMONIAE

	Low Inhibition — High Inhibition
Berberine	
Oregano	
Plant Tannins	
Uva-Ursi	

Prescriptive Agents:

Microbial testing has been performed in vitro to determine antibiotic sensitivity and resistance at standard dosages. Prudent use of antimicrobials requires knowledge of appropriate blood or tissue levels of those agents. Antibiotics that appear in the "S" (susceptible) column are more effective at inhibiting the growth of this organism. Antibiotics that appear in the "I" (intermediate) column are partially effective at inhibiting the growth of this organism. Antibiotics that appear in the "R" (resistant) column allow continued growth of the organism in vitro and are usually less effective clinically. Inappropriate use of antibacterials often results in the emergence of resistance.

Natural Agents:

In this assay, "inhibition" is defined as the reduction level on organism growth as a direct result of inhibition by a natural substance. The level of inhibition is an indicator of how effective the natural substance was at limiting the growth of an organism in an in vitro environment. High inhibition indicates a greater ability by the natural substance to limit growth, while Low Inhibition a lesser ability to limit growth. These natural products should be considered investigational in nature and not be viewed as standard clinical treatment substances.

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Prescriptive Agents

STAPHYLOCOCCUS AUREUS

	S	I	R
Penicillin-G			R
Oxacillin	S		
Ciprofloxacin	S		
Clindamycin	S		
Vancomycin	S		
Trimethoprim/Sulfa	S		
Amox./Clavulanic Acid	S		
Ampicillin/sulbactam	S		

S Indicates susceptibility to prescriptive agents

I Indicates intermediate susceptibility to prescriptive agents

R Indicates resistance to prescriptive agents

Natural Agents

STAPHYLOCOCCUS AUREUS

Low Inhibition — High Inhibition

Berberine	
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