Malabsorption

By: Aida Pirvaram, MD, Cedars-Sinai Medical Center, Los Angeles, CA; Ali Rezaie, MD, MSc, FRCP(C), FACG, Director of GI Motility, Cedars-Sinai Medical Center, Los Angeles, CA

International Foundation for Gastrointestinal Disorders (www.iffgd.org)

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Malabsorption occurs when the body is unable to absorb nutrients effectively, which can lead to a wide range of nutritional deficiencies. This condition is often associated with underlying gastrointestinal (GI) disorders. In the United States, some of the most common causes of malabsorption include pancreatic insufficiency, celiac disease, and Crohn's disease.

Typical signs of malabsorption may include chronic diarrhea with stools that are pale, greasy, large in volume, and foul-smelling, along with unintentional weight loss despite adequate food intake. However, having all of these symptoms at once is relatively uncommon, even in individuals with significant intestinal involvement. Most patients experience milder symptoms, such as bloating, excess gas, or loose stools (Figure 1).

Figure 1. Typical and subtle symptom patterns in malabsorption.

To understand malabsorption, it is helpful to first review the digestive process, which consists of two main components: mechanical digestion and chemical digestion.

Mechanical digestion refers to the physical breakdown of food into smaller particles, making it easier for enzymes to act on them. **Chemical digestion** involves the breakdown of food by digestive enzymes into nutrients the body can absorb, such as amino acids, fatty acids, and simple sugars. Disruption in either process can contribute to poor nutrient absorption and gastrointestinal disease.

Overview of Digestion

The GI system includes the mouth , esophagus, stomach, small intestine, liver, gallbladder, and pancreas. Digestion begins in the mouth with mechanical digestion (chewing) and chemical digestion through enzymes such as salivary amylase and lingual lipase.

Salivary amylase is an enzyme found in saliva (spit). It helps digest carbohydrates into smaller sugars to help digestion.

Lingual lipase is an enzyme found in the mouth that breaks down fats to help digestion

The chewed food is then swallowed and moves through the esophagus to the stomach. No digestion occurs in the esophagus; it just serves as a passageway for food. The food then moves to the stomach where it is stored and mixed through rhythmic muscle contractions. Here, chemical digestion resumes with gastric acid and enzymes such as pepsin, which begin breaking down protein into smaller pieces. While little nutrient absorption happens in the stomach it is important in producing intrinsic factor, which is a type of protein that is necessary for vitamin B12 absorption, and hydrochloric acid, which helps destroy harmful bacteria. . At this stage, food becomes a semi-liquid substance called chyme, which moves into the duodenum, the first part of the small intestine.

Pepsin is an enzyme in the stomach that helps break down protein into smaller pieces to help our body absorb them.

Digestion and Absorption in the Small Intestine

The small intestine is made up of three parts, the duodenum, jejunum, and ileum. It is the primary site for nutrient digestion and absorption. The duodenum receives chyme from the stomach, along with bile from the liver and digestive enzymes from the pancreas. The jejunum is where most chemical digestion and nutrient absorption occur. The ileum, the last segment, continues this process and connects to the large intestine through the ileocecal valve. The inner lining of the small intestine contains villi, tiny, finger-like projections that significantly increase the surface area for absorption. Each villus is covered with microvilli, forming a brush border, which contains enzymes that aid in the final steps of digestion. Beneath the villi, an extensive network of blood vessels transports absorbed nutrients to the hepatic portal circulation, while lymphatic capillaries (called lacteals) absorb and transport dietary fats in the form of chylomicrons (Figure 2).

Hepatic portal circulation is a system of blood vessels that carry nutrients from your gut to your liver

Lymphatic capillaries (lacteals) are tiny vessels in the lining of the small intestine that absorb fats from foods we eat.

Chylomicrons are tiny particles that carry the fat from our intestine through the lymphatic system and into the bloodstream.

