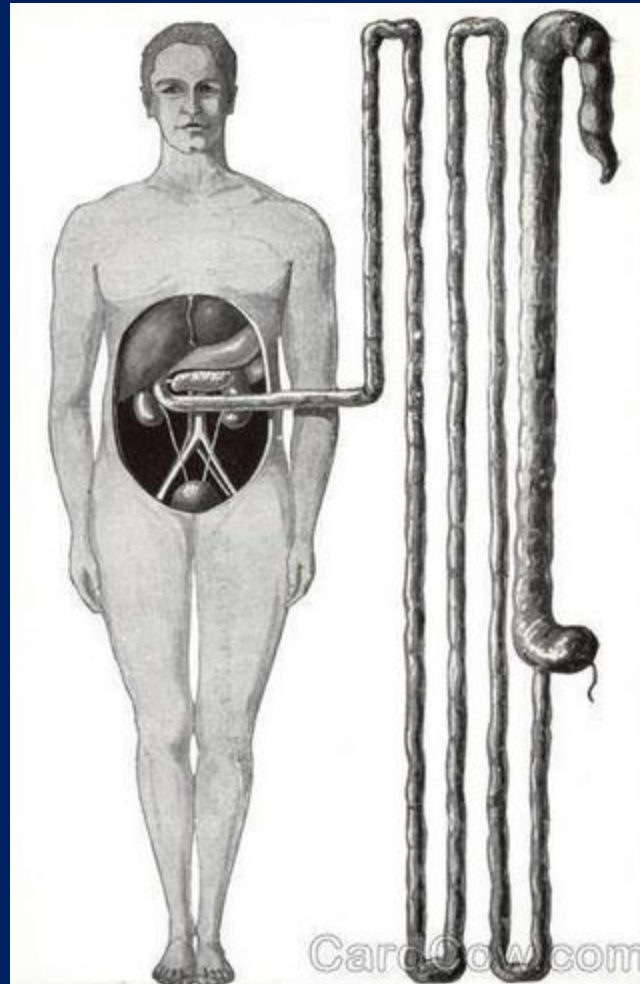


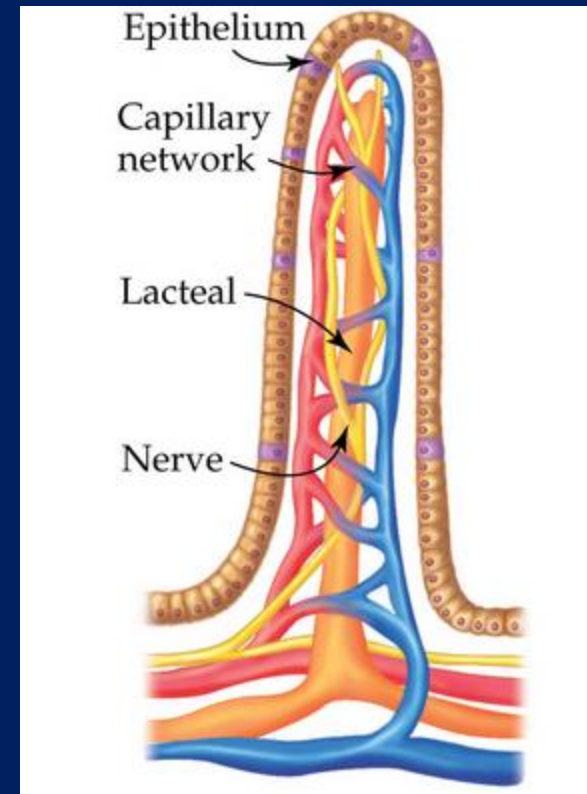
Malabsorption & Celiac Disease

Absorptive Capability

Measured Small Intestine Length = 6 Meters

