



EVALUATING CAUSATIVE FACTOR AND ASSESSMENT TOOLS FOR GRAHANI ROGA VIS A VIS MALABSORPTION SYNDROME

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ABSTRACT Malabsorption refers to variations/changes/ alteration of the gastrointestinal tract (GIT) affecting the digestion, absorption and transport of nutrients across level of the bowel wall. It is regarded as an important clinical indicator of intestinal failure and found to be interlinked with many diseases. In Ayurveda, the term Agni (Fire) is used to showcase the power of digestive process which converts and transforms any substances from one form to another. While addressing process of disease formation, Acharya has mentioned that weakened power of assimilation (Agnimandya) is the root cause of most of the disorders. Grahani Roga is a considered as disease of irregularity of digestion , absorption and assimilation which is of great clinical relevance in the modern era because of its direct link with the Malaborsrption. The individual clinical assessment of Agni and other diagnostic tools becomes vital. It turns out to be important for Ayurvedic physicians to understand and study the concept of Agni, its consequences like Malabsorption and to diagnose the disease with Ayurvedic methods with Modern techniques to give the best treatment approach. Thus the article explores the assessment tools to diagnose the strength of Agni, Grahani and Malabsorption.

KEYWORDS : agni dusti, jatharagni, grahani, malabsorption,

INTRODUCTION

Malabsorption refers to variations/changes/ alteration of the gastrointestinal tract (GIT) affecting the digestion, absorption and transport of nutrients across level of the bowel wall. Malabsorption affects millions of people worldwide. In Ayurveda, the term Agni (Fire) is used to showcase the power of digestive process which converts and transforms substances from one form to another. *Jatharagni* is Sanskrit word which denotes two words *Jathar* –means stomach/GUT and *Agni*- the digestive fire/digestive enzymes, thus jathar-agni is responsible power of digestion process which converts, metabolise, & transform foodstuff in the form of substances which are acceptable by body. Pitta dhara kal (protective layer and functional layer of intestine) is responsible for further digestion, absorption and assimilation. *Grahani* is understood as the Anatomical place of *Jatharagni* / digestion and is supported & nourished by the strength of *Agni*, thus the disorders related to *Agni*, digestion and its absorption is broadly covered under the heading of '*Grahani Roga*' we roughly correlates this condition with modern entity as Malaborsrption.

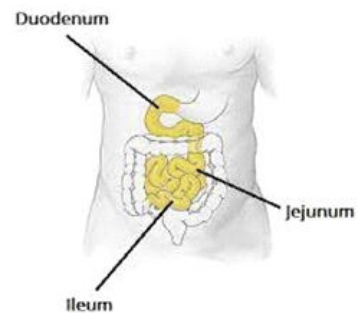
Anatomical consideration :

Acharya Sushruta described that *grahani* is located between *Amashaya* (stomach) and *pakwashaya* (large intestine) and it is the site of *pittadharakala*, (mucosal integrity of small intestine).²

Acharya Charaka described *Grahani* as a seat of *Agni* and it is called so because of holding up the food. It first receives the food from *amashya* (stomach) , holds up the food and release it after it get digested.³ After the completion of digestion, the remnants of food i.e. *Kitta* are propelled towards into the next *Ashaya* i.e. *Pakvashaya* ((from small intestine to large intestine) for further absorption and assimilation. Thus, the process of maximum digestion is accomplished in the area of *grahani* (*duodenum to ilium*). This description of *grahani* indicate it to be whole of the small intestine including duodenum, jejunum and ilium. (Fig no. 1)

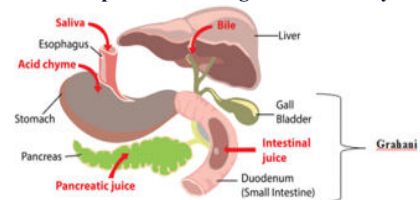
Function of Agni : Ayurveda considers that Deha-Agni (Bodily fire) as the fundamental cause of life, skin texture, strength, health, nourishment, lustre, Oja (immunity), Teja and Prana (life force).⁴ Agni is innumerable because of its presence in each and every dhatu paramanu (cell) of the body, But majorly classified into 3 major sets based on their locations and where they act.