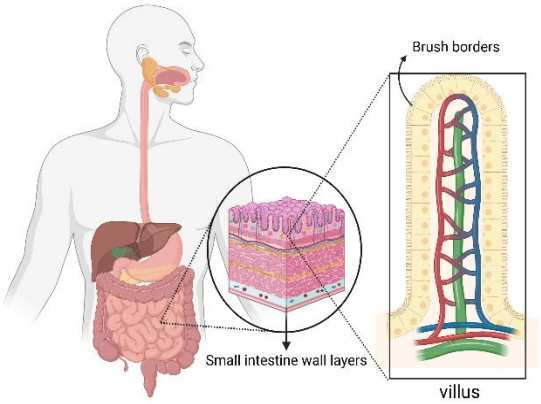

Figure 2. Villi and brush-border anatomy with vascular and lymphatic pathways for nutrient absorption.

The liver is the largest internal organ and gland in the human body. While it serves many functions, its primary digestive role is the production of bile, which combines fats and lipids to aid in their digestion. Bile is stored in the gallbladder and released into the duodenum when fat-containing food is present.

Carbohydrate Absorption

Carbohydrate digestion begins in the mouth, where chewing breaks food into smaller pieces, and salivary enzymes initiate chemical breakdown. As food passes through the digestive tract, enzymes from the pancreas and the brush border of the small intestine continue this process of chemical digestion. These enzymes convert complex carbohydrates (such as starches) into simple sugars (i.e. monosaccharides): glucose, fructose, and galactose. These sugars are then absorbed through the cells lining the small intestine and are transported into the bloodstream, where they can be used by the body for energy.

On the other hand, indigestible carbohydrates, such as fiber, are not absorbed in the small intestine. Instead, they pass into the colon, where they are fermented by colonic bacteria, often producing gas and short-chain fatty acids.

Protein Absorption

Digestion of proteins begins in the stomach and continues into the jejunum. Enzymes known as peptidases, which are secreted by the stomach, pancreas, and the brush border of the small intestine, break large protein molecules (polypeptides) into smaller components: tripeptides, dipeptides, and amino acids. These smaller molecules are then absorbed primarily in the jejunum and proximal ileum, to be used by the body for growth, tissue repair, and other essential functions.

Fat Absorption

Fat digestion starts early in the digestive system. The enzyme lipase is first released in the mouth and begins breaking down large fat molecules called triglycerides into smaller pieces. More lipase from the stomach and pancreas continues this process as food moves into the small intestine.

In the first parts of the small intestine (the duodenum and jejunum), bile from the gallbladder is released. Bile breaks fat into tiny droplets (emulsification), which makes it easier for lipase to finish the job. The final breakdown products of fat digestion gather into small particles called micelles, which help the body absorb fats.

Tests for malabsorption

There are several tests that can be performed to help diagnose malabsorption.

Blood tests

Screening tests for malabsorption often include measuring blood levels of vitamin A, vitamin B12, folate, calcium, vitamin K, and iron.

- Low vitamin A may suggest poor absorption of fat-soluble vitamins or dietary deficiency.

- Vitamin B12 and folate are checked together since deficiencies in these often overlap.
- Low calcium can result from poor vitamin D absorption or from calcium binding to unabsorbed fats.
- Vitamin K deficiency may lead to bleeding problems, and
- iron deficiency anemia may occur when iron is not absorbed properly in the upper small intestine.

Normal blood levels of vitamin A, B12, folate, iron, calcium, phosphorus, albumin, and protein usually mean that malabsorption is not a significant concern. Since these markers can also be influenced by diet and other medical conditions, they are best used as screening tools rather than as definitive tests for malabsorption.

Stool tests

Tests that measure fat in the stool can help detect fat malabsorption. If the stool contains a high amount of fat, it means the body is not absorbing fat properly.

Another useful test is stool alpha-1 antitrypsin. This protein normally stays in the blood and is not broken down in the intestine. If it is found in the stool, it suggests protein loss from the gut. Measuring stool alpha-1 antitrypsin can therefore help identify conditions where the intestine is leaking protein.

Breath tests – Breath tests are another method of detecting malabsorption. They are most often performed to test for lactose, fructose, or sucrose maldigestion. If lactose or sucrose are not being digested, colonic bacteria will use them and produce hydrogen gas which will be exhaled by the patient and measured in breath. Breath tests can also be used to diagnose small intestinal bacterial overgrowth (SIBO) which in a severe form can also lead to malabsorption.

