



Round : Internal medicine.....

Group no : A4.....

Done By : Batool ALzubaidi.....



MALABSORPTION

I. PATHOPHYSIOLOGY

- A. MALABSORPTION
- B. MALDIGESTION

II. COMPLICATIONS OF MALABSORPTION AND MALDIGESTION DISORDERS

- A. GLOBAL MALABSORPTION
- B. PARTIAL MALABSORPTION

III. DIAGNOSTIC APPROACH TO MALABSORPTION AND MALDIGESTION DISORDERS

- A. ASSESS FOR EVIDENCE OF MALABSORPTION OR MALDIGESTION
- B. ASSESS FOR THE CAUSE OF MALDIGESTION
- C. ASSESS FOR THE CAUSE OF MALABSORPTION

IV. TREATMENT OF MALABSORPTION AND MALDIGESTION DISORDERS

- A. EXOCRINE PANCREATIC INSUFFICIENCY (EPI)
- B. BILE ACID DEFICIENCY
- C. LACTOSE INTOLERANCE
- D. CELIACS DISEASE
- E. WHIPPLE'S DISEASE
- F. TROPICAL SPRUE
- G. MANAGEMENT OF ANEMIA

00:49

I. PATHOPHYSIOLOGY

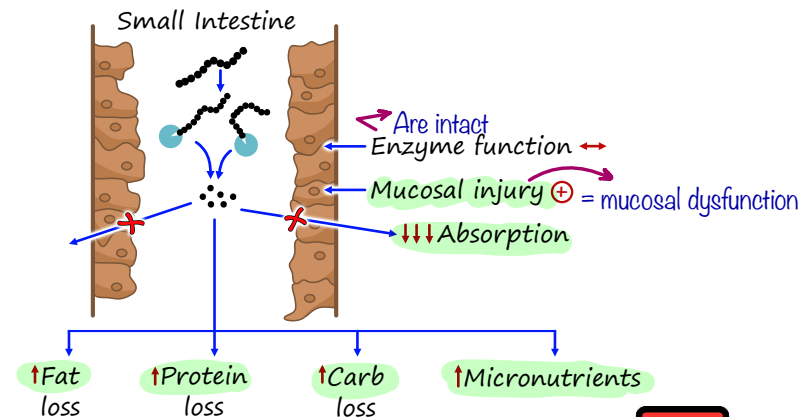
A. MALABSORPTION

00:49

1. Pathophysiology:

- o **Mucosal damage** → Inability to absorb nutrients →
↑ Nutrient loss into the intestinal lumen →
Loss of nutrients in the stool
 - The **digestive enzymes and bile acids are normally functioning**, which allows adequate digestion of nutrients, but the **damaged mucosa** does not allow those nutrients to be absorbed

✚ Enzymes will digest / breakdown molecules normally into their building blocks like mono-saccharides or fatty acids or amino acids which make them easier to be absorbed



2. Causes of Malabsorption:

08:24

a) Celiac Disease

- o **Gluten Ingestion** → Gliadin proteins form → Antigen-presenting cells engulf and **express the gliadin protein** on its surface → **Activation of T-Helper cells**, which cause activation of **Plasma Cells** → Plasma cells synthesize and release **IgA antibodies**, causing an **immune response** and resulting in **injury to the mucosal lining** in the small intestine → This leads to the **inability to absorb nutrients** → ↑ Nutrient loss into the intestinal lumen → **Loss of nutrients into the stool** (e.g. **Proteins, Fats, Carbs, Vitamins, and Minerals**)

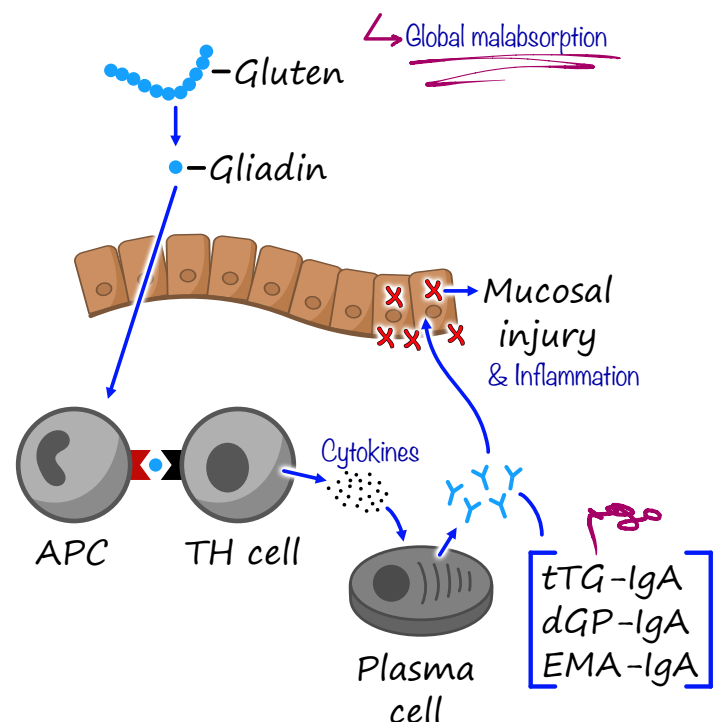
▪ The Following IgA Antibodies are Crucial to Identify:

