



WGO Practice Guideline: Malabsorption

Sections:

1. Definition
2. Mechanisms of malabsorption
3. Diagnostic approach to malabsorption
4. Diagnostic approach to malabsorption: Conclusions
5. Literature References
6. Links to Useful Websites
7. Queries and Feedback from You

1. Definition

Maldigestion: impaired breakdown of nutrients (carbohydrates, protein, fat) to absorbable split-products (mono-, di-, or oligosaccharides; aminoacids; oligopeptides; fatty acids; monoglycerides)

Malabsorption: defective mucosal uptake and transport of adequately digested nutrients including vitamins and trace elements.

Note: Digestive and absorptive processes are so inextricably linked, that a third term, malassimilation has been coined in order to reflect this situation. Despite these distinctions, reflecting the underlying pathophysiology, malabsorption is still widely used as the global term for all aspects of impairment of digestion and absorption.

2. Mechanisms of Malabsorption

The integrated processes of digestion and absorption can be described in three phases:

- **Luminal Phase**
- **Mucosal phase**
- **Removal phase**

During the luminal phase, dietary carbohydrates, proteins and fats are hydrolysed and solubilized, depending largely on pancreatic and biliary secretions.

During the mucosal phase, final hydrolysis and uptake of saccharides and peptides takes place and lipids taken up by epithelial cells are processed and packaged for cellular export.

During the removal phase, the absorbed nutrients enter the vascular or lymphatic circulation.

Disturbances of the absorptive process can take place in each of these three phases and an understanding of the normal absorptive process will help a great deal to understand causes and consequences of malabsorption and thus guide us in designing an appropriate differential diagnostic strategy.

3. Diagnostic approach to malabsorption

3.1. Introduction

The presentation of malabsorption varies considerably and may range from severe steatorrhea and massive loss of weight at one side to very discrete changes in hematological or biochemical laboratory tests found incidentally on the other side.

3.2. Malabsorption: Presentation and diagnostic hints

From a practical point of view the ultimate goal of the diagnostic approach is to find or to rule out a disease or condition which causes malabsorption and it is less important to prove the presence of malabsorption per se.

In the more severe cases, diarrhea and weight loss are typical leading signs; however, in less severe or oligosymptomatic forms of malabsorption it may be difficult to suspect malabsorption as a possible cause of the patient's problems. It is therefore important to listen carefully to the patient, particularly to complaints of frequent soft stools, abdominal discomfort, unexplained loss of weight, fatigue, decreasing strength, unexplained skin alterations, pain in the bones. A summarizing correlation between clinical symptoms, signs, and laboratory findings is shown in table 1.

Table 1: Clinical and laboratory findings in malabsorption

Signs and Symptoms	Laboratory findings	Malabsorbed nutrient
diarrhea	stool weight ↑, serum potassium ↓	water, electrolytes
steatorrhea	fecal fat ↑, serum cholesterol ↓	dietary lipids, bile acids
weight loss	fecal fat ↑, fecal chymotrypsin or elastase ↓; xylose-test ↓	fat, carbohydrates, protein
anemia	serum iron ↓, red blood count hypochromic, microcytic	iron
pernicious anemia, glossitis	red blood count hyperchromic, megaloblastic; Schilling-test abnormal	vitamin B12, folic acid
pain in limbs and bones pathologic bone fractures Chvostek-sign	osteoporosis, osteomalacia calcium ↓, alkaline phosphatase ↑ X-ray film,	potassium, magnesium calcium, vitamin D, protein; aminoacids
signs of bleeding, easy bruising, petechial hemorrhage	prothrombin-time ↑	vitamin K, vitamin C
edema	total protein ↓, serum albumin ↓,	protein

(intestinal protein loss)	fecal a1-antitrypsin-clearance ↑	
abdominal distention, gas	abdominal X-ray, sonography glucose H2-breath-test	carbohydrates
lactose intolerance	lactose-H2-breath-test ↑ intestinal mucosal lactase ↓	lactose
peripheral neuropathy	nervous function ↓	vitamins B1,B6,B12
hyperkeratosis, parakeratosis, acrodermatitis	retinol-, zinc-serum levels ↓	vitamin A, zinc
night blindness	serum retinol ↓	vitamin A