Related Fact Sheet from IFFGD
284 – Small Intestinal Bacterial Overgrowth (SIBO)

Other tests – Tests such as biopsies of the small intestine (performed using an endoscope passed through the mouth into the intestine) are used to diagnose certain malabsorptive conditions. Special tests to image organs such as the pancreas are also useful in some cases.

Specific malabsorptive states

Lactose Intolerance – Perhaps the most common malabsorptive state is due to lactose malabsorption. Lactose intolerance is widespread and underdiagnosed.

Small intestinal disease – Surgical resection or diseases of the small intestine may result in varying degrees of malabsorption depending on the site of resection or disease. Almost all nutrients are usually absorbed in the first three to five feet of the bowel. That is why elemental diet is effective in restoring nutritional status of patients as it gets easily absorbed in the first few feet of the small bowel. The absorption of most minerals, especially iron, calcium and zinc, as well as most vitamins occurs in the upper part of the small intestine. Resections of the lower parts of the small intestine (ileum) may result from surgical intervention for Crohn's disease. The ileum is also important in vitamin B12 absorption. If bile salts are not absorbed properly, the amount of these substances in bile falls, and fats and fat-soluble vitamins (A,D,E,K), cannot be properly absorbed. A further problem is that if bile salts reach the colon, they can cause large amounts of fluid to be secreted causing watery diarrhea. If large portions of the bowel are lost to surgical resection, rapid transit of nutrients through the remaining bowel occurs, causing malabsorption.

Surgical resection is a procedure where a surgeon removes a damaged or diseased section of the intestine.

Elemental Diet is a liquid formula diet where nutrients are broken down into their simplest and most easily absorbed forms.

Pancreatic disease – Diseases of the pancreas can cause malabsorption of fats and carbohydrates. Symptoms depend on the severity of the condition but diarrhea with greasy, foul-smelling stools is common, and weight loss can be profound.

Selected Liver and biliary disease – In conditions when insufficient bile reaches the intestine, fats are not absorbed and again diarrhea and weight loss occur. Vitamins that are absorbed with fats are also affected.

Table 1 summarizes the major categories of malabsorption, their underlying mechanisms, and common examples.

Table 1. Categories of malabsorption with mechanisms and examples.

Category	What Happens	Examples of Conditions
Intestinal Resections	When a large portion of the small intestine is removed (especially more than 200 cm), the body can't absorb nutrients properly.	Short bowel syndrome
Weight Loss (Bariatric) Surgery	These surgeries shorten the bowel and also can lead to an overgrowth of bacteria in the intestine, interfering with nutrient absorption.	After certain weight-loss surgeries
Inflamed Intestines	Inflamed bowel has decreased capacity to absorb nutrients	Crohn's disease), chronic infections, or Celiac disease
Intestinal Fistulas	Abnormal connections in the intestines can cause food to bypass areas that absorb nutrients.	Crohn's disease, diverticular disease, radiation damage, cancers
Slowed Intestinal Movement	If food moves too slowly through the intestines, nutrients may not be absorbed properly.	Diabetes, scleroderma, amyloidosis, ileus (temporary gut paralysis)
Diseases of the Intestinal Lining	Damage to the inner lining of the small intestine affects how well nutrients are absorbed.	Celiac disease, Crohn's disease, radiation enteritis, tropical sprue, Whipple disease, autoimmune conditions, parasite infection (Giardia)

Treatment

Treatment of malabsorption syndromes depends on the specific underlying disease and the symptoms each patient experiences. In general, the main goals of treatment are to control symptoms such as diarrhea, correct nutritional deficiencies, and address the root cause of the condition. In cases where the underlying cause cannot be fully treated, symptom management becomes essential particularly for chronic diarrhea. This often involves dietary changes and medications such as loperamide. In certain cases, especially when the digestive system needs rest or when absorption is severely impaired, a physician may recommend an elemental diet. Elemental diets reduce the workload on the intestines, help control inflammation and support nutritional recovery. They are particularly useful in conditions like Crohn disease, SIBO, short bowel syndrome, and eosinophilic disorders.

