



- Evaluation of pancreatic fluid includes the measurement of the following:

- Fluid volume.
- Concentration of enzymes and bicarbonate.

Clinical condition	Measurement
Acute pancreatitis	Amylase and lipase
Malabsorption	Examination of stool for: fat, starch, meat fiber and D-xylose test
Exocrine function	Trypsin and chymotrypsin
Endocrine function	Insulin, glucagon and blood glucose
Obstructive disorders	Bilirubin

- Tests for exocrine pancreatic diseases:

Disease	Test
Acute pancreatitis	Serum enzymes
Chronic pancreatitis	<ul style="list-style-type: none"> • Fecal fat analysis. • Secretin/ CCK test
Cystic fibrosis	Sweat electrolyte

- Tests for exocrine pancreatic tests can be:

- **Direct.**
 - ✓ Insert and oroduodenal tube to aspirate secretions in response to stimulants:
 - ❖ *Secretin-CCK test:*
 - Testing secretory capacity of exocrine pancreas.
 - Patient should be fasting overnight (6 hours).
 - Pancreas is stimulated by IV secretin followed by CCK.
 - Pancreatic secretions collected by duodenal intubation.
 - Volume and flow rate of secretion of pancreatic fluid, pH, bicarbonate, enzyme (amylase, lipase and trypsin) activities are determined:
 - ✚ ↓flow + ↑enzymes = pancreatic obstruction.
 - ✚ ↓Bicarbonate + ↓enzymes = cystic fibrosis; chronic pancreatitis.
- **Indirect:**
 - ✓ Fecal fat and nitrogen.
 - ✓ Stool trypsin and chymotrypsin.
 - ✓ Elastase-1: 100% sensitivity and 96% specificity for pancreatic insufficiency:
 - ❖ Low levels: pancreatic insufficiency.
 - ❖ False-positive: seen in watery diarrhea.
 - ❖ It is a recommended test of choice for patients with diarrhea thought to be of pancreatic origin.
 - ✓ ¹⁴C-triolein or tripalmitin:
 - ❖ Used to investigate absorption of fats.
 - ❖ Low levels of CO₂ indicate inadequate pancreatic lipase.
 - ✓ Bentiromide:
 - ❖ It is a peptide given by mouth to measure chymotrypsin activity of the pancreas.
 - ✓ Pancreolauryl-fluorescence dilaurate test:
 - ❖ Testing cholesterol ester hydrolase in pancreatic juice.
 - ✓ Urinary trypsinogen-2 determination.
- Schilling test:
 - ✓ Dietary B₁₂ released by HCl binds to R-factor.
 - ✓ Pancreatic proteases release B₁₂ from R-factor.
 - ✓ B₁₂ binds to intrinsic factor for absorption in terminal ileum.

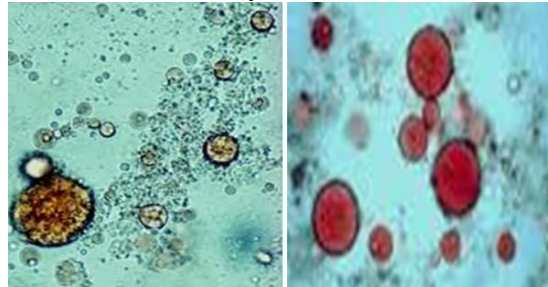


- **Sweat electrolyte:**

- Sodium and chloride measured for diagnosis of cystic fibrosis.
- Notice that sweat electrolytes does not distinguish cystic fibrosis-carriers from normal homozygotes.
- **Cystic fibrosis in children:** 2-5 fold increase in sodium and chloride concentration in sweat.
- **In adults**, no condition increase chloride and sodium above 80 mmol/L.
- **Females** have high levels of Na and Cl, 5-10 days before menstruation, but not as high as in cystic fibrosis.

- **Fecal fat analysis:**

- **There are four sources of fecal fat:**
 - ✓ Dietary.
 - ✓ Excreted (mainly in bile).
 - ✓ Shaded cells.
 - ✓ Intestinal bacteria.
- **Fecal lipids composed of:**
 - ✓ 60% of free fatty acids.
 - ✓ 30% of sterol.
 - ✓ 10% TAG.
 - ✓ Small amounts of cholesterol and phospholipids.
- **Steatorrhea is seen in:**
 - ✓ Exocrine pancreatic insufficiency.
 - ✓ Small intestine disease.
 - ✓ Biliary obstruction.
- **Tests for detection of fecal lipids:**
 - ✓ Sudan III or IV:
 - ❖ TAG and other neutral fats stain yellow-to-red with Sudan III



- ✓ Oil red O.
 - ✓ Nile blue sulfate.
 - **Detection of undigested meat fibers needs 10% alcohol and eosin stain.**
 - **Increases of fats and meat fibers indicates pancreatic steatorrhea.**
 - **For quantitative fecal fat determination:**
 - ✓ 3-5 days stool collection is used.
 - ✓ Patient should take lipid-rich diet 2 days before stool collection.
 - ✓ There are two techniques:
 - ❖ *Gravimetric method:* steps involve
 - Emulsification of stool with water.
 - Acidification.
 - Extraction of lipids with ether and ethanol.
 - ❖ *Titration method:* measures only saponifiable fatty acids. It is not a preferable method.
- **Serum enzymes:**
- **Serum amylase:** useful in diagnosis of acute pancreatitis. Notice that plasma levels retain to normal within 3-5 days!
 - **Urine amylase is a more sensitive marker for acute pancreatitis.**



- **Serum lipase is used for detection of pancreatic necrosis including pancreatitis.**
- **Some believes serum lipase may be even more sensitive than amylase.**
- **Both enzymes increase in:**
 - ✓ Pancreatic cancer.
 - ✓ Trauma.
 - ✓ Intestinal obstruction.
 - ✓ Infarction.
 - ✓ Perforation.
- **Amylase increases in:**
 - ✓ Mumps.
 - ✓ Hepatitis.
 - ✓ Cirrhosis.
 - ✓ Cholecystitis.
- **Lipase increases in:**
 - ✓ Bone fracture.
 - ✓ Fat embolism.