3.3. Malabsorption: additional diagnostic hints

In addition to the clinical and laboratory signs and symptoms in table 1, other diagnostic hints can be provided by:

- history of previous surgery of the GI-tract
 - partial or total gastrectomy
 - small bowel resections (jejunum?, ileum?, extent of resection?, ileocecal?)
 - partial or total resection of the pancreas
- history of chronic pancreatitis
- history or evidence of chronic cholestasis
- history of irradiation treatment.

Some diseases associated with malabsorption are found more frequently in families :

- celiac disease
- Crohn's disease
- mucoviscidosis or cystic fibrosis
- disaccharidase deficiencies (lactase)

For this reason it is important to carefully explore the family history.

Clinical examination may reveal some of the findings shown in table 1, however, none of these findings are specific for malabsorption only.

So-called routine laboratory examination may give additional hints, such as anemia (micro- or macrocytic?), diminished serum concentrations of iron, ferritin, calcium, magnesium, total protein, albumin, cholesterol and prothrombin time.

If the case history, clinical examination or routine laboratory profile raises suspicion of a possible malabsorptive disorder, one should also examine the stool as for instance gross steatorrhea can be recognized macroscopically and additional information may be gained about stool volume and the presence of parasites.

3.4. Malabsorption: diagnostic approach

Prior to the development of advanced endoscopic and imaging techniques for abdominal organs (ultrasound, endosonography, X-ray, computed tomography, magnetic resonance imaging, etc.) functional testing for the digestive activities of gastric juice, bile and pancreatic secretion and for the capacity of intestinal absorption of numerous nutrients had a prominent place in the diagnostic approach to malabsorption. This situation has changed and today for practical reasons it is not recommended to apply a multitude of tests in every patient with suspected malabsorptive disorder. Instead the diagnostic approach aims primarily to establish a diagnosis of underlying diseases rather than to prove or exclude a "malabsorption syndrome".

The following diagnostic algorithm is based on practical experience and arbitrarily integrates pathophysiological concepts, modern function tests and morphological investigations.

DIAGNOSTIC ALGORITHM:

Take careful history including drug intake, travelling and special foods, drinks or sweets

Consider family history

Notice hints for malabsorption from physical examination

Look at stool for volume, appearance, admixtures of mucus, blood, parasites

Draw blood for screening laboratory examination to find additional hints



If the case warrants further exploration, go on with:

H₂-breath tests for carbohydrate malabsorption (lactose, fructose) endomysial-, antigliadin- and/or tissue transglutaminase-antibodies (celiac disease) search for giardia lamblia, enteropathogenic bacteria, parasites and ova.



Abdominal ultrasound (gallbladder; liver; pancreas; intestinal wall aspects; adenopathy; etc.)



Oesophago-Gastro-Duodenoscopy including biopsies from stomach (autoimmunegastritis? H. pylori?) and duodenum (celiac disease?, inflammatory bowel diseases? Especially duodenojejunal involvement is associated with malabsorption ; table 2)



Ileocolonoscopy including biopsies of colon and ileum (ileal disease? bile salts ↓?, vit. B12 ↓?)



If pancreatic disease with secretory insufficiency is suspected,

Consider:

- tests for secretory function e.g. elastase or chymotrypsin in stool
- computer tomography; magnetic resonance imaging of pancreatic duct-systems or ERCP

The gold standard still is the secretin-pancreozymin-test; this test is not really necessary for routine examination but may be helpful in individual cases; likewise the quantitative determination of fecal fat excretion is hardly needed any more for clinical judgement of pancreatic diseases. Moreover when in doubt a therapeutic trial with pancreatic enzyme suppletion therapy may be considered.