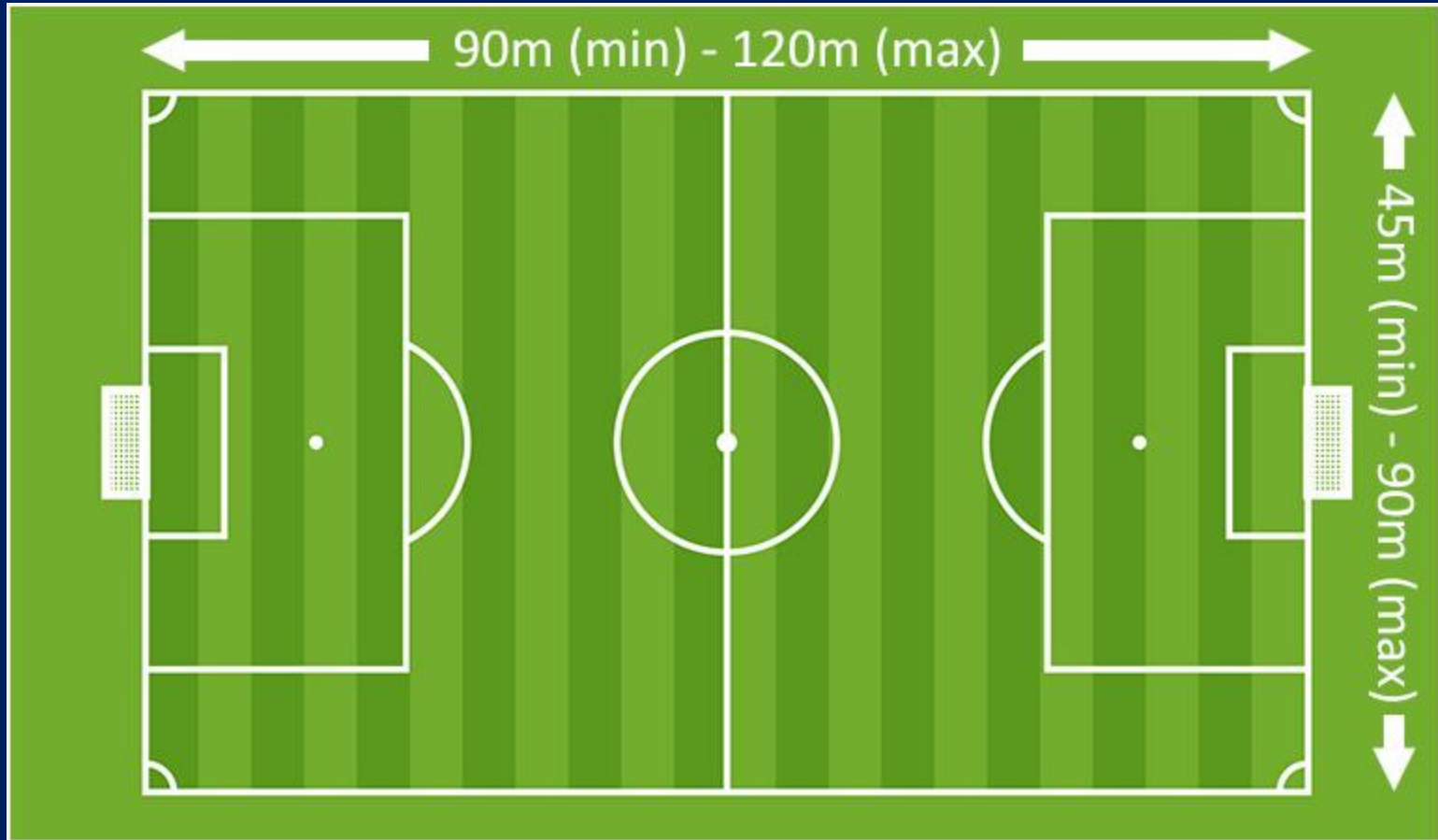


Absorptive Capability



Villi / Mico-Villi

Absorptive Capability



Standard Football Field

Maldigestion Vs Malabsorption

Maldigestion:

