EnteroScan® Comprehensive v2.0

COMPREHENSIVE ANALYSIS OF THE GUT MICROBIOME & INTESTINAL FUNCTION

Name:	Gender: **FEMALE**	Age: **73 YEARS**
Sample Taken Day: **3 NOVEMBER 2023**	Date of Analysis: **3 NOVEMBER 2023**	
Specimen: **Stool**	Patient Code Number:	

Macroscopic Inspection & General Characteristics

	Result		Reference Range
Density	Very Soft	🔴	Soft
Color	Brown	🟢	Brown
Mucus	2+	🟢	0 – 2+
Pus	0	🟢	Negative
Fibers	2+	🟢	0 – 2+
Food Debris	2+	🟢	0 – 2+

Density: Feces contain about 75% (63-86%) of water and should generally be formed and soft. Fecal density depends on the bowel transit time and water absorption.

Color: Fecal color indicates various pathological conditions of the gastrointestinal tract. Usually, the color is light brown to brown.

Pus and Mucus: The presence of mucus or pus is indicative of irritable bowel syndrome, inflammation of the intestinal wall, Salmonella, Shigella or amoeba infections, diverticulitis, intestinal abscesses, etc. Stool mucus may be due to prolonged intestinal irritation or stimulation of the parasympathetic nervous system, as in constipation or colitis.

Fibers and Food Debris: Their presence above normal range is indicative of hypochlorhydria, pancreatic insufficiency, inadequate chewing, and poor digestion

Fecal Classification According to the Bristol Scale

	Result		Reference Range
Classification	Type 5	🔴	Type 3 - 4

The Bristol scale is a medical aid for the classification of feces into 7 categories (1-7) and is a way of estimating the bowel transit time. Types 1-2 indicate constipation; types 3-4 are normal (especially 4), whereas types 5-7 indicate diarrhea.

Note: The result is a combination of laboratory assessment and medical history (patient assessment)

Acid-Base Balance

	Result	Reference Range	≤ 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 ≥8.5
Fecal pH	6,5	6.0 – 7.0	

Fecal pH results from the effect of various factors in the gastrointestinal tract, such as gastric acid, pancreatic bicarbonate, short-chain fatty acids (SCFA), ammonia, bile, organic acids, and acids produced by gut flora. Normal fecal pH levels enhance bowel colonization by beneficial bacteria and prevent colonization by pathogenic and potentially pathogenic microorganisms, promote the physiological processes of digestion and absorption of nutrients, and the production of SCFA.

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Microscopic Inspection

	Result		Reference Range
White Blood Cells	0 - 2 HPF	●	0 - 2 HPF *
Red Blood Cells	0 - 1 HPF	●	0 - 1 HPF
Fat Granules	0 - 2 HPF	●	0 - 2 HPF
Starch Granules	0 - 2 HPF	●	0 - 4 HPF

White Blood Cells: Elevated white blood cells in the stools indicate inflammation or infection of the gastrointestinal tract.
Red Blood Cells: The presence of erythrocytes in the sample indicates possible bleeding of the gastrointestinal system (due to hemorrhoids, polyps, or malignancy) and should be investigated, first by repeating the test and second using other specific tests (stool hemoglobin, M2-PK) and subsequently with colonoscopy and/or gastroscopy.
Lipid Granules: Increased fat granules levels in the stools indicate poor digestion and malabsorption.
Starch Granules: Increased levels of starch granules in stools indicate poor digestion and malabsorption, mainly of carbohydrates.

Digestion & Nutrients Absorption Indicators

TEST	RESULT		REFERENCE RANGE
Pancreatic Elastase **Method**: Enzyme-linked immunosorbent Assay (ELISA)	494 μg/g	●	Normal: >**200 μg/g** Mild to moderate insufficiency: **100 – 200 μg/g** Severe insufficiency: **0 – 99 μg/g**

Pancreatic elastase is a digestive enzyme the pancreas produces and secretes into the duodenum. Pancreatic Elastase is predominantly bound to bile salts during its intestinal transit and thus does not break down. Its concentration in the stool reflects the secretory capacity of the pancreas. It is a valuable indicator for diagnosing or excluding pancreatic exocrine function insufficiency in unexplained diarrhea, constipation, steatosis, flatulence, weight loss, upper abdominal pain, and food intolerance. It also monitors pancreatic exocrine function in cystic fibrosis, diabetes mellitus, and chronic pancreatitis.

Note: The laboratory successfully participates in the interlaboratory external quality control of INSTAND e.V., Germany, for stool diagnostic tests.