In short bowel syndrome, treatment focuses on rapidly correcting fluid and nutrient loss with intravenous fluids and vitamin/mineral replacement. Proton pump inhibitors (PPIs) may be prescribed to reduce stomach acid, which can worsen malabsorption, and loperamide may help slow intestinal movement to improve absorption. Early initiation of enteral nutrition can support intestinal adaptation. If necessary, total parenteral nutrition (TPN) is used to deliver nutrients directly into the bloodstream. In some cases, patients may benefit from a medication called teduglutide, which mimics a natural gut hormone and improves absorption. Although some individuals may face lifelong challenges due to reduced bowel length, many can manage their condition effectively with proper treatment and dietary support. In rare, severe cases, an intestinal transplant may be considered.

Related Fact Sheet from IFFGD
290 – What is Short Bowel Syndrome (SBS)

In celiac disease, lifelong avoidance of gluten found in wheat, barley, and rye is essential. Nutrient deficiencies should be addressed, particularly iron and folate, and calcium and vitamin D (Table 2).

In Crohn disease, treatment aims to reduce inflammation, heal the intestinal lining, and restore nutritional balance. Common medications include 5-aminosalicylates, corticosteroids (such as budesonide), immunosuppressants (like thiopurines), and biologic therapies. An elemental diet can be a valuable non-pharmacologic option, particularly for children or patients seeking to avoid medications, by reducing gut inflammation and improving nutrient absorption. Surgery is reserved for complications such as strictures or fistulas but is not considered curative.

In radiation enteritis, treatment is supportive. Antibiotics may be used to address bacterial overgrowth, and bile salt binders can help relieve diarrhea. Nutritional support with oral supplements, elemental diets, or even TPN may be necessary in some patients.

Radiation enteritis is inflammation of the intestines caused by cancer radiation therapy to the abdomen or pelvis

Finally, in lactose intolerance, complete elimination of dairy is not always required. Many people can tolerate small amounts of lactose. Lactose-free dairy products and over-the-counter enzyme supplements can also be helpful. Calcium and vitamin D levels should be monitored and supplemented as needed to prevent deficiencies.

Table 2. Common nutrient deficiencies in malabsorption syndrome

Nutrient Not Absorbed	What You Might Notice	Common Test Results
Calories	Weight loss despite eating normally	—
Fat	Pale, bulky, greasy stools; diarrhea without pain	More than 7% of dietary fat seen in stool samples
Protein	Swelling (edema), muscle loss, missed periods (amenorrhea)	Low blood protein (hypoalbuminemia, hypoproteinemia)
Carbohydrates	Watery diarrhea, gas, bloating, sour-smelling stools, intolerance to milk products	Increased breath hydrogen (after carbohydrate ingestion)
Vitamin B12	Fatigue, anemia, numbness or tingling, balance issues, memory trouble	Low vitamin B12, increased methylmalonic acid and homocysteine, enlarged red blood cells (macrocytosis)
Folate (Vitamin B9)	Fatigue, anemia	Low folate in blood and red blood cells, elevated homocysteine
B Vitamins (general)	Cracks at corners of the mouth, smooth or sore tongue, skin issues	—
Iron	Tiredness, pale skin, cracks on the tongue, unusual food cravings (like ice or dirt)	Low iron, ferritin, and iron saturation
Calcium & Vitamin D	Numbness, tingling, muscle cramps, bone pain or fractures	Low calcium, increased alkaline phosphatase, abnormal bone scan (low density)
Vitamin A	Dry skin, rough patches, trouble seeing in the dark (night blindness)	Low vitamin A (retinol) in blood
Vitamin K	Easy bruising, frequent nosebleeds, heavy periods or bleeding	Low vitamin K, reduced clotting factors in blood

About IFFGD

The International Foundation for Gastrointestinal Disorders (IFFGD) is a 501(c)(3) nonprofit education and research organization. We work to promote awareness, scientific advancement, and improved care for people affected by chronic digestive conditions. Our mission is to inform, assist, and support people affected by gastrointestinal disorders. Founded in 1991, we rely on donors to carry out our mission. Visit our websites at: www.iffgd.org or ww.AboutIBS.org

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537 Long Point Road, Unit 101

Mt Pleasant, SC 29464