Figure 1 Anatomical Consideration of *Grahani* as Organ



The first one, Jatharagni, acts on the food in the digestive tract and converts it into absorbable form⁵. The Jathar Agni, is the principal Agni which roughly related with all the gastrointestinal digestive enzymes. (Fig no. 2) Organs like liver, gall bladder, pancreas, intestinal juices all contributes in digestion thus plays part as Jathar-agni.

Figure 2 Associated part of Jathar agni / Gastric enzymes

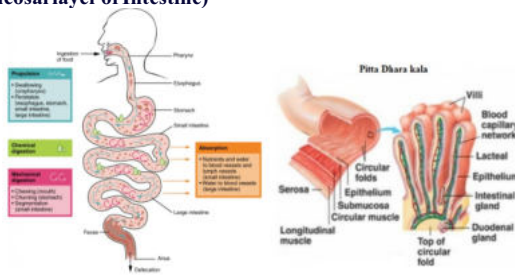


- The second set of Agni is known as Bhutagni, and it is of 5 types. Each of these 5 acts on the 5 primordial constituents of the absorbed food: Earth, Water, Fire, Air, and Space. These 5 Bhutagnis transform the substrates into such form that can be assimilated at tissue level.⁶
- The third set of Agni is called Dhatvagni, which is of 7 types based on the kind of tissue that it helps nourishing. Dhatvagnis act at tissue level and help in the process of tissue building.⁷

It may be noted that these 3 levels of action of Agni are very much similar to the 3 steps of metabolism that are understood in contemporary biochemistry: digestion (hydrolysis), intermediary metabolism (preparatory phase), and the Krebs cycle which takes place at a cellular level.⁸

Pittadharakala (mucosal layer) is stated to cover that part of the Grahani ie. Duodenum to ileum (mucosal layer of intestinal tract) which is related with digestion, separation and absorption of food. Acharya susruta explains, the separation of Sara (nutrients from food) and Kitta (unwanted) takes place by Pittadharakala. The Pittadharakala would also appear to be the structure that make available the pachak pitta (digestive secretions/enzymes). It is the site of Antar-agni. It receives food bolus from amashaya and performs shoshan (absorption) and pachan (digestion), then transmit pakwa anna (digested food) to pakwashaya, (large intestine)⁹ [susruta]. Thus Impaired nutrient absorption is located somewhere along the small intestine since it provides a substantial surface area maximized by villi and microvilli and space within the lumen. (Fig 3.)

Figure 3 & 4 Anatomical consideration of Pitta Dhara Kala (Mucosal layer of Intestine)



According to Ayurveda these are following physiological functions of Grahani-¹⁰

- Grahani means collection of food
- Dhara means holding the food
- Pachan means digestion
- shoshan means absorption
- munchana means separation and propelling action
- Vivechana means dissemination and Assimilation

Etiology of Grahani and Agni dusti as per Ayurveda :

1. A balanced diet and regular exercise are the keys to good digestive health. But in current era, faulty dietary habits, sedentary lifestyle and stress are main causative factors for diseases. People eat a lot of junk and highly processed food with preservatives which contributes significantly to mal digestion leads to Mal absorption and other gastric diseases. Below are some etiological factors mentioned in Ayurveda which destroys the *Agni* or imbalances the strength of *Agni*¹¹:

1. Excessive drinking of water after meal
2. Incompatible and unwholesome diet (Samasana)
3. Irregular food habits (Visamsana)
4. Suppression of natural urges of nindra (sleep), vata (flatus) and purisha (stool)
5. Improper sleeping habits
6. Emotional disturbances
7. Loss of teeth due to ageing
8. Decreased saliva production
9. Over eating (Adhyasana)

