# Malabsorption syndrome

## Introduction

The main purpose of the GIT is to digest and absorb:
1. **Nutrients** → fat, CHO, and protein
2. **Micronutrients** → Vitamin and trace minerals
3. **Water and electrolyte**

<table>
<thead>
<tr>
<th>Process of digestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Intraluminal digestion in which protein, CHO and fats are broken down by secreted enzymes</td>
</tr>
<tr>
<td>2. Absorption (mucosal process) → transepithelial transport of nutrients, fluid and electrolytes through enterocytes into blood stream</td>
</tr>
<tr>
<td>3. Transport → post mucosal events</td>
</tr>
</tbody>
</table>

## Definition

1. Malabsorption is a state of abnormal digestion or absorption of nutrients across the GIT. or
2. An alteration in the ability of the intestine to absorb nutrients adequately into the blood stream

## Pathophysiology

Malabsorption constitutes the pathological interference with one or more the normal physiological consequence:

1. **Digestion (intra luminal process)**
   - Impaired hydrolysis of nutrient in the small intestine

2. **Absorption (mucosal process)**
   - Mucosal disease
   - Mucosal loss (surgical resection)

3. **Transport (postmucosal events) of nutrients**

## Classification

1. Generalized mucosal abnormalities resulting in multiple nutrient malabsorption
2. Specific nutrient malabsorption disorder (CHO, fat, Protein, vitamin and mineral malabsorption)

## Causes

1. Intestinal causes → most common
   - Tropical sprue → unknown etiology but may be due to bacterial, viral, parasitic infection, folic acid deficiency
   - Celiac disease (non tropical sprue, Gluten sensitive enteropathy)
     - Autoimmune disorder in which there is an abnormal reaction to gluten protein found in wheat.
     - Ag ab reaction → damage of intestinal mucosa
     - CP → severe malabsorption syndrome, associated autoimmune disease + dermatitis herpetiformic
     - Ix → jejunal biopsy see villous atrophy, IgA antigliadin antibodies
     - Treatment → the only effective treatment is lifelong gluten free diet

2. Stagnat (blind) loop syndrome → stagnation of intestinal content eg stricture of SI, Diverticulosis → causing bacterial overgrowth → mucosal injury & nutrients utilization

3. Systemic disease → DM, amyloidosis, Gardia, Strongeloides

4. Inflammation → Crohn’s disease, irradiation

5. Iatrogenic → antacids, biguanieds, cholestyramine

6. Lymphatic obstruction → Lymphoma

## Drugs

<table>
<thead>
<tr>
<th>Luminal effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neomycin</td>
</tr>
<tr>
<td>Cholestyramine</td>
</tr>
<tr>
<td>Alcohol</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Enterocyte damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct toxicity</td>
</tr>
<tr>
<td>Brush border enzyme effect</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Macosal effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neomycin</td>
</tr>
<tr>
<td>Alcohol</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intercellular effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neumycin</td>
</tr>
<tr>
<td>Alcohol</td>
</tr>
</tbody>
</table>