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Digestion & Nutrients Absorption Indicators

	Result		Reference Range
Undigested Muscle Fibers	0 - 0 HPF	●	0 HFP
Undigested Vegetable Fibers	0 - 2 HPF	●	0 – 2 HFP
Carbohydrates	< 0.25 g/dL	●	Negative: < 0.25 g/dL Borderline: 0.25–0.5 g/dL Positive: > 0.5 g/dL
Triglycerides	1,8 mg/g	●	0.2 – 3.5 mg/g
Cholesterol	1,0 mg/g	●	0.2 – 3.8 mg/g
Acid Steatocrit	15,2%	●	< 31.0%
Total Fecal Fat	6,41 gr/24h	●	5.80 – 12.40 gr/24h

Undigested Muscle Fibers: Undigested muscle fibers indicate insufficient digestion - especially of proteins, due to HCl / pepsin deficiency in the stomach or dysfunction of the exocrine pancreas.

Undigested Vegetable Fibers: Undigested vegetable fibers may indicate insufficient chewing or inadequate digestion - especially of carbohydrates.

Carbohydrates: Fecal carbohydrates estimate the presence of all reducing substances (glucose, galactose, fructose, lactose, etc.). The presence of carbohydrates in stools suggests a lack of enzymes that degrade them due to congenital deficiency or non-specific inflammation of the intestinal mucosa.

Triglycerides: Triglycerides are the main ingredient of food fat and are usually cleaved from pancreatic lipase to glycerol and free fatty acids.

Cholesterol: Fecal cholesterol derives from both dietary sources and the degradation and catabolism of intestinal mucosal epithelial cells. Increasing cholesterol levels may indicate malabsorption or rapid destruction of cells, as in mucosal inflammation.

Acid Steatocrit: Acid steatocrit is an indicator of the total fat in stools. It is considered the most accurate method for fecal fat from a single stool sample.

Total Fecal Fat: Total fat includes the sum of all fecal lipids. These fats are mainly derived from the diet, although a part comes from bile and apoptosis of the intestinal mucosa. Increasing total fat is indicative of malabsorption.

*Per High Power Field (400X)

● Normal Result ● Borderline Result ● Pathological Result

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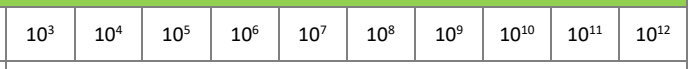
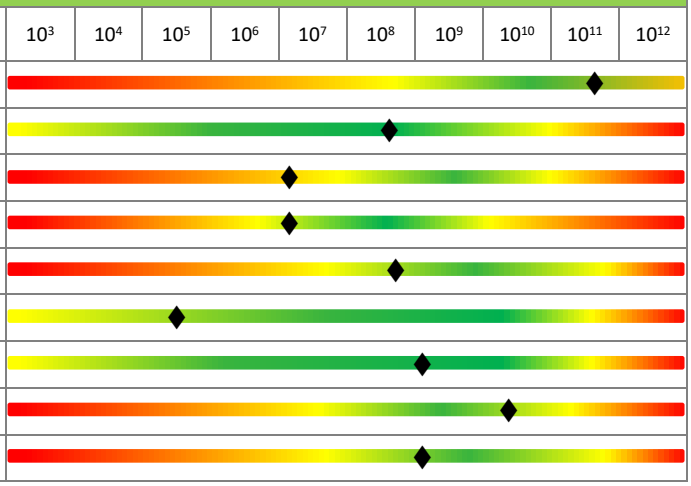
Quantitative Determination of Aerobic Gut Microbiome

	Result (GE/ml)	Reference Range (GE/ml)
E. coli	1 x 10^5	10^6 – 10^8
E. coli Enteropathogenic	5 x 10^1	< 10^3
Enterococcus sp.	2 x 10^5	< 10^8
Klebsiella pneumoniae	5 x 10^2	< 10^4
Klebsiella oxytoca	4 x 10^1	< 10^4
Proteus vulgaris / mirabilis	6 x 10^1	< 10^4
Enterobacter sp.	3 x 10^6	< 10^4
Citrobacter sp.	7 x 10^2	< 10^4
Staphylococcus aureus	5 x 10^2	< 10^4
Acinetobacter spp.	7 x 10^4	< 10^6
Streptococcus sp.	4 x 10^8	< 10^8
Salmonella sp.	Not Detected	Not Detected
Shigella sp.	Not Detected	Not Detected



Quantitative Determination of Anaerobic / Microaerophilic Gut Microbiome

	Result (GE/ml)	Reference Range (GE/ml)
Bacteroides sp.	7 x 10^{11}	10^9 – 10^{12}
Bacteroides thetaiotaomicron	6 x 10^8	< 10^{10}
Bifidobacterium sp.	1 x 10^7	10^8 – 10^{10}
Lactobacillus sp.	1 x 10^7	10^7 – 10^9
Blautia sp.	7 x 10^8	10^8 – 10^{11}
Prevotella sp.	4 x 10^5	< 10^{11}
Ruminococcus sp.	1 x 10^9	< 10^{11}
Roseburia inulinivorans	4 x 10^{10}	10^8 – 10^{10}
Eubacterium rectale	1 x 10^9	10^8 – 10^{11}