Clinical manifestation of Grahani as Roga (disease) :

“*Rogasarve-pimandagnou*”¹²: As the malfunction of Agni, *Mandagni* is the root cause of the gastrointestinal tract. The disease *Grahani Roga* is caused by *Agni Dushti* (imbalance of digestive fire). If *Jathar-agni* present at level of *Grahani* (duodenum to ileum) is not functioning properly,

- one gets poor digestive capacity,
- sluggish blood -circulation in GUT
- poor complexion
- low energy levels (anemia etc)
- flatulence
- poor immunity against diseases (easily get diseased)

Manda-Agni, one among the stage of *Agni dusti* (imbalance), produces *Ama*. *Ama* a pathological bio-waste-products or toxic metabolites, which occurs due to the improper functioning of digestive Agni; this *Ama* produced spreads in the system and produce diseases at the level where it settled down in the system.

Psychological factors like; kama (lust), krodha (anger), shoka (grief), bhaya (fear), chinta (stress) also hamper the strength of *Jatharagni*.

thus contributes in the production of *Ama* in the body as well as in mind.

Malabsorption :

Malabsorption is defined as intestinal absorption capacity falling short of 85%. It is regarded as an important clinical indicator of intestinal failure¹³. The latter refers to the inability of the GIT to digest and absorb sufficient nutrients to maintain the GIT mucosa integrity, fluid balance, nutritional status and overall health¹⁴. The gastrointestinal tract is involved in absorbing nutrients such as fats, carbohydrates, proteins, vitamins, minerals, and trace elements. Malabsorption refers to impaired nutrient absorption at the level of lower gastrointestinal tract, where nutrients are absorbed, and maldigestion refers to impaired nutrient digestion within the intestinal lumen or at the brush border. These defects can result from an inherent disease of the mucosa, conditions that lead to acquired damage of the mucosa, congenital defects in the intestinal membrane transport systems, impaired absorption of specific nutrients, impaired GI motility (decreased peristalsis and stasis), disrupted bacterial flora, infection, or compromised blood flow or compromised lymphatics. The result is either a global impairment of absorption of all nutrients or specific nutrients.^{15,16}

Digestion and absorption occur by a combination of mechanical mixing, enzyme synthesis, enzyme secretion, enzymatic activity, mucosal integrity, blood supply, intestinal motility, and a balanced microbial flora. Malabsorption syndromes are categorized according to which of these three stages is or are affected¹⁷

There are three stages of nutrient absorption: luminal, mucosal, post absorptive

- The luminal phase involves mechanical mixing and digestive enzymes.
- The mucosal phase requires a properly functioning mucosal membrane for absorption.
- The postabsorptive phase becomes facilitated by an intact blood supply and lymphatic system.

Causative factors for Malabsorption :²⁸

The Malabsorption syndromes have multiple etiologies :

At the level of *Jathar-agni* :

- Decreased duodenal pH: optimal duodenal pH 6.5: Zollinger-Ellison syndrome
- Impaired lipid processing by bile acids: This occurs when bile acid synthesis fails to reach levels sufficient for adequate fat absorption, bile acid secretion is impaired, or bile acids remain in the intestinal lumen instead of being absorbed.¹⁸
- Liver disease - liver disease such as hepatic cirrhosis impair bile acid synthesis. In gastrointestinal amyloidosis, the amyloid deposition in liver stellate cells can cause similar pathologies to fibrotic liver disease.¹⁹
- Cholestasis - decreased or obstructed bile secretion and flow due to intrahepatic and/or extrahepatic pathology.²⁰
- Pancreatic exocrine insufficiency: defective production of pancreatic lipase, colipase, and bicarbonate.²¹
- Chronic pancreatitis, Pancreatic resection & Pancreatic cancer - obstruction and loss of functional pancreatic tissue

At the level of *Pitta Dhara Kala* :