- **Tissue Transglutaminase (tTG-IgA)**
 - o **Most sensitive** and moderately specific → The **primary screening** antibody
- **Deaminated Gliadin Peptide (dGP-IgA)**
 - o Useful in **young children** or IgA deficiency
- **Endomysial Antibodies (EMA-IgA)**
 - o **Most specific** antibody (~100%) → The **confirmatory** antibody

▪ Celiac may also lead to cutaneous lesions:

- **Dermatitis herpetiformis**

Celiac Disease



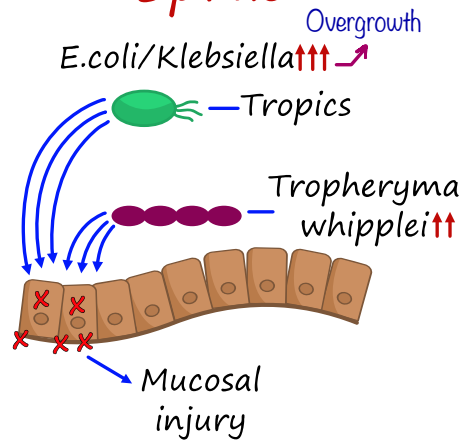
b) Whipple's Disease

- **Tropheryma whipplei** → Triggers **direct mucosal injury** of the intestinal lining → **Activates macrophage** reactions that **engulf the bacteria** and form **foamy macrophages** → Leads to the **inability to absorb nutrients** → ↑ Nutrient loss into the intestinal lumen → **Loss of nutrients into the stool (e.g. Proteins, Fats, Carbs, Vitamins, and Minerals)**

▪ Systemic Involvement:

- Joints → Arthralgias
- Myocardium → Cardiomyopathy
- Brain → Dementia, Movement disorders

Whipple's/Tropical Sprue



c) Tropical Sprue

- **Exposure to Tropical Areas** (The Caribbean, India, and Asia) → **Infectious pathogen** acquired → Triggers **direct mucosal injury** of the intestinal lining → Leads to the **inability to absorb nutrients** → ↑ Nutrient loss into the intestinal lumen → **Loss of nutrients into the stool (e.g. Proteins, Fats, Carbs, Vitamins, and Minerals)**

- Tropical sprue may be due to a variety of bacteria

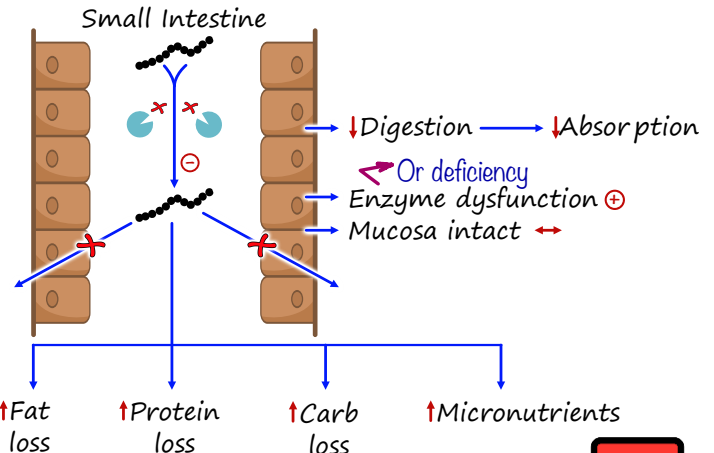
• Examples:

- E.coli
- Klebsiella



1. Pathophysiology:

- **Deficiency of Intraluminal Digestive Enzymes or Absence of Bile Acids** in the intestinal lumen → Leads to the **inability to digest nutrients** via the enzymatic activity, and **inability to emulsify fats** for aiding in digestion via the bile acid presence → This inability to digest nutrients leads to the **inability to absorb nutrients** → ↑Nutrient loss into the intestinal lumen → **Loss of nutrients into the stool**
 - The **intestinal mucosa is intact**, but is **unable to absorb** nutrients given they are **not adequately digested** to enable absorption