If small bowel disease is still within the differential diagnostic scope,

Consider

- Schilling-test (Vit B12)
- Glucose-H₂-test (bacterial overgrowth)
- a1-antitrypsin clearance (intestinal protein loss)
- Small bowel X-ray (fistulae, diverticula, blind loops, short bowel, etc.)
- Angiography of celiac and mesenteric arteries (ischemic bowel damage)

3.5. Comments on the diagnostic algorithm

The quantitative determination of fecal fat excretion is generally accepted as an adequate global test for malassimilation. This test is not readily available however, as most hospitals and laboratories find it unpleasant to work with a 3 day complete collection of feces and the test depends on the ingestion of a defined diet high in fat over a period of 5 - 6 days by the patient. This test is not needed in most instances, as nowadays diseases of the pancreas, the small intestine and other more complex situations can be diagnosed by other techniques, mentioned in the diagnostic algorithm. More recently near-infrared spectrometry has been suggested as a new, rapid and accurate method for measuring fecal fat which correlates well with fecal fat determination. The acid steatocrit method has been proposed as an other useful test for the screening and monitoring of patients with steatorrhea. If the presence of celiac disease is suspected, the determination of antibodies to endomysium, tissue transglutaminase or gliadin is now generally recommended in addition to or prior to duodenal mucosal biopsy.

Hydrogen breath tests (lactose, fructose, glucose) are now readily available and widely used to check for carbohydrate malabsorption by the small intestine. These tests for lactose or fructose malabsorption or for bacterial overgrowth (glucose) are well established.

Stool examinations are particularly helpful in the search for parasites, bacteria or fecal (occult) blood excretion; a positive test for fecal blood can provide indirect evidence of possible inflammatory or neoplastic processes in the gastrointestinal tract.

If small bowel disease is suspected, gastroduodenoscopy is an appropriate procedure to examine the proximal part of the small bowel whereas ileocolonoscopy is a suitable technique to examine the distal part of the small bowel. When biopsies are taken from these two ends of the small bowel histological and additional work up of these biopsy specimens may help to establish diagnoses summarized in table 2 .

Table 2 Diagnostic significance of small bowel biopsy
<p>supportive diagnostic evidence or proof of</p> <ul style="list-style-type: none"> • celiac disease • tropical sprue • Collagenous sprue • Whipple disease • Parasites, e.g. lamblia • Eosinophilic Enteritis • Primary intestinal Lymphoma • Primary intestinal Lymphangiectasis • Immuno Deficiency Syndrome • A-b-lipoproteinemia • Other findings

Endoscopic forceps biopsies are usually sufficient for diagnostic evaluation and the use of intestinal suction biopsy (single or multiple suction biopsies) without endoscopic control is no longer necessary.

The examination of the entire small bowel is best done by X-ray. The Enteroclysis method is a well-established procedure. With this technique it is possible to find inflammatory or neoplastic morphologic changes of the small bowel in those areas, which can not be reached easily by duodenoscopy or colo-ileoscopy. Another important finding that can be revealed by this X-ray technique is the presence of intestinal diverticula, which may give rise to bacterial overgrowth syndromes.

Finally, while there are many different function tests for different parts of the small bowel they are generally not very sensitive and especially the tests for more specific functions of the ileum like the Schilling test are positive only if more than 50 cm of ileum has been put out of function (for instance as a result of resection or of major inflammatory processes).

As mentioned, the insufficient exocrine function of the pancreas can also be a major cause of malabsorption. Practical non-invasive indirect tests to assess excretory pancreatic insufficiency should start with quantitative measurement of fecal excretion of chymotrypsin or elastase.

The sensitivity and specificity of these tests are in the order of 60 - 90% and this of course may be a problem in the individual case - especially in mild pancreatic insufficiency.

There are a few additional non-invasive tests that deserve mentioning such as the Bentiromide (PABA)-test or the Pancreolauryl test. Both tests are well established although of limited value in patients with minor degrees of pancreatic insufficiency. If for any reason the investigation of pancreatic exocrine function is deemed appropriate in a specific patient, then intubation studies involving placement of a nasoduodenal tube and stimulation of pancreatic secretion by i.v. administration of secretin and pancreozymin are considered the gold standard for sensitive and specific determination of pancreatic exocrine secretion

capacity. This test usually is performed in research centers rather than on a clinical ward. Therefore, like quantitative fecal fat excretion, the secretin pancreozymin or the Lundh test are not generally available in a clinical hospital setting. In most cases both tests are not needed from a clinical point of view.