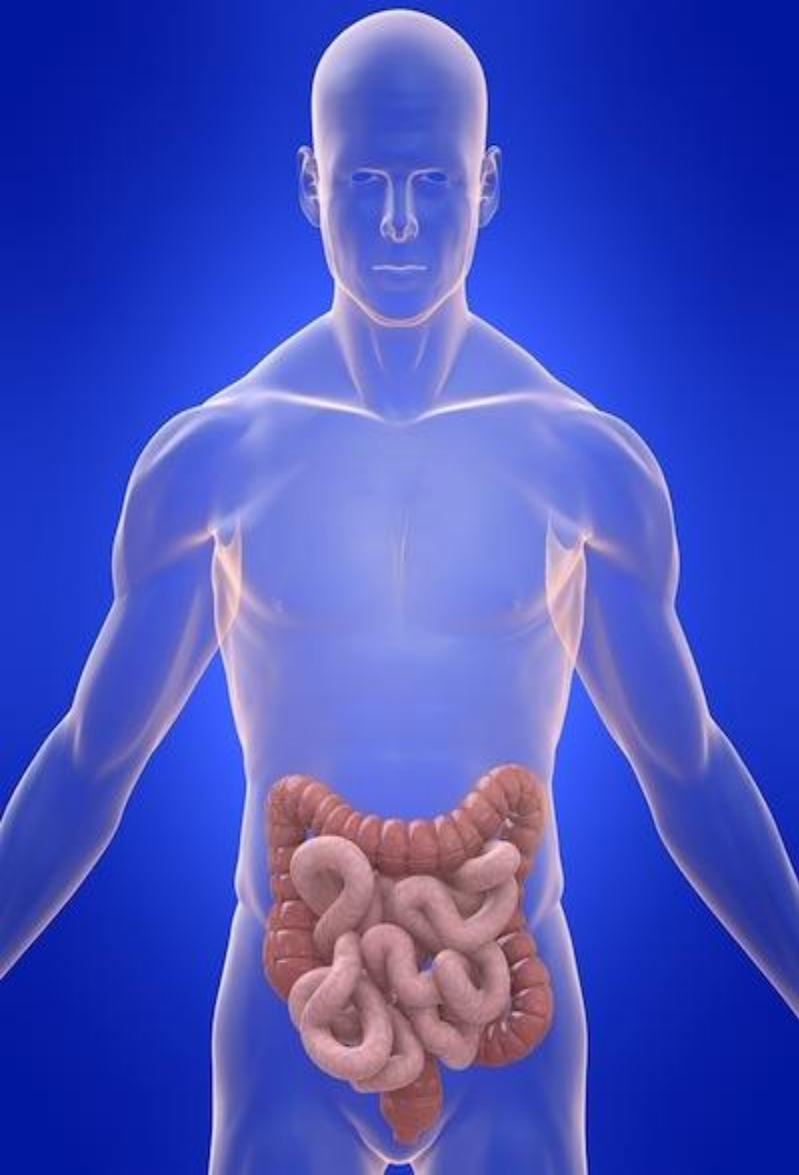
Impaired breakdown of nutrients

Malabsorption:

Defective mucosal uptake and transport of adequately digested nutrients including vitamins and trace elements.

Malabsorption Syndrome

A clinical term that encompasses defects occurring during the digestion and absorption of food nutrients by the gastrointestinal tract.



The digestion or absorption of a single nutrient component may be impaired, as in lactose intolerance due to lactase deficiency.

However, when a diffuse disorder, such as Celiac disease or Crohn's disease, affects the intestine, the absorption of almost all nutrients is impaired.

Pathophysiology

Malabsorption results from disturbance in at least one of the 3 phases of nutrients digestion & absorption:

- 1. Luminal phase (Defective digestion)***
- 2. Mucosal phase (Defective absorption)***
- 3. Post Absorptive phase (Deranged lymphatics)***

Where to start from?!!

The best way to classify the numerous causes of malabsorption is to consider the 3 phases of digestion and absorption.

Maldigestion

Impaired Luminal phase



Defect in the hydrolysis of nutrients

Luminal Phase “*digestion*”

☐ Pancreatic insufficiency

“The most common cause”

•Ch Pancreatitis •CF •Post Sx (Gastric/Pancreatic)