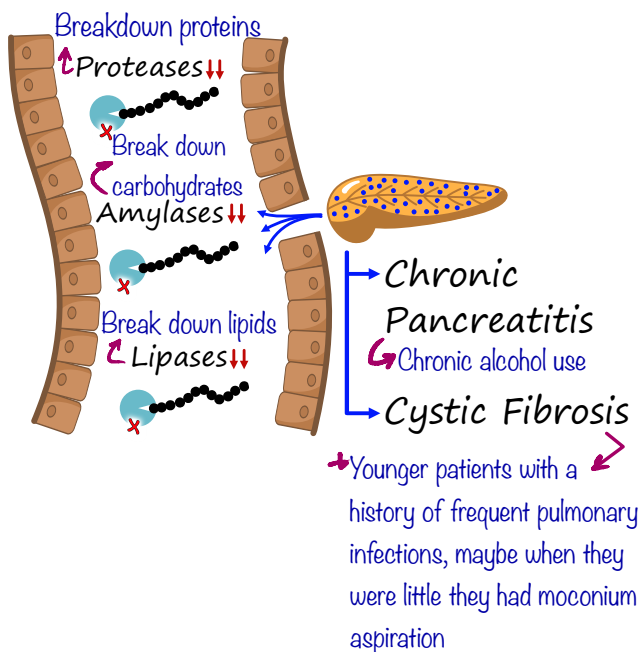
✦ Nutrient loss is selective depending on enzyme that is not functioning

2. Causes of Maldigestion: Global malabsorption

14:27

a) Exocrine Pancreatic Insufficiency (EPI)

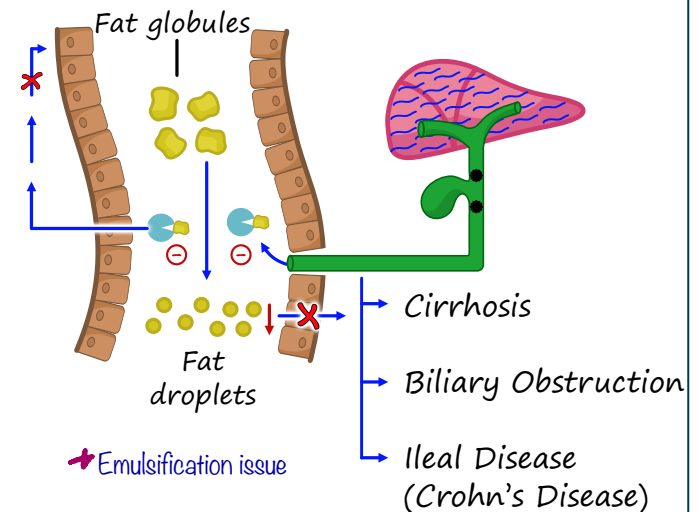
- **Chronic Pancreatitis or Cystic Fibrosis** → Progressive fibrosis and calcification of the pancreas → **Loss of function** in the **exocrine portion** of the pancreas → ↓Pancreatic proteases, lipases, and amylases in the intestinal lumen → Leads to the **inability to digest proteins, fats, and carbohydrates**
 - An enzyme deficiency that is diagnostically crucial to identify in EPI is ↓**Fecal Elastase**



Partial malabsorption

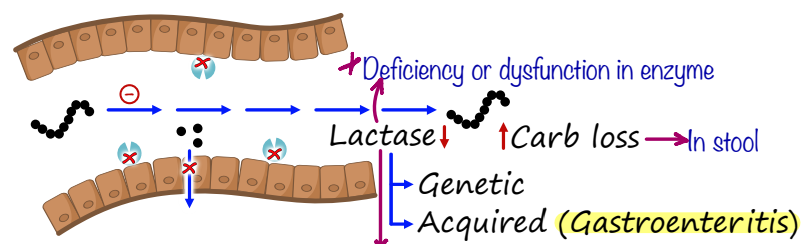
b) Bile Acid Deficiency (Partial)

- **Cirrhosis** → Hepatocytes are unable to synthesize bile into the biliary system → Reduction in bile/bile acids into the small intestine → Inability to emulsify fats → **Loss of fat in stool**
- **Biliary Obstruction** → Bile flow is blocked from moving by the common bile duct and into the small intestine → Reduction in bile/bile acids into the small intestine → Inability to emulsify fats → **Loss of fat in stool**
- **Crohn's Disease** → Ileum inflammation occurs → **Inability to absorb bile acids** → Reduced bile acids recycled back to the hepatocytes → Hepatocytes unable to synthesize enough bile into the biliary system → Reduction in bile/bile acids into the small intestine → Inability to emulsify fats → **Loss of fat in stool**



c) Lactose Intolerance (Partial)