4. Diagnostic approach to malabsorption: Conclusions

Maldigestion, malabsorption and malassimilation are synonym terms describing insufficient nutrient uptake and utilization by the gastrointestinal tract. This syndrome can be caused by many different diseases and may lead to a wide spectrum of clinical signs, symptoms and biochemical findings including vitamin - or nutrient deficiency syndromes. When assessing this situation it is important to keep in mind, that it is less meaningful to prove the existence of a malabsorption syndrome and that instead emphasis should be put on defining an underlying disease entity which then provides the basis for appropriate counselling and treatment.

5. Literature references

1. S.A. Riley, M.N. Marsh: Maldigestion and Malabsorption; Chapter 88, pages 1501-1522 In: Sleisenger and Fordtran's, Gastrointestinal and Liver Disease, Pathophysiology/Diagnosis/Management, 6th Edition, Volume 2, W.B. Saunders company 1998
2. Malabsorption syndromes Julio C. Bai Digestion 1998;59:530-546 [Pubmed-Medline](#)
3. Near-infrared spectrometry analysis of fat, neutral sterols, bile acids, and short-chain fatty acids in the feces of patients with pancreatic maldigestion and malabsorption Nakamura T., Takeuchi T., Terada A., Tando Y., Suda T.: Int. J. Pancreatol. 1998 Apr.; 23(2):137-43 [Pubmed-Medline](#)
4. Clinical use of acid steatocrit Van den Neucker A., Pestel N., Tran T.M., Forget P.P., Veeze H.J., Bouquet J., Sinaasappel M.: Acta Paediatr. 1997 May; 86 (5):466-9 [Pubmed-Medline](#)
5. The clinical relevance of lactose malabsorption in irritable bowel syndrome Bohmer C.J., Tuynman H.A Eur. J. Gastroenterol. Hepatol. 1996 Oct.;8 (10):1013-6 [Pubmed-Medline](#)
6. Accuracy of measurement of dual-isotope Schilling test urine samples: a multicenter study Krynycky B.R., Zuckier L.S. J. Nucl. Med. 1995 Sep; 36 (9):1659-65 [Pubmed-Medline](#)
7. Fecal elastase 1: a novel, highly sensitive, and specific tubeless pancreatic function test. Loser C., Mollgard A., Fölsch UR Gut 1996 Oct; 39 (4): 580-6. [Pubmed-Medline](#)

6. Links to useful websites

[National Guidelines Clearing House](#)

Type:"Malabsorption"into the search box

[MedlinePlus:](#)

Overview about Malabsorption for consumers/patients

[American Gastroenterological Association](#)

Evaluation of food allergies; Celiac Sprue; Evaluation and management of Chronic Diarrhea; Malnutrition in HIV patients; IBS

[American Society of Colon and Rectal Surgeons](#)

Practice parameters for treatment of mucosal ulcerative colitis

[National Heart, Lung, and Blood Institute \(U.S.\)/National Institute of Diabetes and Digestive and Kidney Diseases \(U.S.\)](#)

Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults

[Infectious Diseases Society of America](#)

Practice guidelines for the management of infectious diarrhea

[Centers for Disease Control and Prevention/American Medical Association/Food Safety and Inspection Service/Center for Food Safety and Applied Nutrition](#)

Diagnosis and management of foodborne illnesses: a primer for physicians

7. Queries and feedback from you

INVITATION TO COMMENT

The Practice Guidelines Committee welcomes any comments and queries that readers may have. Do you feel we have neglected some aspects of the topic? Do you think that some procedures are associated with extra risk? Tell us about your own experience. You are welcome to click on the link below and let us know your views.

guidelines@worldgastroenterology.org