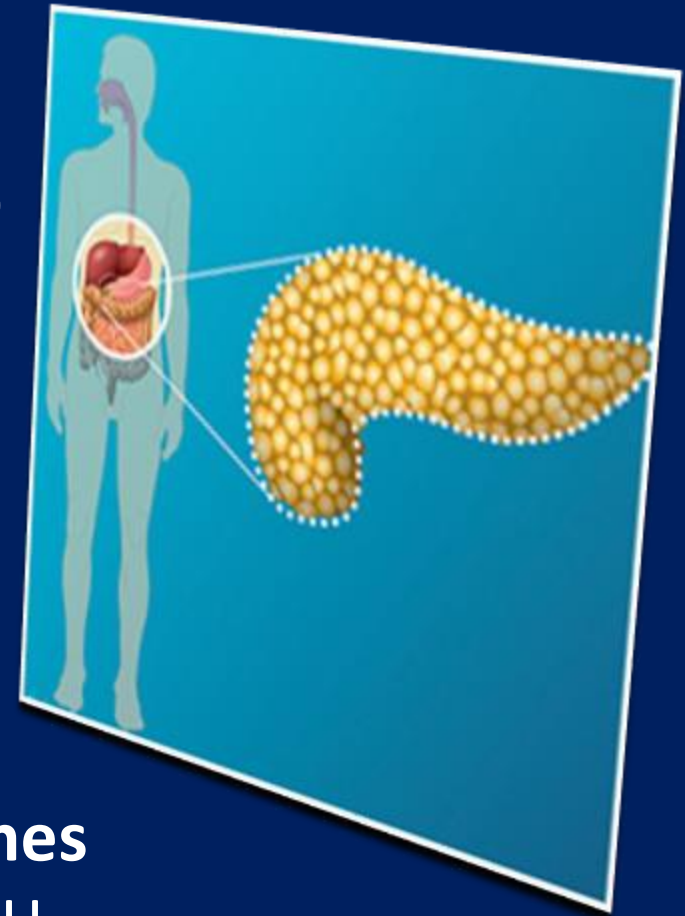


↓↓lipase & ↓↓proteases



lipid & protein malabsorption

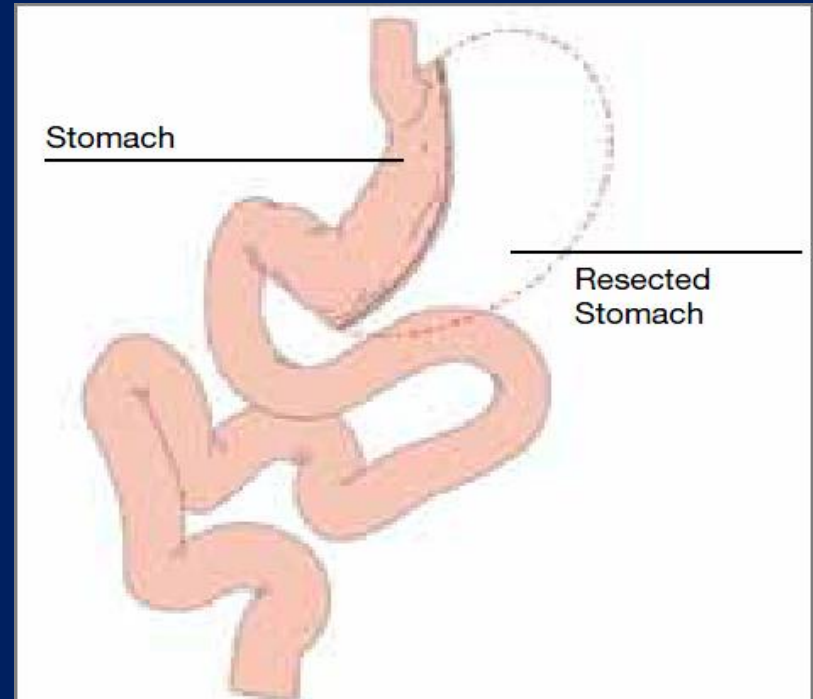
☐ Inactivation of pancreatic enzymes
by gastric hypersecretion (ZE) → ↓pH



Luminal Phase

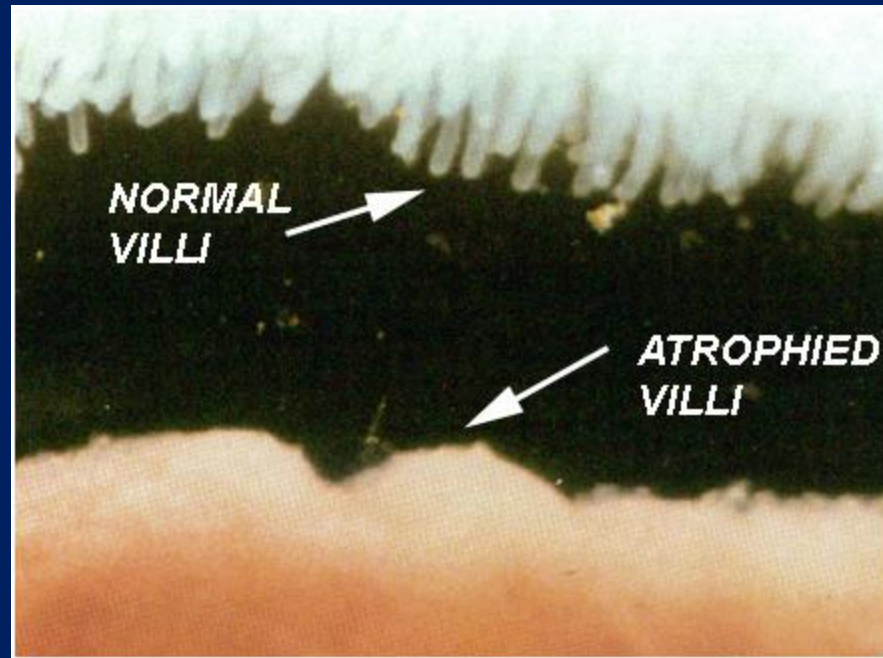
“digestion”

- ❑ **Post-Gastrectomy**
Inadequate mixing of nutrients, bile, and pancreatic enzymes, also causes impaired hydrolysis.