- **Genetic or Acquired** (e.g. Gastroenteritis) **Lactase Deficiency** → **Inability to digest lactose-containing carbohydrates** → **Inability to absorb lactose-containing carbohydrates** → **Loss of lactose-containing carbohydrates in the stool**



✦ Responsible for the break down of lactose to smaller little sugars so they can be absorbed easily



II. COMPLICATIONS OF MALABSORPTION AND MALDIGESTION DISORDERS

A. GLOBAL MALABSORPTION

1. Pathophysiology:

a) Celiac, Whipple's, Tropical Sprue

- **Mucosal damage** → Inability to absorb nutrients →
↑ Nutrient loss into the intestinal lumen →
Loss of nutrients in the stool (e.g. Proteins, Fats, Carbs, Vitamins, and Minerals)

b) Exocrine Pancreatic Insufficiency

- **Loss of function in the exocrine portion of the pancreas**
→ ↓ Pancreatic proteases, lipases, and amylases in the intestinal lumen → Leads to the **inability to digest proteins, fats, and carbohydrates**

2. Presentation:

a) Weight Loss

↓ Resulting in atrophy and weakness

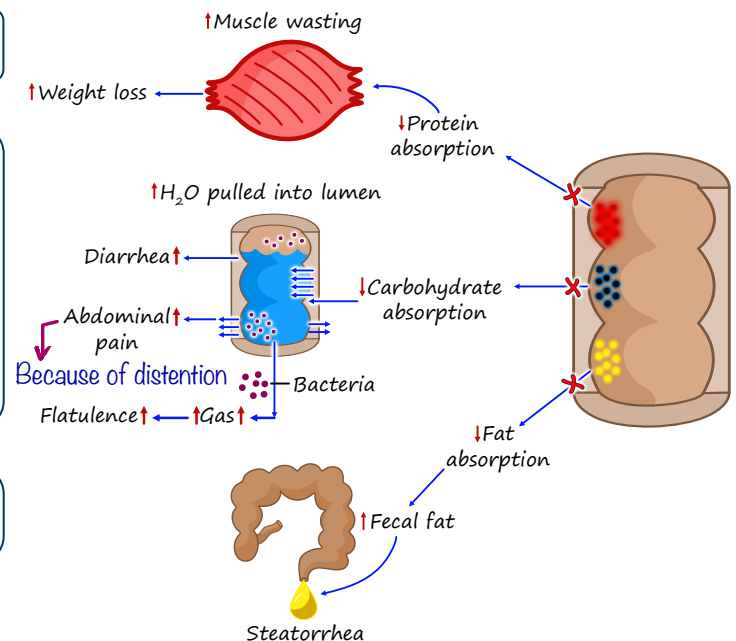
- Due to ↓ **Protein Absorption** → Leads to **muscle wasting**

b) Chronic Diarrhea

- Due to ↓ **Carbohydrate Absorption** → this leads to water being pulled into the bowel lumen → larger volumes of liquid stool pass through the intestines
 - Associated with **Abdominal pain** from **bowel distention** from increased fluid in the intestinal lumen
 - Associated with **Flatulence** from **increased gas production** as a byproduct of carbohydrate breakdown by bacterial in the intestinal lumen

