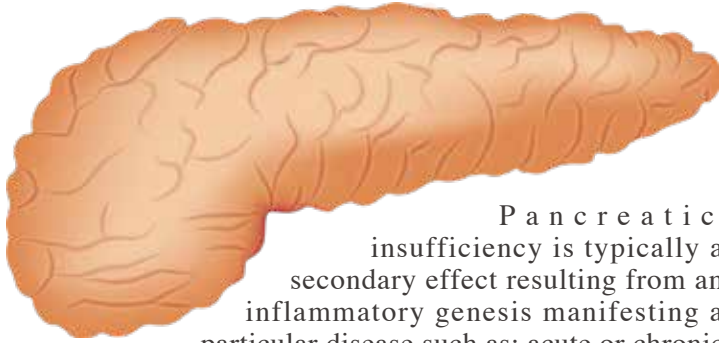




# Nutrition Interventions for Pancreatic Insufficiency



Pancreatic insufficiency is typically a secondary effect resulting from an inflammatory genesis manifesting a particular disease such as: acute or chronic (mainly in adults) pancreatitis, cystic fibrosis (CF, mostly in children), diabetes mellitus, NAFLD, and pancreatic cancer, or due to emotional and physical trauma such as surgical resection. Responsible for the digestion of many nutrients, a deficiency of certain pancreatic enzymes can cause various types of malabsorption, leading to malnutrition, increased morbidity and mortality.

## Pancreatic Function

The pancreas possesses both endocrine and exocrine functions, and is essential for the digestion, absorption, and metabolism of various nutrients. The pancreatic acini produce and secrete digestive enzymes that are then delivered to the duodenum along with bile salts which allows for digestion within the small intestine. Amylase is an enzyme that breaks down carbohydrates. Lipase digests fats. Protease and elastase are both responsible for digesting protein. Impairment of pancreatic function therefore leads to maldigestion and malabsorption.

Pancreatic islets, make up the endocrine portion of the pancreas which produces the hormones insulin, glucagon, amylin, ghrelin, pancreatic polypeptide, and somatostatin that are secreted directly into circulation. Both metabolic stress and genetics play a significant role in the response of pancreatic  $\beta$  cells which when overwhelmed contributes to pancreatic dysfunction.

## Pancreatic Insufficiency Symptoms

Pancreatic insufficiency most commonly affects exocrine function. Exocrine pancreatic insufficiency (EPI), a condition that affects normal nutrient digestion and absorption, results from low levels of digestive enzymes. Several conditions can cause EPI, manifesting in non specific symptoms including: bloating, abdominal discomfort, steatorrhea, diarrhea, excess gas, and weight loss. These symptoms may not become apparent until exocrine pancreatic function drops below 10% of normal. Nutrient malabsorption due to EPI can lead to malnutrition. Signs and symptoms of malnutrition associated with EPI include: dry skin, depression, edema, fatigue, dizziness, feeling cold often, irritability, memory/concentration issues, osteoporosis, and muscle loss.

## Nutrition Support in Pancreatic Insufficiency

Many patients with EPI, especially those meeting criteria for malnutrition, may require nutrition supplements. If the patient is on an oral diet, then oral nutrition supplements can be provided.

Patients who have signs of micronutrient/vitamin/enzyme deficiencies, inadequate intake, or prolonged malabsorption should be assessed. This should include vitamin A, D, E, K, B12, iron, zinc, selenium, and copper. Because people with EPI have trouble digesting fat, and are especially at risk for deficiencies in fat-soluble vitamins. According to an article published in the journal *Pancreas*, as many as 35% of people with both chronic pancreatitis and EPI are deficient in vitamin A, 63% of people were deficient in vitamin D and vitamin K.

Some smaller studies have suggested a symbiotic relationship with the use of prebiotics and probiotics in those with acute pancreatitis.

## Pancreatic Enzyme Supplement

pancreatic enzyme supplement is necessary for those with EPI as it allows for appropriate nutrient absorption. Exposing these digestive enzymes to heat reduces their effectiveness. Further description of the digestive enzymes distinguished by type found in pancreatic supplements are provided below.

● **Amylase.** This class of digestive enzyme is needed to help break down carbohydrates and sugars. The main symptom of amylase deficiency is diarrhea due to undigested starches caught in the lower intestine. Types of amylases include  $\alpha$ -amylase,  $\beta$ -amylase, and  $\gamma$ -amylase.

● **Lipase.** This class of digestive enzyme is needed to help break down carbohydrates and sugars. The main symptom of amylase deficiency is diarrhea due to undigested starches caught in the lower intestine. Types of amylases include  $\alpha$ -amylase,  $\beta$ -amylase, and  $\gamma$ -amylase.

● **Protease.** These digestive enzymes are necessary for the breakdown of proteins. When you don't produce enough, you may have a higher risk of developing allergies or getting bacterial intestinal infections. Types of protease include cysteine proteases, serine proteases, and glutamic proteases.

They should be taken before or during a meal. Dosing of digestive enzymes is based on body weight, fat content of meals, or pancreatic lipase output; it's also based on age.