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Name:	Gender: **FEMALE**	Age: **73 YEARS**
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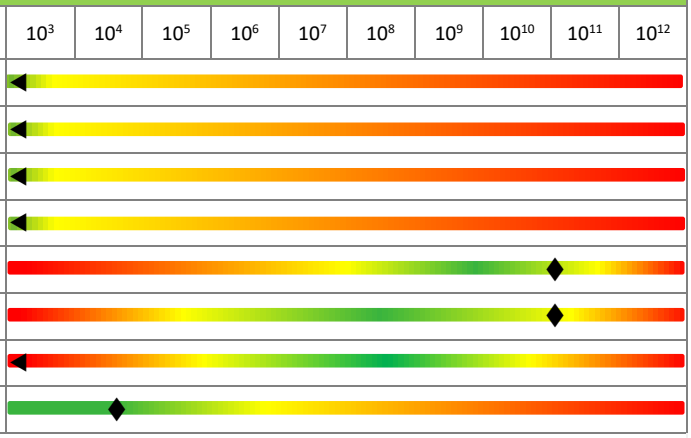
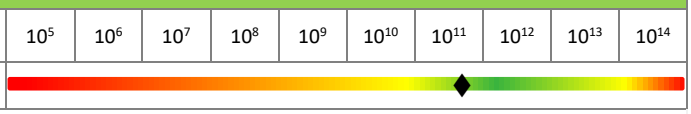
Quantitative Determination of Anaerobic / Microaerophilic Gut Microbiome

	Result (GE/ml)	Reference Range (GE/ml)
Fusobacterium nucleatum	Not Detected	Not Detected
Clostridium difficile	Not Detected	Not Detected
Clostridium perfringens	Not Detected	Not Detected
Parvimonas micra	Not Detected	Not Detected
Faecalibacterium prausnitzii	1×10^{11}	$10^{8} – 10^{11}$
Akkermansia muciniphila	1×10^{11}	$10^{6} – 10^{11}$
Methanobrevibacter smithii	4×10^{2}	$10^{6} – 10^{10}$
Methanosphaera stadmanae	5×10^{4}	$< 10^{6}$



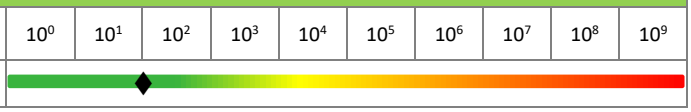
Total Microbiome Mass

	Result (GE/ml)	Reference Range (GE/ml)
Total Microbiome Mass	7×10^{11}	$10^{11} – 5 \times 10^{12}$



Quantitative Determination of Fungal Gut Mycobiome

	Result (GE/ml)	Reference Range (GE/ml)
Candida sp.	9×10^{1}	$< 1 \times 10^{4}$



Methodology

Total DNA was isolated from the biological material, the quality and quantity of which were spectrophotometrically tested. Intestinal microbiome detection kits are based on **Real-Time PCR**. The PCR mixture contains probes identifying specific genetic targets in the isolated genetic material. Once the genetic target is hybridized, the detector is activated. As a result of activation, fluorescence increases in proportion to the amplification of the target sequence. The fluorescence intensity is measured in each reaction cycle with the real-time PCR thermal cycler and analyzed with special software. The genetic material was isolated with specially designed stool extraction kits.

*GE/ml: Genome Equivalent/ml (Unit for measuring DNA copies)

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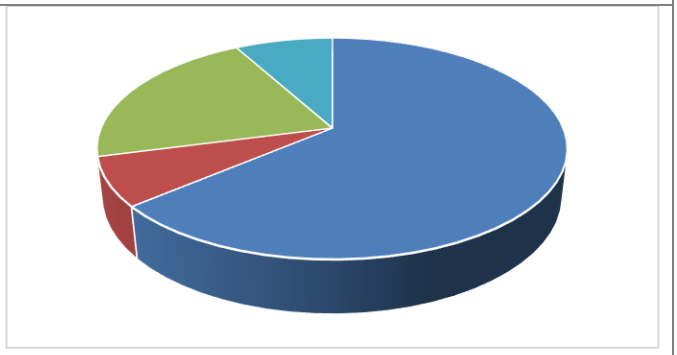
Microbial Phyla Distribution

	Result (%)	Reference Range (%)
Bacteroidetes	63,8	33.0 – 66.0
Firmicutes	7,1	28.0 – 57.0
Actinobacteria	21,1	0.2 – 4.8
Proteobacteria	0,0	0.7 – 4.5
Verrucomicrobia	8,0	0.2 – 4.0
Euryaercheota	0,0	0.0 – 0.6
Fusobacteria	0,0	0.0 – 0.9
Firmicutes / Bacteroidetes	0,11	0.9 – 1.4



The Microbial Phyla are tested the same way as the individual microorganisms' species and genera: isolation of DNA and bacterial phylum determination with independent real-time PCR.