- Lost absorptive intestinal surface area: lost functional small intestine mucosa results in decreased transit time and reduced exposure to digestive enzymatic activity.
- Diffuse mucosal or enterocyte disease like Crohn disease (an inflammatory bowel disease), Ulcerative colitis (an inflammatory bowel disease) & Celiac disease
- Small intestinal bacterial overgrowth (SIBO):
- Diffuse mucosal injury: Tropical sprue (post-infective tropical malabsorption) - an inappropriate response to ingested gluten through all three small intestine segments. Tropical sprue has a higher association with megaloblastic anemia through folate and vitamin B12 deficiency than celiac sprue.
- Autoimmune enteropathy - a likely family of diseases that occurs primarily in children and has histological findings of villous blunting and crypt hyperplasia like celiac disease

At the level of *Pachak Pitta*

- Inadequate disaccharidase activity: Lactase deficiency (also known as hypolactasia) - the most common disaccharidase deficiency. lactase deficiency is actually the result of decreased enzyme synthesis rather than a lactase defect. Lactase deficiency can also be congenital, like other disaccharidase deficiencies.²²

How do you describe your bowel habits?	I have a tendency for constipation	My bowels are sometimes hard and an other times are soft	My bowels are normal (neither too hard nor too soft)	---
How do you describe your eating habits?	I generally have food after the scheduled time	I generally have food either before or after the scheduled time	I generally have food exactly on scheduled time	I generally have food before scheduled time
How do you feel after the complete digestion of meals?	I frequently feel heaviness in abdomen and body	I occasionally feel slight heaviness in abdomen and body	I mostly feel lightness in abdomen and body	I feel lightness in abdomen and body quite early after having meals
How do you express your feelings that you thinking after looking at the food items that you like?	I do not feel like eating even when hungry	I sometimes feel like eating and sometimes do not	I feel like eating food	I feel like eating any food (even irrespective of whether I like it or not)
Total Scores:	.../11	.../11	.../11	.../10

ASSESSMENT & DIAGNOSIS :

History taking and physical examination plays a crucial role in early diagnosis and Assessment. a diagnosis requiring more specific testing in non-specific symptoms of unintentional weight loss, ongoing diarrhea, or poor wound healing.

- A. History and physical examination
- B. Assessment of strength of *Agn bala and Avastha (stage) of Agni Dusti*
- C. Examination of Purish- stool
- D. Laboratory testing

A. History and Physical examination :

The history and physical examination are vital when initiating the evaluation of *Grahani Roga* vis a vis malabsorption syndromes. When the history and physical make the diagnosis fairly clear, general evaluation is not necessary. Below are the typical signs and symptoms encounter that need to examine.

- According to Acharya chakrapani , In *Grahani roga* , due to weakness of jathar-agni , it gets Grahani place gets vitiated and digestion gets hampered which in turn releases stool in its **apakwa avastha** (undigested form/ poorly absorbed).²³
- According to *Acharya Susruta* ,²⁴

- i. Frequent passage of stools,
- ii. Quantity of stool – large
- iii. Undigested or digested food particles in stool,
- iv. Associated with abdominal pain,
- v. Either chronic Constipation or Diarrhea

- Questioner can be developed which includes a review of systems, above symptoms evaluation, symptom duration, symptom timing, presence or absence of pain/pain radiation, location/location changes, intensity/intensity changes, known precipitating factors, associated symptoms (e.g., change in bowel habits/frequency), whether or not the presenting symptoms have happened previously. Important additional questions include past medical history (e.g., peptic ulcer disease), family history (especially for systemic and gastrointestinal conditions), medications, surgeries, radiation exposure/treatments, caustic substance ingestion, allergies, and social history (e.g., smoking, drinking, recreational drug use past or present)²⁵