c) Steatorrhea

- Due to ↓ **Fat Absorption** → Leads to **greasy and foul-smelling stools**

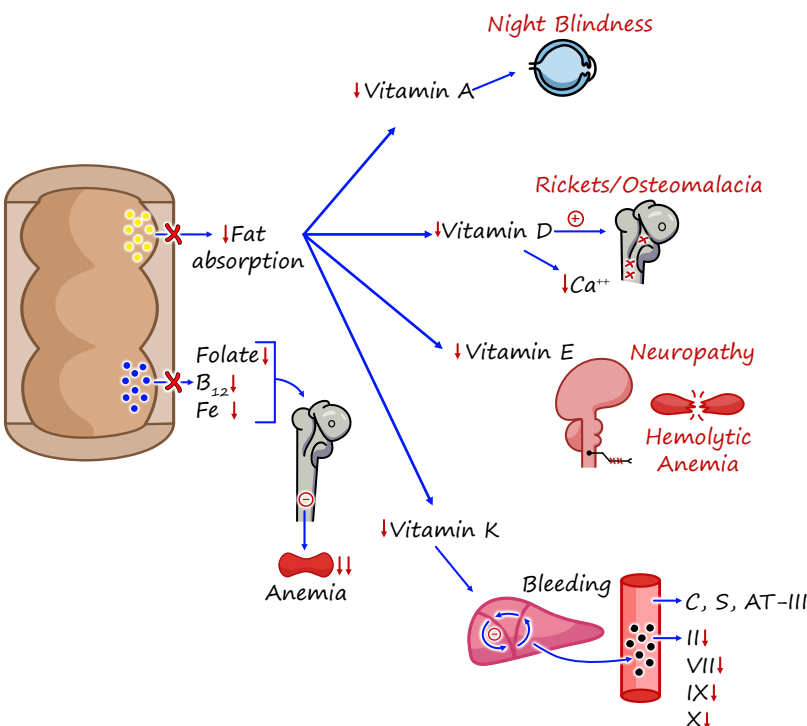


d) Vitamin A, D, E, K Deficiency

- Due to ↓ **Fat Absorption** → Inability to assist in the co-absorption of fat-soluble vitamins across the small intestines
 - **Vitamin A Deficiency:**
 - May present with **night blindness**
 - **Vitamin D Deficiency:**
 - May present with **hypocalcemia, rickets, or osteomalacia**
 - **Vitamin E Deficiency:**
 - May present with **hemolytic anemia or neuropathy**
 - **Vitamin K Deficiency:**
 - May present with **bleeding**

e) Anemia

- Due to ↓ **B12, Folate, and Iron Absorption** → Inability of the bone marrow to mature and produce RBCs → ↓ RBCs enter the circulation
 - B12 and Folate deficiency → **Macrocytic Anemia**
 - Iron deficiency → **Microcytic Anemia**



B. PARTIAL MALABSORPTION

1. Pathophysiology:

a) Bile Acid Deficiency

- **Absence of Bile Acids** in the intestinal lumen → Leads to the inability to emulsify fats for aiding in digestion → Leads to the inability to absorb fats → ↑Fat loss into the intestinal lumen → **Loss of fats into the stool**

b) Lactose Intolerance

- **Lactase Deficiency** → Inability to digest lactose-containing carbohydrates → Inability to absorb lactose-containing carbohydrates → **Loss of lactose-containing carbohydrates in the stool**

2. Presentation:

a) Bile Acid Deficiency

i) Steatorrhea

- Due to **↓Fat Absorption** → Greasy and foul-smelling stools

ii) Vitamin A, D, E, K Deficiency

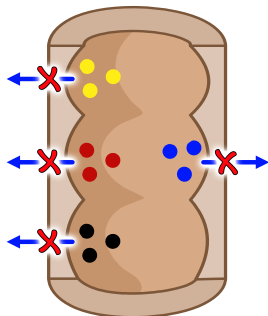
- Due to **↓Fat Absorption** → Inability to assist in the co-absorption of fat-soluble vitamins across the small intestines
 - **Vitamin A** Deficiency:
 - May present with **night blindness**
 - **Vitamin D** Deficiency:
 - May present with **hypocalcemia**, **rickets**, or **osteomalacia**
 - **Vitamin E** Deficiency:
 - May present with hemolytic anemia or neuropathy
 - **Vitamin K** Deficiency:
 - May present with **bleeding**

b) Lactose Intolerance

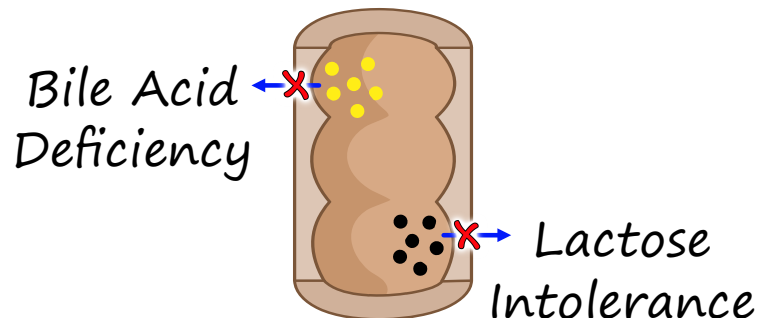
Watery Diarrhea

- Due to **↓Carbohydrate Absorption** → water pulled into the bowel lumen → larger volumes of liquid stool pass through the intestines
 - Associated with **Abdominal pain** from bowel distention from increased fluid in the intestinal lumen
 - Associated with **Flatulence** from increased gas production as a byproduct of carbohydrate breakdown by bacterial in the intestinal lumen