Balance of Intestinal Microbiome

				Mild		Moderate		Severe		Very Severe		
	Result	**Reference Range**	0-1	2-3	4-5	6-7	8-9	10-11	12-13	14-15	16-17	18-19
Intestinal Dysbiosis Index	5,0	0 – 1										

Intestinal Dysbiosis Index: Points show the deviation of the intestinal flora from the average. Normal flora has an Intestinal Dysbiosis Index of 0 points. The higher the Intestinal Dysbiosis Index, the greater the deviation from regular, and the more intense the Dysbiosis is. Dysbiosis is Mild, Moderate, Severe, and Very Severe.

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Basic Parasitological Stool Examination

	Result		*Comments*
Entamoeba histolytica[*]	Negative (-)	●	Amoebas often cause acute diarrhea and other gastrointestinal symptoms. In some cases, amoebiasis can be chronic, and in some rare instances, amoebas can escape from the intestinal lumen forming abscesses in other organs.
Entamoeba dispar[*]	Negative (-)	●	Entamoeba dispar is a non-pathogenic amoeba of the human gastrointestinal tract morphologically and microscopically identical to the pathogenic amoeba Entamoeba histolytica. Some strains of E. dispar have been associated with non-dysenteric colitis and liver abscesses; therefore, the non-pathogenicity of E. dispar is questionable.
Giardia lamblia[*]	Negative (-)	●	Giardia is a flagellate protozoon that infects the small intestine and is transmitted by fecal-oral route. Contaminated water and food are the main sources of the parasites. Symptoms include diarrhea and malabsorption of nutrients, weakness, flatulence, etc.
Cryptosporidium parvum[*]	Negative (-)	●	Cryptosporidium is a microscopic parasite that causes the diarrheal disease cryptosporidiosis. The parasite is protected in the environment by a "shell" that makes it resistant even to chlorination. The most common way of transmission is via water.
Blastocystis hominis[+]	Negative (-)	●	It is the most common parasite but is often overlooked. It is potentially pathogenic and has been associated with chronic pathological conditions such as irritable bowel syndrome, chronic fatigue, arthritis, and others.
Balantidium coli	Negative (-)	●	It is the largest protozoon that infects humans. It is transmitted from contaminated water or food. The disease may remain asymptomatic or appear with diarrhea and abdominal pain.
Nematodes	Negative (-)	●	The Nematodes group includes many parasites such as Ascaris, Ancylostoma and pinworms. Stool examination is for both parasites and their eggs.
Cestodes	Negative (-)	●	The Cestodes group includes Taenias and genera like Echinococcus and Hymonolepis. They are transmitted to humans by consuming infected me. Stool examination is for both parasites and their eggs.

Note: 2-3 stool samples are required on different days before the final decision on the absence of an intestinal parasitic infection

[*]**Method**: Molecular (RT-PCR)
[+]**Method**: Culture & Microscopy. Quantitative Parasitic Determination is reported as Positive if it is > 5 / HFP

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Specialty Stool Tests

	TEST	RESULT		REFERENCE RANGE
933	***Helicobacter pylori*, Antigen** (Rapid method [immunochromatography] for the qualitative detection of Helicobacter pylori in stool using monoclonal antibody) **Method Specificity**: ~97% **Method Sensitivity**: ~92%	Negative (-)	●	**Negative (-)** Absence of Helicobacter pylori **Positive (+)** Presence of Helicobacter pylori
933	Helicobacter pylori is a Gram (-) bacterium found in the stomach and can cause ulcers and chronic gastritis. It has been associated with an increased risk of stomach cancer. More than 80% of people having Helicobacter are asymptomatic, and about 50% of the world's population has Helicobacter in their stomachs. This test reveals H. pylori directly in the gastrointestinal tract and can also be used to monitor eradication treatment. The precise way of microbe transmission has yet to be discovered, with a more likely way of transmission from one person to another.			

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Indicators of Gastrointestinal System Inflammation

TEST	RESULT		REFERENCE RANGE
Faecal Calprotectin **Method**: Enzyme-linked immunosorbent Assay (ELISA)	29,5 μg/g	●	**Negative**: 0 – 50 μg/g faeces **Borderline**: 51 – 100 μg/g faeces **Positive**: ≥ 101 μg/g faeces

Calprotectin is predominantly produced by polymorphonuclear neutrophil cells and is a specific and sensitive marker of inflammation. It is used for the diagnosis and monitoring of inflammatory bowel diseases. Calprotectin levels of < 50 μg/g of faeces mean no active inflammatory process in gastrointestinal tract. Borderline calprotectin levels (51-100 μg / g of faeces) may be indicative of a mild inflammatory process (e.g. IBD under treatment or in remission) or associated with taking of non-steroidal anti-inflammatory drugs (NSAIDs), aspirin and proton pump inhibitors (PIP). For patients with IBD symptoms and borderline calprotectin levels, it is recommended to repeat testing after 4-6 weeks. Calprotectin levels of > 101 μg / g of faeces mean an active inflammatory process in the gastrointestinal tract (e.g. ,IBD, celiac disease, colon cancer, gastrointestinal infections).