Mucosal phase

- Mucosal damage: (Villous Atrophy)



Mucosal phase

□ Mucosal damage: (Villous Atrophy)

Celiac disease, Intestinal Lymphoma

Crohn's disease (CD), Eosinophilic enteritis, Amyloidosis

SIBO, Giardiasis, Whipple's disease, Tropical sprue, Viral GE,, Intestinal TB

NSAIDs, Olmesartan

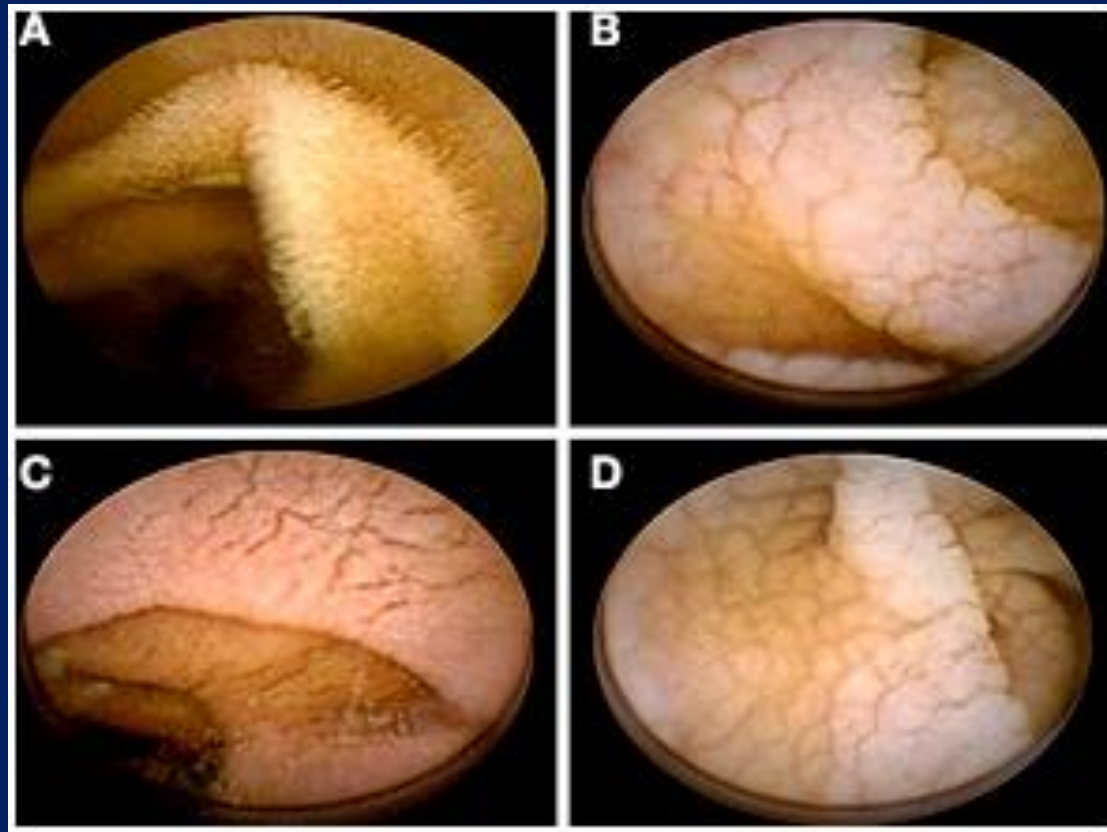
ZE synd (Gastrinoma)



↓ surface area, ↓ absorption/secretion

Mucosal phase

□ Mucosal damage: (Villous Atrophy)





Post Absorptive Phase

“Lymphatics”

- Obstruction of the lymphatic system:

- Congenital

- (Intestinal Lymphangiectasia)