Global Malabsorption vs. Partial Malabsorption



Celiac
Tropical sprue
Whipple's
EPI

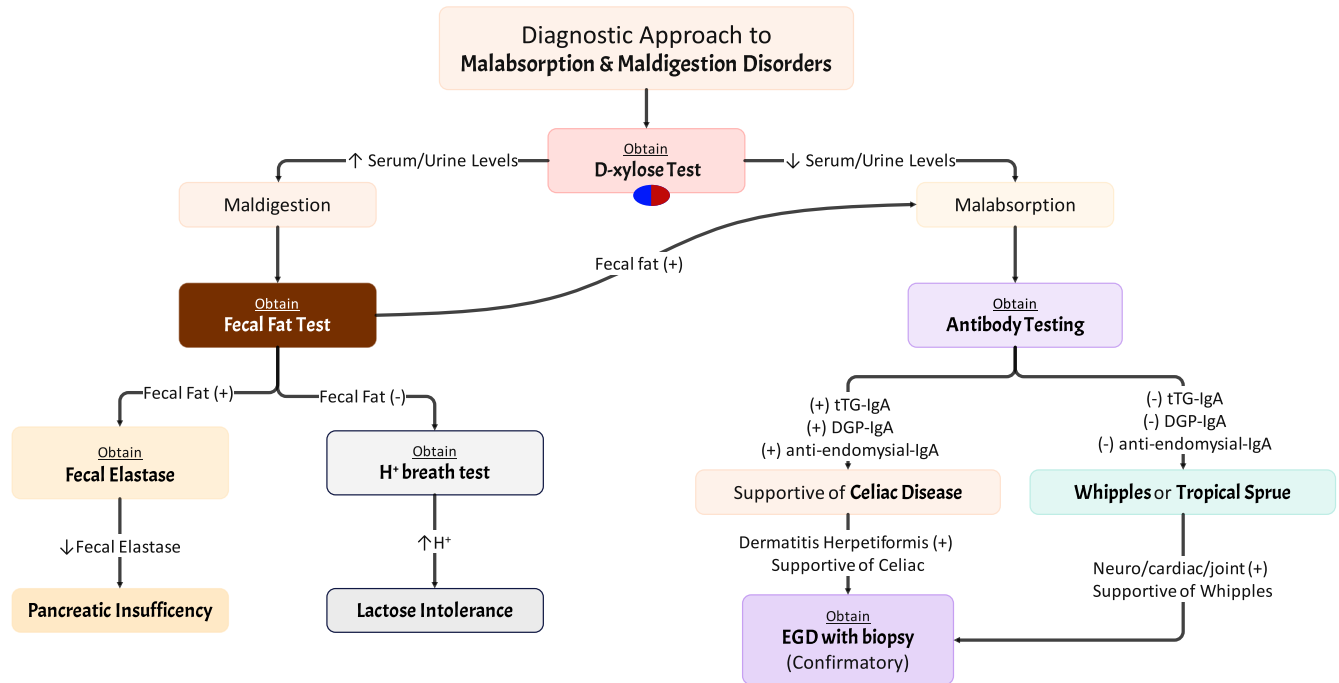


Bile Acid
Deficiency

Lactose
Intolerance



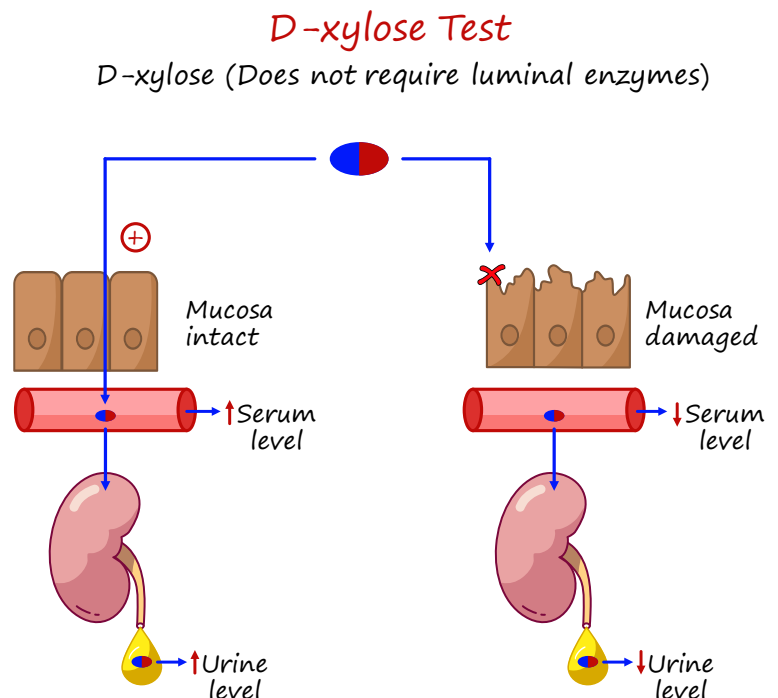
III. DIAGNOSTIC APPROACH TO MALABSORPTION AND MALDIGESTION DISORDERS



A. ASSESS FOR EVIDENCE OF MALABSORPTION OR MALDIGESTION

1. Obtain D-Xylose Test

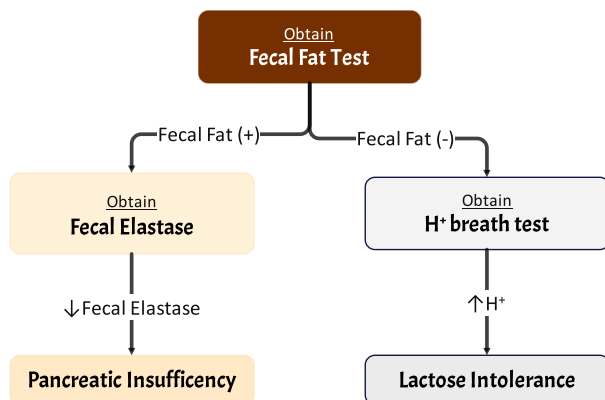
- **Indications:**
 - Suspicion of Malabsorption/Maldigestion disorder
- **Abnormal Findings:**
 - **Normal or ↑ Serum or Urine Xylose Levels:**
 - The absorption of ingested D-xylose, which does not require enzymatic digestion, indicates an **intact mucosa**, as it must reach the bloodstream to be filtered by the glomerulus
 - **Present in Maldigestion** → **Intact mucosa**
 - **↓ Serum or Urine Xylose Levels:**
 - The **failure to absorb ingested D-xylose**, which does not require enzymatic digestion, suggests a **non-intact mucosa**, preventing its entry into the bloodstream and subsequent filtration by the glomerulus
 - **Present in Malabsorption** → **Non-Intact Mucosa**



B. ASSESS FOR THE CAUSE OF MALDIGESTION

1. Obtain **Fecal Fat Test**, **Hydrogen Breath Test**, and **Fecal Elastase Levels**

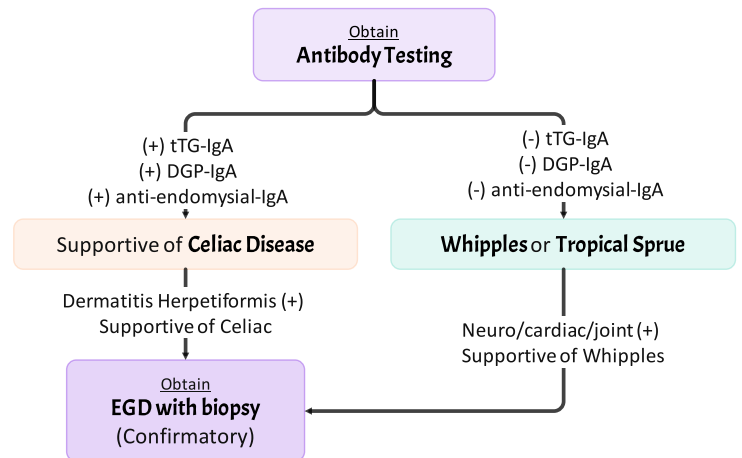
- **Indications:**
 - Suspicion of **Maldigestion** with a ↑Serum or Urine Xylose levels after D-xylose test
- **Abnormal Findings:**
 - **Exocrine Pancreatic Insufficiency:**
 - **↑Fecal fat**
 - Due to a lack of pancreatic lipase enzymes → Leads to the inability to digest fats
 - **↓Fecal Elastase Levels**
 - Recommended to assess for Chronic Pancreatitis