Indicative mean calprotectin concentration in patients with symptomatic colorectal cancer is > 350 μg / g of faeces, whereas, in active, symptomatic IBD, it can be 200 – 40.000 μg/g of faeces.

According to recent studies (Feng Li et al., 2015, PLOS One & Hestvik et al., 2011, BMC Pediatrics), the concentration of calprotectin in apparently healthy children is:
0 – 3 months: 345 μg/gr faeces (95% CI* 195 – 621 μg/gr faeces)
3 – 6 months: 278 μg/gr faeces (95% CI 85 – 988 μg/gr faeces)
6 – 12 months: 183 μg/gr faeces (95% CI 109 – 418 μg/gr faeces)
1 – 4 years: 75 μg/gr faeces (95% CI 53 – 119 μg/gr faeces)
4 – 12 years: 28 μg/gr faeces (95% CI 25 – 35 μg/gr faeces)

* confidence interval

Note: The laboratory successfully participates in the interlaboratory external quality control of INSTAND e.V., Germany, for stool diagnostic tests.

TEST	RESULT		REFERENCE RANGE
Faecal Hemoglobin (**FOB – Fecal Occult Blood**) **Method**: Immunochromatography	Negative (-)	●	Negative (-)

Method Detection Limit: 6 μg Hemoglobin / 1 gr faeces
Method Relative Sensitivity: 99.1% (98.2% – 99.6%)
Method Relative Specificity: 93.6% (90% – 97%)
Method Relative Accuracy: 98.0% (96.9% – 98.7%)

Faecal Hemoglobin: Qualitative detection of human hemoglobin using a monoclonal antibody. Blood in stool may be due to stomach ulcers, polyps, inflammatory bowel diseases, diverticulitis, and colon malignancies.

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Indicators of Gastrointestinal System Inflammation and Hypersensitivity

	Result		Reference Range
Faecal Histamine **Method**: Enzyme-linked immunosorbent Assay (ELISA)	**3287 ng/g**	↑	< 959 ng/g faeces

Faecal Histamine: A natural substance released by the immune system after exposure to an allergen. Histamine is also released from injured cells and acts as a vasodilator. Increased levels of stool histamine may be caused by food intolerance (from food or food additives), food allergy, as a side effect of some medicines, inflammation, stress, alcohol, etc.

Indicators of Intestinal Immunological Status

	Result		Reference Range
Secretory Immunoglobulin A (sIgA) **Method**: Enzyme-linked immunosorbent Assay (ELISA)	**3187 µg/ml**	↑	510 – 2040 µg/ml

Secretory Immunoglobulin A: Secreted from basal membrane plasma cells regardless of serum IgA production. Reduction of secretory IgA in stool indicates reduced immune system activity in the intestine, and its increase is associated with increased activity e.g., in infections, allergies, and autoimmune diseases.

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Indicator of Gastrointestinal System Homeostasis

	Result		Reference Range
Intestinal Alkaline Phosphatase (**IAP**) **Method:** Enzymatic / Spectrophotometric	252 U/g	●	> 70 U/g faeces

Intestinal Alkaline Phosphatase is an enzyme secreted by the intestinal epithelial cells. It is positioned at the **crossroads** between nutrition, lipid absorption, gut microbiota, LPS, and inflammation, causative agents of obesity, metabolic diseases, and other diseases. Intestinal Alkaline Phosphatase is involved in many functions: regulation of pH on the surface of the intestine and secretion of bicarbonates from the pancreas, absorption of lipids, inactivation of free nucleotides through dephosphorylation (ATP, ADP, AMP), and bacterial toxic substances(e.g., lipopolysaccharide [LPS], phalatlin, methylation-free CpG dinucleotides), reduction of intestinal inflammation and systemic inflammatory response, regulation of intestinal microbiota, reduction of microbe translocation, reduction of immune response and inflammatory response due to LPS, involvement in inflammatory bowel diseases (Crohn and ulcerative colitis), regulation of calcium absorption, involvement in diseases such as necrotizing enterocolitis and celiac disease, reduction of metabolic syndrome, regulation of intestinal permeability.
Blood groups 0 and B have a higher IAP concentration, while group A is lower. Reduction in intestinal alkaline phosphatase activity is associated with increased intestinal inflammation, dysbiosis, bacterial translocation, and subsequent systemic inflammation.