## Clinical manifestation

1. Diarrhea / steatorrhea |
2. Weight loss |
3. Symptoms of nutrient deficiency |
4. Clinical manifestation of the cause

### Symptoms of nutrient deficiency

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Nutrient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight loss with normal appetite</td>
<td>Calori</td>
</tr>
<tr>
<td>Pale,voluminous,greasy offensive diarrhea</td>
<td>Fat</td>
</tr>
<tr>
<td>Edema, muscle atrophy.</td>
<td>Protein</td>
</tr>
<tr>
<td>Abdominal bloating, flatus, diarrhea</td>
<td>Carbohydrate</td>
</tr>
<tr>
<td>Macrocytic anemia</td>
<td>Vit B12</td>
</tr>
<tr>
<td>Macrocytic anemia</td>
<td>Folic acid</td>
</tr>
<tr>
<td>Subacute combined degeneration of sp.cord</td>
<td>Vit B (general)</td>
</tr>
<tr>
<td>Cheliosis, glossitis, A.stomatitis, Acrodermatitis</td>
<td>Iron</td>
</tr>
<tr>
<td>Microcytic anemia</td>
<td>Ca &amp; Vit D</td>
</tr>
<tr>
<td>Osteomalacea , osteoporosisand Tetany</td>
<td>Vit A</td>
</tr>
<tr>
<td>Follicular hyperkeratosis, Night blindness</td>
<td>Vit K</td>
</tr>
<tr>
<td>Bleeding diathesis</td>
<td>K</td>
</tr>
<tr>
<td>Arrhythmia</td>
<td>Vit B1</td>
</tr>
<tr>
<td>Goiter</td>
<td>Vit B6</td>
</tr>
<tr>
<td>Infertility</td>
<td>Vit B3</td>
</tr>
<tr>
<td>Diarrhea, Dermatitis, Dementia = Pellagra</td>
<td>Vit E</td>
</tr>
<tr>
<td>infertility</td>
<td>Vit C</td>
</tr>
<tr>
<td>Scurvy</td>
<td>Tryptophan</td>
</tr>
<tr>
<td>Goiter</td>
<td>Depression</td>
</tr>
<tr>
<td>Ferritin</td>
<td>Tryptophan</td>
</tr>
<tr>
<td>Pellagra</td>
<td>Vitamin A</td>
</tr>
</tbody>
</table>

## Intestinal causes

- Tropical sprue → unknown etiology but may be due to bacterial, viral, parasitic infection, folic acid deficiency
- Celiac disease (non tropical sprue, Gluten sensitive enteropathy)
  - Autoimmune disorder in which there is an abnormal reaction to gluten protein found in wheat.
  - Ag ab reaction → damage of intestinal mucosa
  - CP → severe malabsorption syndrome, associated autoimmune disease + dermatitis herpetiformic
  - Ix → jejunal biopsy see villous atrophy, IgA antigliadin antibodies
  - Treatment → the only effective treatment is lifelong gluten free diet
**Investigation**

<table>
<thead>
<tr>
<th>Sign or symptom</th>
<th>Initial lab finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wasting, edema</td>
<td>Low serum albumin</td>
</tr>
<tr>
<td>Weight loss, oily-bulky stool</td>
<td>High stool fat, Low serum carotene</td>
</tr>
<tr>
<td>Parasthesias, tetany, bone pain</td>
<td>Low calcium, high alkaline phosphatase, low mineralization of bone</td>
</tr>
<tr>
<td>Ecchymosis, petechiae, purpura</td>
<td>Prolonged prothrombin time</td>
</tr>
<tr>
<td>Anemia</td>
<td>Low serum folate or Vit B12</td>
</tr>
<tr>
<td>- macrocytic</td>
<td>Low serum iron</td>
</tr>
</tbody>
</table>

**Radiological studies**

1. Barium follow through is useful in delineating small intestine anatomy
2. Dilatation of intestinal lumen, loss of normal feathery appearance
3. CT abdomen is useful in ruling out structural abnormality done in pancreatic protocol when visualizing pancreas
4. Ultrasound
5. MRCP to complement or as an alternative to ERCP

**Intestinal mucosal biopsy ➔ using crossby capsule or endoscopy**

1. Coeliac disease ➔ villous atrophy
2. Tropical sprue ➔ short villi and increased lymphocyte
3. Low mucosal disaccharidase levels in primary disaccharidase deficiency (lactase, sucrose, maltase)

**Special test**

**Ix for fat malabsorption**

1. **Fecal fat microscopy (sudan black test)**
   - Best screening method
   - Mixing the stool with sudan stain, fat droplets will separate and be identified, more than 6 - 8 droplets / low power fields is abnormal
2. **72 hour quantitative fecal fat test**
   - The gold standard to confirm steatorrhea
3. **Serum cholesterol and serum carotene level decrease in malasorption**