B. Assessment of strength of Agn bala and Avastha (stage) of Agni Dusti :

Aparna Singh et al. has developed “Self-assessment questionnaire” based on scoring tool to assess strength of Agni bala. The tool required that the respondents record their agreement or disagreement with the question in appropriate columns by marking a check mark (✓) against the specific statement/question. The guidelines regarding the method of responding were clearly stated. Respondents were supposed to tick the statement/questions that best described their physiology. One score was assigned for the specific response, if found to be present in that individual. Total scores were calculated in respective columns and subsequently the scores were converted into percentage for further statistical analysis. The status of *Agni* in an individual was decided on the basis of maximum percentage scores obtained under the different categories of *Agni*.²⁶ (Fig no. 4)

Figure 5 Self-Assessment Questionnaire For Agni Bala Strength

Question	I do not agree	I do not agree	I do not agree	I do not agree
How often are you able to digest your food?	I can't digest my food	I can't digest my food	I can't digest my food	I can't digest my food
How often do you feel bloated or full after eating your meal?	I feel bloated or full after eating my meal	I feel bloated or full after eating my meal	I feel bloated or full after eating my meal	I feel bloated or full after eating my meal
How often do you experience gas or flatulence after eating your meal?	I experience gas or flatulence after eating my meal	I experience gas or flatulence after eating my meal	I experience gas or flatulence after eating my meal	I experience gas or flatulence after eating my meal
How often do you feel indigestion or heartburn after eating your meal?	I feel indigestion or heartburn after eating my meal	I feel indigestion or heartburn after eating my meal	I feel indigestion or heartburn after eating my meal	I feel indigestion or heartburn after eating my meal
How often do you feel a heavy or full stomach after eating your meal?	I feel a heavy or full stomach after eating my meal	I feel a heavy or full stomach after eating my meal	I feel a heavy or full stomach after eating my meal	I feel a heavy or full stomach after eating my meal
How often do you feel a burning sensation in your stomach after eating your meal?	I feel a burning sensation in my stomach after eating my meal	I feel a burning sensation in my stomach after eating my meal	I feel a burning sensation in my stomach after eating my meal	I feel a burning sensation in my stomach after eating my meal
How often do you feel a sour taste in your mouth after eating your meal?	I feel a sour taste in my mouth after eating my meal	I feel a sour taste in my mouth after eating my meal	I feel a sour taste in my mouth after eating my meal	I feel a sour taste in my mouth after eating my meal
How often do you feel a bitter taste in your mouth after eating your meal?	I feel a bitter taste in my mouth after eating my meal	I feel a bitter taste in my mouth after eating my meal	I feel a bitter taste in my mouth after eating my meal	I feel a bitter taste in my mouth after eating my meal
How often do you feel a metallic taste in your mouth after eating your meal?	I feel a metallic taste in my mouth after eating my meal	I feel a metallic taste in my mouth after eating my meal	I feel a metallic taste in my mouth after eating my meal	I feel a metallic taste in my mouth after eating my meal

A. Examination of Purish –Stool

a. Ayurvedic Fecal test: It gives the gives information about, the appearance of the stool, color, odour, consistency etc. Stool description could be of floating or dipped, pale or yellow, greasy stools, and a patient may report seeing oil droplets in the toilet, stool bulk, stool consistency, stool smell.

b. *Ama & Niram* fecal Test : It is the objective method which was used to detect the presence of *Ama* in stool in ancient time In sa-amaj purisha, it sink in water and having foul smell. if purisha is free from *Ama* it floats in water and doesn't have foul smell.²⁷ thus it gives information overall about :-

- Status of *Agni* (digestive fire)
- Symptoms of abnormal *Doshas* (body humors)
- 72-hour fecal fat excretion - the gold standard for steatorrhea diagnosis; performed on a 72-hour stool collection, accurate interpretation of fecal fat depends on patient's successful adherence to testing instructions
- Sudan III stain - performed on a spot stool sample, sensitive