Leaky Gut Indicator

	Result		Reference Range
A1-Antitrypsin **Method**: Enzyme-linked immunosorbent Assay (ELISA)	0,077 mg/g	●	< 0.268 mg/g faeces

A1-antitrypsin is an enzyme typically produced by the liver and circulates in the blood. There are very small quantities of A1-antitrypsin in the intestine and feces. The physiological role of A1-antitrypsin in the blood is to inactivate certain enzymes (enzyme inhibitors), while its deficiency (congenital or acquired) is associated with chronic obstructive pulmonary disease. An increase of A1-Antitrypsin in the stools is indicative of intestinal protein loss, which is a sign of increased intestinal permeability and leaky gut syndrome. The consequences of leaky gut are that substances usually filtered by the intestine "leak" into the bloodstream and can lead to the appearance of various pathological conditions associated with leaky gut, such as IBD, Irritable Bowel Syndrome (IBS), Food Intolerance, and Food Allergy, Asthma, Type 2 Diabetes, Obesity and Metabolic Syndrome, Chronic Inflammation, Malabsorption Syndromes, Autoimmune Diseases, Allergies, etc.

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Short Chain Fatty Acids (SCFA)

Test	Result (µmol/g)		Result (%)		Reference Range
Acetic Acid (C2)	14,7	●	50,5%	●	14.4 – 156.3 µmol/g (33.0 – 71.6%)
Propionic Acid (C3)	4,9	●	16,8%	●	2.4 – 41.4 µmol/g (7.9 – 35.5%)
Butyric Acid (C4)	8,2	●	28,2%	●	1.9 – 47.1 µmol/g (7.7 – 30.8%)
Iso-Butyric Acid (C4)	0,8	●	2,7%	●	0.0 – 4.5 µmol/g (0.0 – 4.8%)
Valeric Acid (C5)	0,5	●	1,8%	●	0.0 – 6.0 µmol/g (0.0 – 5.3%)
Total SCFA	29,1	●			24.2 – 242.6 µmol/g

Short Chain Fatty Acids (SCFAs): SCFAs are produced by the fermentation of fiber and protein by certain members of the gut flora. SCFAs produced by the fermentation of fiber by bacteria such as Bifidobacteria and lactobacilli have beneficial effects, such as being used as an energy source by intestinal epithelial cells (and the rest of the body) and creating an acidic intestinal environment. unfavorable for the development of pathogens. In addition, SCFAs have anti-inflammatory and anti-cancer effects on the intestinal epithelium, antimicrobial properties, and help maintain the integrity of the intestinal barrier. Low SCFA levels may indicate that the diet is low in fiber or protein or that there is an imbalance in the intestinal flora (dysbiosis)

Detection Method: High-Pressure Liquid Chromatography (HPLC)

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Fecal Chemical Composition

	Result		Reference Range
Water	86,8%	🔴	63.0 – 86.0 %
Proteins	3,3%	🟢	3.2 – 16.2%
Fat	3,9%	🟢	2.4 – 8.0%
Carbohydrates (Sugars)	0,00%	🟢	0.0 – 0.06%
Dietary Fibers[+]	3,3%	🟢	0.4 – 19.0% (Median: 5%)
Inorganic Elements	2,7%	🟢	1.5 – 3.1%

Water: Feces contain about 75% (63-86%) water and should usually be formed and soft. Fecal density depends on the rate of bowel transit time and water absorption.

Proteins: Fecal protein content is derived from undigested food proteins, microbial proteins, apoptotic epithelial cells, and mucus proteins.

Fat: Fecal fat includes fatty acids, waxes, and phosphoglycerates and is derived from undigested food fat, bacteria, and apoptotic epithelial cells.

Carbohydrates: Fecal carbohydrates are primarily made up of undigested cellulose, plant fibers, and pentosan. Feces do not contain large amounts of carbohydrates because most are absorbed.

Dietary Fibers: Fibers are found in stools because the large polysaccharides prevent digestion. The dietary intake of fibers strongly affects the amount of fecal fibers.

Inorganic Elements: Inorganic fraction of feces consists predominantly of calcium phosphate and iron phosphate. In healthy adults, the amount of inorganic elements is in equilibrium and is not subject to any change inside the body.

[+]There is a significant variation in daily dietary fiber consumption, and it is dependent on age, geographic area, socio-economic situation, as well as specific dietary specifications (e.g., vegetarian, raw food diet, etc.), diet, body weight and the amount and type of dietary fiber (indigestible or digestible).