**Ix for CHO malabsorption**

1. **D – xylose absorption test**
   - Step 1 - 25 gm dose of D-xylose ingestion
   - Step 2 - urine collected for next 5 hours
   - Step 3 - at 1 hour, a blood sample taken (optional)
   - <5gm (20% excretion) in urine or serum conc <20mg/dl of d-xylose = abnormal intestinal absorption
2. **Glucose tolerance test ➔ flat curve**
3. **Lactose tolerance test ➔ intolerance due to lactase deficiency**
4. **Hydrogen breath test**

**Ix for protein malabsorption**

1. **Fecal microscopy ➔ animal skeletal muscle fiber**
2. **Fecal nitrogen ➔ normal 2 – 2.5gm/day. More than 3gm.day = protein malasorption**
3. **Serum albumin is decreased**

**Ix for vitamin malabsorption**

- **Vit K ➔ prothrombin time**
- **Serum folate**
- **Vitamin B12 ➔ Schilling test**
  - Performed to evaluate vitamin B12 absorption.
  - Helps to assess the integrity of gastric, pancreatic and ileal functions.
  - The test
    - Administering labeled 58Co-labeled cobalamine p.o.
    - Non-labeled Cobalamine 1mg i.m. 1hr after ingestion to saturate hepatic binding sites
    - Collecting urine for 24 hour ➔ Abnormal - <10% excretion in 24 hrs

**Management**

- **Tb enteritis ➔ anti Tb drugs**
- **Tropical sprue ➔ antibiotic (tetracycline) & folic acid**
- **Coeliac disease ➔ gluten free diet**
- **Lactose intolerance ➔ lifelong lactose free diet**
- **Bacterial over growth usually respond well to course of antibiotic**
**Diarrhea**

<table>
<thead>
<tr>
<th>Definition</th>
<th>Diarrhea can be considered in increase in stool frequency (3 or more stools/day) and/or the presence of loose or liquid stools</th>
</tr>
</thead>
</table>

**Pathophysiology**

<table>
<thead>
<tr>
<th>Select Patient</th>
<th>Such a derangement can be the result of either</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>An osmotic force that acts in the lumen to drive water into the gut or</td>
</tr>
<tr>
<td>2.</td>
<td>the result of an active secretory state induced in the enterocytes secretion of water &amp; electrolytes into the lumen.</td>
</tr>
</tbody>
</table>

**Osmotic diarrhea**

- Excess amounts of poorly absorbed substance that remain in intestinal lumen
- Substance exert osmotic effect
- Obligate water retention in intestinal lumen
- Lactose, lactulose, magnesium, polyethylene glycol (PEG)
- Stool output proportional to the intake of the unabsorbable substrate and
- Usually not massive;
- Diarrheal stools promptly regress with discontinuation of the offending nutrient.
- And the stool ion gap is high, exceeding 100 mOsm/kg.
- Fecal osmotic gap $\geq 125$

**Secretory diarrhea**

- In secretory diarrhea, the epithelial cells’ ion transport processes are turned into a state of active secretion.
- The most common cause of acute-onset secretory diarrhea is some viruses, bacteria and parasites cause increased secretion of fluid, e.g. cholera & E.coli.
- Include a high purging rate,
- A lack of response to fasting, and
- A normal stool ion gap (ie, 100 mOsm/kg or less), indicating that nutrient absorption is intact.
- Stool output is not proportional to the intake of the unabsorbable substrate
- Fecal osmotic gap $<50$

**Stool ion gap**

The stool ion gap is obtained by:

- Stool Ion gap = [total stool osmolality - 2(stool sodium + stool potassium)].
- Normally: 100 mOsm/kg or less

**Classification**

Diarrhea generally is divided into two types, on the basis of duration of symptoms:

1. Acute diarrhea lasts from a few days up to 3 weeks.
2. Chronic diarrhea can be defined in several ways but almost always lasts more than three weeks.