 - **Bile Acid Deficiency:**
 - **↑Fecal fat**
 - Due to a lack of bile acids → Leads to the inability to emulsify and digest fats
 - **Normal Fecal Elastase Levels**
 - Recommended to assess for Cirrhosis, Cholelithiasis, or Crohn's Disease
 - **Lactose Intolerance:**
 - **(-) Fecal fat**
 - A negative test as this will not affect fat absorption
 - **(+) Hydrogen Breath test**
 - Occurs when lactose is not metabolized by lactase → Bacteria metabolize lactose and generate large amounts of H⁺ gas that can be detected



C. ASSESS FOR THE CAUSE OF MALABSORPTION

1. Obtain **Fecal Fat Test** and Obtain **Antibody Testing** (e.g. tTG-IgA, dGP-IgA, EMA-IgA)

- **Indications:**
 - Suspicion of **Malabsorption** with a ↓Serum or Urine Xylose levels after D-xylose test
- **Abnormal Findings:**
 - **Celiac Disease:**
 - **↑Fecal fat**
 - Due to the lack of an intact intestinal mucosa → Leads to the inability to absorb fats
 - **(+) tTG-IgA, dGP-IgA, EMA-IgA**
 - If tTG-IgA is (+) → Celiac Disease is likely
 - If tTG-IgA is (-) or inconclusive → Assess dGP-IgA → If (+) test is revealed → Celiac Disease is highly likely
 - A biopsy should be considered for definitive diagnostic confirmation
 - **Whipple's Disease and Tropical Sprue:**
 - **↑Fecal fat**
 - Due to the lack of an intact intestinal mucosa → Leads to the inability to absorb fats
 - **(-) tTG-IgA, dGP-IgA, EMA-IgA**
 - Due to the absence of antibodies, a biopsy can be obtained to definitively diagnose Whipple's vs Tropical sprue vs Seronegative Celiac
 - Whipple's indicate the presence of Tropheryma whipplei and Foamy Macrophages