EnteroScan® Comprehensive v2.0

COMPREHENSIVE ANALYSIS OF THE GUT MICROBIOME & INTESTINAL FUNCTION

Name:	Gender: **FEMALE**	Age: **73 YEARS**
Sample Taken Day: **3 NOVEMBER 2023**	Date of Analysis: **3 NOVEMBER 2023**	
Specimen: **Stool**	Patient Code Number:	

Special Comments

Bifidobacterium sp.
The large intestine, small intestine, mouth, and vagina are the natural environment of Bifidobacteria. They make up an important part of the permanent microorganisms of the intestinal flora, which tend to decrease in elderly patients. In breastfed infants, species of Bifidobacterium represent the predominant bacterial population during the end of the first week of life.
Due to their high number and their saccharolytic activity, they contribute to the resistance of the colonization of the gastrointestinal tract by producing short-chain fatty acids and lowering the pH of the intestinal contents in cooperation with lactobacilli and enterococci. Bifidobacteria use ammonia as a source of nitrogen at acidic pH. Their optimal growth takes place at pH values between 6 and 7. Bifidobacteria are considered vital to the health of infants, preventing the growth of disease-causing bacteria. Breast milk promotes the growth of Bifidobacteria.
As the newborn matures, Bifidobacteria decrease, and usually, in adult humans, their total number is less than 3% of the total microbial population. These microbes help the body and are involved in lactose tolerance, preventing diarrhea, reducing food allergies, and inhibiting the growth of pathogens. Increased concentrations of Bifidobacterium are observed in obese and overweight patients compared to lean patients. Lower concentrations of Bifidobacterium have been associated with Irritable Bowel Syndrome after weight loss surgery and gastric bypass, in patients with Inflammatory Bowel Disease (IBD), in patients with Alzheimer's disease, in children with Type 2 diabetes and allergies, and in children with Autism disorders. Infants with lower concentrations of Bifidobacterium have an increased risk of developing childhood obesity.

Escherichia coli
Escherichia coli (E. coli) is considered one of the most important microbes of the intestinal microbiome, although it represents less than 0.01% of the total intestinal microbiome. E. coli plays critical roles in the intestine:
>Antibacterial properties: synthesis of microbicidal substances that have antagonistic activity against enteropathogenic microbes.
>Stabilization of the intestinal barrier: stimulation of the mucosal immune system and production of sIgA via lipopolysaccharides (LPS) and low molecular weight peptides.
>Metabolic properties: production of short-chain fatty acids (SCFA) by breakdown of carbohydrates.
>Gases production (H2 and CO2) with the presence of increased concentrations of carbohydrates (due to decreased absorption or digestive problems)
>Increase in energy intake through the breakdown of proteins (due to increased intake or digestive problems), during which toxic biogenic amines and ammonia may be produced (they also cause the alkalinization of the intestinal contents).
Reduction of E. coli (usually along with Lactobacillus species) is a common finding in irritable bowel syndrome and food intolerance.
E. coli is extremely important for synthesizing certain essential amino acids such as tryptophan, phenylalanine, and tyrosine, vitamins including folic acid, K2, and coenzyme Co-Q10, as well as essential enzymes for cellular metabolism and reproduction. Decreased tyrosine levels (a dopamine precursor) have been shown to affect memory. E. coli can reduce histamine release.
E. coli imbalance is generally reported in patients with irritable bowel syndrome (IBS), ulcerative colitis and Crohn's disease, immune dysfunction, chronic fatigue syndrome, rheumatoid arthritis patients, inflammatory disorders, metabolic as well as mood disorders.

Enterobacter sp.
Enterobacter is a genus of common Gram-negative, facultatively anaerobic, non-sporogenic bacteria of the Enterobacteriaceae family. Many strains of these bacteria are pathogenic and cause opportunistic infections in immunocompromised and mechanically ventilated individuals. The urinary and respiratory systems are the most common sites of infection.
The increase of Enterobacter species in the intestinal microbiome has been associated with the occurrence of obesity through the mechanism of endotoxemia and chronic inflammation or inflammation of the intestinal epithelium.

Streptococcus sp.
They are Gram-positive bacteria belonging to the genus Firmicutes. Species of the genus Streptococcus colonize the skin and mucous membranes throughout the body. High intestinal concentrations may result from reduced stomach acids, use of antacids, decreased digestive capacity, SIBO, or constipation. Elevated concentrations may also indicate intestinal inflammatory activity and cause diarrhea.
Higher concentrations of S. salivarius and S. thermophilus have been associated with moderate to severe disease in patients with ulcerative colitis and a reduction in the population of Bifidobacterium. Higher levels of Streptococcus were also observed in patients with colon cancer.
High concentrations of Streptococcus have also been associated with psoriasis and persistent atopic dermatitis in infants.
The number of Enterococci, Streptococci, Staphylococci, and atypical E. coli strains increases in those receiving proton pump inhibitors (PPIs).

Methanobrevibacter smithii
Methanobrevibacter smithii is the dominant representative of the Archaea in the human gut microbiome. M. smithii plays an essential role in the efficient digestion of polysaccharides (complex sugars) by consuming the final products of bacterial fermentation. M. smithii is a methanogen that recycles hydrogen by combining it with carbon dioxide to form methane as the end product. The removal of hydrogen from the intestinal environment is thought to increase energy extraction from nutrients by shifting bacterial fermentation to more oxidized end products.