**Acute diarrhea**

- An increased number of stools or looser form than is customary for the patient, lasting less than 3 weeks,
- Often associated with abdominal symptoms such as cramping, bloating, and gas.
- Although often mild, acute diarrhea can lead to severe dehydration as a result of large fluid and electrolyte losses.

**Causes**

1. Bacterial infections - Salmonella, Shigella, E.coli, Cholera.
2. Viral infections - Rota virus, Norwalk virus.
3. Food intolerances - Unable to digest certain foods - such as dairy products.
4. Parasites: Giardia.
5. Iatrogenic - Antibiotics, Chemotherapy, and antacids containing magnesium.
6. Recent dietary changes can also lead to acute diarrhea. These including intake of coffee, tea, or colas.

**Symptoms**

- Cramping
- Abdominal pain
- Bloating
- Nausea

- An urgent need to use the bathroom
- Fever
- Bloody stools

**Complication**

- Dehydration occurs when there is excessive loss of fluids and minerals from the body.
- Electrolytes (mineral) abnormalities
- In addition to dehydration, there may also be irritation of the anus.

**Investigation**

- In most patients with mild acute diarrhea, no laboratory evaluation is needed. BUT,
- Most individuals have mild symptoms that are usually attributed to dietary factors or motility disturbances.
- Thus, a “watch and wait” approach using nonspecific therapies will be beneficial or at least do no harm.
- When the condition becomes aggravated in severity and leads to, or is associated with blood or fat in stool, weight loss, dehydration, vomiting, fever, changes in serum electrolytes, etc., then additional evaluation is needed.

**Studies in select patient with acute diarrhea**

1. Fecal leukocyte determination
2. Stool culture for enteric pathogens
3. Stool examination for ova and parasites
4. Blood electrolytes measurement.
5. Flexible sigmoidoscopy with biopsy

**Treatment**

1. Dietary modifications,
   - Milk & dairy products, fatty foods & spicy foods, caffeine and nicotine should be avoided for 24 to 48 hours.
   - Initial dietary should begin with soups and broth
2. Fluid and electrolyte replacement
   - It is important to take plenty of fluid and salt to avoid dehydration.
   - Anti-diarrheal drug therapy includes bismuth subsalicylate and antimotility agents such as loperamide.
   - Antibiotics: if patient have high fever, dysentery, or moderate to severe traveler’s diarrhea
3. Antibiotics
Chronic diarrhea

Definition
Chronic diarrhea lasts for more than 3 weeks

Etiology
1. Malabsorption syndrome. (enumerate its causes)
2. Diseases of the colon:
   • Irritable bowel syndrome.
   • Inflammatory bowel diseases e.g. ulcerative colitis.
   • Cancer colon.
3. Endocrine causes:
   • Thyrotoxosis.
   • Diabetic neuropathy.
   • Addison’s disease.
   • Zollinger Ellison syndrome

Diagnosis
• Most cases of chronic diarrhea can be diagnosed through careful history and physical examination and selected laboratory studies.
• Diagnoses that remain in question, can often be made through endoscopic evaluation with biopsy.

A) History
• The top initial priority in the evaluation of a patient who presents with diarrhea is to describe stool volume, frequency, consistency, and gross appearance.
• This description initiates the diagnostic pathway and helps avoid unneeded diagnostic studies.
  1. Stool volume
  2. Stool appearance
  3. Steatorrhea / bloody diarrhea
  4. Travel history

Stool volume
Stool volume may suggest the disease location and underlying pathophysiologic mechanism.
• For example, very-large-volume stools (> 750 mL/day) imply small bowel disease and secretory diarrhea.
• Conversely, small-volume stools (< 350 mL/day) are typical of colonic diseases and functional gastrointestinal disorders.