IV. TREATMENT OF MALABSORPTION AND MALDIGESTION DISORDERS

Type	Treatment
Pancreatic Insufficiency	- Pancreatic enzyme replacement
Lactose Intolerance	- Lactase enzyme replacement or - Lactose free diet
Celiac Disease	- Gluten free diet
Whipple's Disease	- Ceftriaxone x 2 weeks → Bactrim x 1 year
Tropical Sprue	- Tetracycline
Micronutrient replacement	- Folate, B12 Replacement - Iron Replacement - Fat Soluble Vitamin Replacement

A. EXOCRINE PANCREATIC INSUFFICIENCY (EPI)

- **Treatment:**
 - Pancreatic Enzyme Replacement
- **Indications:**
 - Diagnosis of Chronic Pancreatitis or Cystic Fibrosis that is causing EPI
- **Purpose:**
 - Provide exogenous pancreatic enzymes to ensure any nutrients being ingested are properly digested and subsequently absorbed
- **Monitoring:**
 - Improvement in steatorrhea, weight gain, and resolution of complications (e.g. anemia, vitamin deficiency, etc.)

C. LACTOSE INTOLERANCE



- **Treatment:**
 - Lactose restriction or Lactase enzyme replacement prior to ingestion of lactose-containing foods
- **Indications:**
 - Diarrhea, flatulence, and abdominal pain associated with lactose intolerance
- **Purpose:**
 - Provide exogenous lactase enzymes to ensure any lactose being ingested is properly being digested and subsequently absorbed
- **Monitoring:**
 - Improvement/Resolution in diarrhea, flatulence, and abdominal pain

B. BILE ACID DEFICIENCY



- **Treatment:**
 - Treatment of the underlying cause is critical
 - In the interim, use of **bile acid sequestrants** may be utilized (e.g. Cholestyramine)
- **Indications:**
 - Bile acid deficiency-related diarrhea
- **Purpose:**
 - Bile acid sequestrants help reduce the severity of diarrhea
- **Monitoring:**
 - Improvement in diarrhea

D. CELIAC DISEASE



- **Treatment:**
 - Gluten-free diet
- **Indications:**
 - Diagnosed Celiac or presence of Dermatitis Herpetiformis
- **Purpose:**
 - Prevent gliadin from triggering an immune response and downstream cascade from IgA antibodies → This reduces mucosal injury and allows for proper absorption
- **Monitoring:**
 - Improvement in steatorrhea, weight gain, and resolution of complications (e.g. anemia, vitamin deficiency, etc.)
 - IgA antibodies should normalize with a gluten-free diet
 - Mucosal healing on follow-up biopsy



E. WHIPPLE'S DISEASE

- **Treatment:**
 - IV Ceftriaxone for 2 weeks followed by Trimethoprim-Sulfamethoxazole (i.e. Bactrim)
- **Indications:**
 - Biopsy confirming Whipple's Disease
- **Purpose:**
 - Eradicate *Tropheryma whipplei*
- **Monitoring:**
 - Improvement in steatorrhea, weight gain, and resolution of complications (e.g., anemia, vitamin deficiency, etc.)

F. TROPICAL SPRUE



- **Treatment:**
 - Tetracycline
- **Indications:**
 - Persistent diarrhea after returning from a trip in a tropical area (e.g. Caribbean, India, Asia)
 - Biopsy confirming Tropical sprue
- **Purpose:**
 - Eradicate infectious agents causing diarrhea
- **Monitoring:**
 - Improvement in steatorrhea, weight gain, and resolution of complications (e.g., anemia, vitamin deficiency, etc.)

G. MANAGEMENT OF ANEMIA



- **Treatment:**
 - Folate, B12, and Iron Replacement
- **Indications:**
 - Anemia secondary to **Global Malabsorption**
- **Purpose:**
 - In addition to treating the underlying causes → The administration of these supplements ensures the bone marrow has the nutrients needed to synthesize RBCs
- **Monitoring:**
 - Improvement in Hemoglobin and normalization of the MCV