M. smithii in the intestinal microbiome affects the specificity and efficiency of the bacterial breakdown of dietary polysaccharides, thus ultimately affecting the calorie intake and body fat of the individual. M. smithii and some other bacteria are most commonly found in lean individuals.
M. smithii is found at very high concentrations in anorexic individuals. The increase of Methanobrevibacter in patients with anorexia may be related to an adaptive effort to make the most of the low-calorie diet of anorexic patients. The increase of M. smithii leads to the optimization of calorie intake from the minimal diet of these patients. M. smithii could also be associated with constipation, a common condition for anorexic patients. Studies show a strong relationship between delayed intestinal transit and methane production. Experimental data suggest a direct inhibitory effect of methane on the smooth muscle tissues of the colon. Patients with irritable bowel syndrome with constipation (IBS-C) have higher concentrations of M. smithii.
M. smithii is particularly sensitive to antibiotics and statins (cholesterol-lowering drugs).

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EnteroScan® Comprehensive v2.0

COMPREHENSIVE ANALYSIS OF THE GUT MICROBIOME & INTESTINAL FUNCTION

Name:	Gender: **FEMALE**	Age: **73 YEARS**
Sample Taken Day: **3 NOVEMBER 2023**	Date of Analysis: **3 NOVEMBER 2023**	
Specimen: **Stool**	Patient Code Number:	

General Comments

EnteroScan® is a group of specialized laboratory tests that analyze the **intestinal microbiota** and **its functions** and, along with other innovative and conventional biomarkers, shed light on the possible causative relationships and underlying causes of pathological conditions such as inflammatory bowel diseases, nervous system disorders such as autism, allergies and autoimmune diseases such as multiple sclerosis and rheumatoid arthritis, obesity, metabolic syndrome, type 2 diabetes mellitus and many other chronic diseases and pathological conditions.

The human intestine hosts more than 10^{14} microorganisms from more than 500-1000 species. The human gastrointestinal tract and the intestinal flora together form a unique ecosystem; this association between host and microbes contributes to health and disease. The intestinal microbial genes, in total, are 100 times more than the host's genes. All **functions** encoded by these microbial genes are associated with the microorganisms' survival, but many of these activities are also related to human physiology. The effects of microbial metabolism may benefit the human body, including improvement of digestion, vitamin synthesis, inhibition of growth of other pathogenic microbes, reduction of produced gases, and regulation of immune function. On the other hand, the gut microbiome can synthesize carcinogens and toxins and contribute to the onset of diarrhea, constipation, and intestinal infections.

The Intestinal Microbiome represents a unique «new organ» within the human digestive tract from a scientific perspective and its function.

The beneficial functions of the Intestinal Microbiome on human health include:

- Production of various enzymes for digestion and absorption processes (e.g., participation in the regulation of carbohydrate, protein, and fat metabolism, regulation of the absorption of micronutrients such as iron)
- Vitamin composition (vitamin K, B complex vitamins), essential for the health of the whole body
- Production of short-chain fatty acids (SCFA), which are the primary source of energy for colon cells and some bacteria
- Conversion of bile acids secreted by the liver for the correct digestion of proteins and lipids
- Production of antimicrobial and antifungal agents necessary for the local defense of the intestinal tract from pathogenic microorganisms
- Adjustment of the immune system function, the most significant part of which (> 80%) is located in the intestine
- Enhancement of intestinal barrier function and prevention of increased permeability
- Adjustment of digestive tract motility
- Metabolism of various carcinogenic substances in food and pharmaceuticals
- Adjustment of the gastrointestinal tract pH

According to more and more scientific studies, **all physiological functions** in the human body are affected, directly or indirectly, by the **Intestinal Microbiome** and its functions.

Comprehensive EnteroScan® investigates and provides answers about the Intestinal Microbiome and its functions related to **Gastrointestinal Diseases** such as Inflammatory Bowel Diseases (Crohn's Disease and Ulcerative Colitis, IBD), Irritable Bowel Syndrome (IBS), Celiac Disease (gluten intolerance), Colon Cancer as well as symptoms of the gastrointestinal tract (constipation, diarrhea, flatulence, etc.) that are not part of the above diseases, related to **diseases in which the Immune System is involved** such as Allergy (Atopic Dermatitis, Asthma, Rhinitis, etc.) and Autoimmune Diseases such as Rheumatoid Arthritis, Fibromyalgia, Psoriasis, Type I diabetes mellitus and other chronic diseases, related to **Nervous System diseases** such as Autism Spectrum Disorders (ASD), Multiple Sclerosis, Depression Disorders, Stress, etc., and can also provide prevention solutions to neurodegenerative diseases such as Parkinson's and Alzheimer's Disease, related to **diseases such as Obesity** and other weight problems, Metabolic Syndrome, Type 2 Diabetes Mellitus, Non-Alcoholic Fatty Liver Disease and Atherosclerosis.