B. Laboratory Testing is used to Support the Diagnosis But is Not Diagnostic.

- Blood tests**²⁸
- Comprehensive metabolic panel - electrolyte disturbances, hepatic function, renal function
- Complete blood cell count - contributes to evaluating anemia.
- Albumin
- Vitamins (e.g., vitamin B12, folate, vitamin D)
- Iron panel (includes serum iron, total iron-binding capacity, ferritin)

More Specific Evaluation of Malabsorption Syndromes²⁸

- Carbohydrate malabsorption syndromes :Breath tests: Small intestinal bacterial overgrowth (SIBO) - positive glucose or lactulose breath test, but breath tests are not considered reliable for diagnosis.
- Jejunal aspirate culture: The gold standard for small intestinal bacterial overgrowth
- Computed tomography (CT): for Pancreatitis
- Magnetic resonance (MR) elastography²⁹: In the case of liver stiffness, MR elastography is useful to diagnose liver fibrosis, hepatic amyloidosis, and other conditions that increase liver stiffness.
- Magnetic resonance cholangiopancreatography (MRCP) & Endoscopic retrograde cholangiopancreatography (ERCP): Pancreatic insufficiency (i.e., history was positive for pancreatitis and alcohol use, or high fecal elastase) - magnetic resonance cholangiopancreatography (MRCP), followed by endoscopy if MRCP is negative
- Endoscopy with biopsy (indicated for diagnoses that require both visualization and biopsy):
- Crohn disease - visualized duodenal mucosa cobble stoning.
- Celiac disease - visualized reduced duodenal folds or mucosal scalloping.
- Jejunoleitis
- Colonoscopies and biopsies: Ulcerative colitis
- Acid-fast stains: Acid-fast stains serve to differentiate *Tropheryma whipplei* vs. *Mycobacterium avium* because they appear virtually indistinguishable on biopsy.

DISCUSSION :

Grahani Roga is a considered as disease of irregularity of digestion , absorption and assimilation which is of great clinical relevance in the modern era because of its direct link with the Malabsorption. *Pitta Dhar Kala* or Intestinal flora has shown to aid digestion, act as a physical barrier against pathogens, help to detoxify that which passes through the intestines, aid in stress management, produce and release important biological enzymes and chemicals (such as neurotransmitters), and the control of inflammation. However, as a result of impairment, the gastrointestinal tract or *Agni Dusti* , can allow toxins to escape into the blood stream and locate in different parts of

the body – causing inflammation. This is known as 'impaired intestinal permeability' and is often caused by microbial dysbiosis (an imbalance of harmful bacteria in relation to healthy bacteria).

Ayurveda being one of the health care systems that rests on the concept of individualization and person-centric approach, the clinical assessment of *Agni* and Stool examination becomes vital in the context of diagnosing *Grahani roga*, dietary recommendations, lifestyle-related advices, and the choice of therapeutic interventions. This article explores the diagnostic tools of Ayurveda and modern test to correctly understand the pathology and diagnosis of *Grahani* vis a vis Malabsorption. As “*Mandaagni* is the prime causative factor for Malabsorption thus main focus is been given on assessing the health status of digestive organs, level of digestive enzymes, status of strength of agni bala, level of *Pitta Dhara Kala*, level of *Pachak Pitta*, & status of *Pakwashya* –Intestine. The “Self-assessment questionnaire” based on scoring tool to assess strength of Agni bala & *Ama* & *Niram* fecal Test is found to be useful in assessing the “*Grahani*” vis a vis Malabsorption/Maldigestion along with other modern assessments.