Stool appearance
Stool appearance helps to classify diarrhea as
1. Watery (Osmotic & Secretory),
2. Bloody (Inflammatory),
   • Chronic bloody diarrhea is most likely due to Inflammatory Bowel Disease (IBD). These include ulcerative colitis or Crohn’s disease.
   • Pain with defecation suggests rectal inflammation.
   • Other less common causes include ischemia of the gut, infections, radiation therapy and colon cancer or polyps.
3. Fatty (steatorrhea),
   • Steatorrhea describes greasy, oily, foul smelling, bulky, or voluminous stools that are often difficult to flush, might contain undigested food particles.
   • These characteristics suggest pancreatic disease, short bowel syndrome, celiac disease, giardiasis, and small bowel bacterial overgrowth (SBBO).

Onset of diarrhea soon after eating and/or relief with fasting. Might suggest
1. Malabsorption (eg, lactose malabsorption),
2. Maldigestion (eg, pancreatic insufficiency),
3. Rapid intestinal transit following surgery (eg, post gastrectomy), or
4. An exaggerated gastrocolic reflex as seen in IBS.

If these symptoms are present, the patient should be asked about the intake of common triggers such as milk, fructose.

Travel history
• Nonspecific foreign travel history ➔ Enterotoxigenic E coli, Giardia, Salmonella, and Shigella species.
• Travel to Africa ➔ Entamoeba species, Vibrio cholerae
• Travel to South America and Central America ➔ Entamoeba species, V cholerae, enterotoxigenic E coli
• Travel to Asia ➔ V cholerae
• Travel to India ➔ Entamoeba species, V cholerae
• Travel to Japan ➔ Vibrio parahaemolyticus
• Travel to Mexico ➔ Aeromonas, Entamoeba,
• New Guinea ➔ Clostridium species
• Travel to Africa ➔ Enterotoxigenic E coli

B) Physical Examination
• May help determine the severity of the diarrhea and underlying disease.
• Full vital signs and degree of hydration
• The patient’s general appearance and mental status may signify toxicity or chronic debilitation.
• Weight loss or wasting.

Abdominal tenderness, bowel sounds.
• Rectal examination ➔ to exclude rectal mass or blood.
• Erythema nodosum is tender, red nodules under the skin, on the anterior aspects of the legs, ulcerative colitis.
• Clubbing (IBD, laxative abuse, malignancy)

C) Rx for Chronic Diarrhea
• Most individuals have mild symptoms that are usually attributed to dietary factors or motility disturbances.
• Thus, a “watch and wait” approach using nonspecific therapies will be beneficial or at least do no harm.
• When the condition becomes aggravated in severity and leads to, or is associated with blood or fat in stool, weight loss, dehydration, vomiting, fever, changes in serum electrolytes, etc., then additional evaluation is needed.
  1. Stool culture. to check for bacteria, parasites.
  2. Blood tests. can be helpful in ruling out certain diseases.
  3. Sigmoidoscopy. to examine the rectum and lower part of the colon.
  4. Colonoscopy. to examine the entire colon.
  5. Imaging tests. To rule out structural abnormalities as the cause of diarrhea.
  6. Investigations for malabsorption syndrome

Treatment
• Symptomatic: - Anti diarrhea : Diphenoxylate ( lomotil ), Loperamide
• Supportive:
  • Diet: light diet.
  • Treatment of complications: Fluid – K – HCO3.
• Specific : treatment of the cause.

Nn
• Diarrhea is an increase in the frequency of bowel movements, an increase in the looseness of stool or both.
• Complications of diarrhea include dehydration, electrolytes (mineral) abnormalities, and irritation of the anus.
• Tests that are useful in the evaluation of acute diarrhea include examination of stool for white blood cells and parasites, cultures of stool for bacteria, and blood tests for electrolyte abnormalities.
• Chronic diarrhea is a common problem that can present in a variety of ways.
• However, through careful attention to elements of a patient’s presentation, past history, and physical examination, it is possible to uncover common underlying patterns. Tests that are useful in the evaluation of chronic diarrhea include examination of stool for parasites, upper gastrointestinal X-rays (UGI series), barium enema, esophago-gastro-duodenoscopy (EGD) with biopsies, colonoscopy with biopsies, hydrogen breath testing, and measurement of fat in the stool.