- Acquired

- Whipple disease, neoplasm (lymphoma), TB, CHF, Constrictive Pericarditis, Rad Tx, Retroperitoneal Fibrosis



impairs the absorption of
chylomicrons & lipoproteins

Pathophysiology of Clinical Manifestations of Malabsorption

Symptom or Sign	Mechanism
Weight loss/malnutrition	Anorexia, malabsorption of nutrients
Diarrhea	Impaired absorption or secretion of water and electrolytes; colonic fluid secretion secondary to unabsorbed dihydroxy bile acids and fatty acids
Flatus	Bacterial fermentation of unabsorbed carbohydrate
Glossitis, cheilosis, stomatitis	Deficiency of iron, vitamin B12, folate, and vitamin A
Abdominal pain	Bowel distention or inflammation, pancreatitis
Bone pain	Calcium, vitamin D malabsorption, protein deficiency, osteoporosis
Tetany, paresthesia	Calcium and magnesium malabsorption
Weakness	Anemia, electrolyte depletion (particularly K ⁺)
Azotemia, hypotension	Fluid and electrolyte depletion
Amenorrhea, decreased libido	Protein depletion, decreased calories, secondary hypopituitarism
Anemia	Impaired absorption of iron, folate, vitamin B12
Bleeding	Vitamin K malabsorption, hypoprothrombinemia
Night blindness/xerophthalmia	Vitamin A malabsorption
Peripheral neuropathy	Vitamin B12 and thiamine deficiency

Diarrhea

- ❑ Diarrhea is the most common symptomatic complaint
- ❑ Diarrhea is defined as an increase in stool mass, frequency, or fluidity, typically greater than 200 g per day.



Steatorrhea

– Steatorrhea is the result of fat malabsorption.

– The hallmark of steatorrhea is the passage of pale, bulky, and malodorous stools.

– Such stools often float on top of the toilet water and are difficult to flush. Also, patients find floating oil droplets in the toilet following defecation.



Weight loss & fatigue

- Weight loss is common and may be pronounced; however, patients may compensate by increasing their caloric consumption, masking weight loss from malabsorption.
- The chance of weight loss increases in diffuse diseases involving the intestine, such as celiac disease and Whipple disease.



Flatulence & abdominal distention



Bacterial fermentation of unabsorbed food substances releases gaseous products, such as hydrogen and methane, causing flatulence.

Flatulence often causes uncomfortable abdominal distention and cramps.

Edema

- Hypoalbuminemia from chronic protein malabsorption or from loss of protein into the intestinal lumen causes peripheral edema.
- Extensive obstruction of the lymphatic system, as seen in intestinal lymphangiectasia, can cause protein loss.
- With severe protein depletion, ascites may develop.

**THIS MAY BE
CAUSING
YOUR
EDEMA**



Anemia

- Depending on the cause, anemia resulting from malabsorption can be either microcytic (iron deficiency) or macrocytic (vitamin B-12 deficiency).
- Iron deficiency anemia often is a manifestation of celiac disease.
- Ileal involvement in Crohn disease or ileal resection can cause megaloblastic anemia due to vitamin B-12 deficiency.



Metabolic defects of bones



- Vitamin D deficiency can cause bone disorders, such as osteopenia or osteomalacia.
- Bone pain and pathologic fractures may be observed.
- Malabsorption of calcium can lead to secondary hyperparathyroidism.

Carbohydrate Malabsorption

Etiology

Lactase deficiency:

(Most common *AE* of carbohydrate malabsorption)

- S/P intestinal resection
- Mucosal disease
- Post-infectious GE syndrome (Viral/Bacterial)
- Changing diet from Eastern → Western Diet

Carbohydrates Malabsorption

Workup

- **Stool Osmolality:**

Normally shall equal that of plasma Osmolality

Shall be measured; if not → will considered ≈ 290

Stool gap: is normally a minimal difference 2ry to some \ominus charged particles $\approx 50 - 100$

So ...

Stool gap =

(Measured) (or ≈ 290) - (Calculated) [stool ($\text{Na}^+ + \text{K}^+$) x2]

Carbohydrates Malabsorption

Workup

- **Stool Osmotic gap**

>100 (Osmotic Diarrhea)

- **Stool pH**

<6 (Fermentation)

- **Lactase DNA Assay**

- **Breath testing w/H₂**

(↑fermentation of unabsorbed carbohydrate by bacteria) = Malabsorption

**Fat
Malabsorption**



Greasy foul smell Diarrhea
↓ Wt
fat-soluble Vit def (ADEK)

**Protein
Malabsorption**

```
graph TD; A[Protein Malabsorption] --> B[Diarrhea  
Dependent edema  
Ascites];
```

**Diarrhea
Dependent edema
Ascites**