CONCLUSION

Individualization and person-centric approach is important as every individual is different. *Mandaagni* is been causative factor for *Grahani* vis a vis Malabsorption, thus diagnosis should be done at different level of *Jatharagni*, types of Agni dusti, status of *Agni Bala*, status of *Pitta Dhara Kala*, *Pachak Pitta*, status of *Pakwashya* and *Purish Pariksha* (stool examination)

REFERENCES:

1. Ibidem Charaka Samhita(3), *Grahani Doshachikitsa Adhyaya* 15/42, 43; 460
2. Sushruta, Uttartantra 40, Atisar Pratishedham, shloka168, edited by Shastri Ambikadutta, Sushruta Samhita part I, reprint edition, Varanasi, Chaukhamba Prakashan,2005,pg.237.
3. Agnivesha, Charaka, Dridhabala, CarakSamhita, Chikitsasthanam, *GrahanidoshachikitsitamAdhyaya*, 15/56- 57, In: P. V. Sharma, editor. Varanasi, ChaukhambaOrientalia,2014 p.254
4. Charaka S, Sashtri Kashinath, Pt, Chaturvedi Gorakhnath., Chaukhamba Bharti Academy;2004. Chikitsanathana, 15/3.
5. Pandey, K, Chaturvedi, G, eds. *Grahanidoshachikitsa*, Charaka Samhita. Varanasi, India: Chaukhamba Bharati Academy; 2004:452. Reprint)(Pandey, K, Chaturvedi, G, eds. *Grahanidoshachikitsa*, Charaka Samhita. Varanasi, India: Chaukhamba Bharati Academy;2004:459. Reprint.
6. Pandey, K, Chaturvedi, G, eds. *Grahanidoshachikitsa*, Charaka Samhita. Varanasi, India: Chaukhamba Bharati Academy;2004:454. Reprint.
7. Kunte, AM, Navare, KRS, eds. *Doshavigyaniya, Ashtanga Hridaya*. Commentary of Arundatta and Hemadri. 9th ed. Varanasi, India: Chaukhamba Orientalia; 2005:188.
8. Patwardhan, K. Human Physiology in Ayurveda (Jiakraishnadas Series no. 134). Varanasi, India: Chaukhamba Orientalia;2008:27–31.
9. Sushruta, sharir sthan 4, , *Grabhavyakaran sharir*, shloka16-17, edited by Shastri Ambikadutta, Sushruta Samhita part I, reprint edition, Varanasi, Chaukhamba Prakashan,2005,pg.40
10. Dr. Jagruti Chaple, *PHYSIOLOGICAL ASPECT OF PITTADHARA KALA AND ITS APPLICABILITY*. National Conference Proceeding Book “Kalaanveshan-2019” Available : https://www.researchgate.net/publication/342588975_Physiological_Aspect_Of_Pittadhara_Kala_And_Its_Applicability
11. Ibidem Charaka Samhita(3), *Grahani Doshachikitsa Adhyaya* 15/55; 462
12. Ibidem Charaka Samhita(3), *Grahani Doshachikitsa Adhyaya* 15/56, 57; 462
13. Keur MB, Beishuizen A, van Bodegraven AA. Diagnosing malabsorption in the intensive care unit. *F1000Med Rep*. 2010;2. pii: 7
14. Davidson J, Plumb A, Burnett H. Adult intestinal failure. *Clin Radiol*. 2010; 65:395–402
15. Konturek PC, Brzozowski T, Konturek SJ. Stress and the gut: pathophysiology, clinical consequences, diagnostic approach and treatment options. *J Physiol Pharmacol*. 2011 Dec;62(6):591–9. [PubMed]
16. Owens SR, Greenson JK. The pathology of malabsorption: current concepts. *Histopathology*. 2007 Jan;50(1):64–82. [PubMed]
17. Clark R, Johnson R. Malabsorption Syndromes. *Nurs Clin North Am*. 2018 Sep;53(3):361–374. [PubMed]
18. Rinawi F, Jancu TC, Hartman C, Cohen H, Yarden-Bilavsky H, Lev MR, Shamir R. Fat malabsorption due to bile acid synthesis defect. *Isr Med Assoc J*. 2015 Mar;17(3):190–2. [PubMed]
19. Rowe K, Pankow J, Nehme F, Salyers W. Gastrointestinal Amyloidosis: Review of the Literature. *Cureus*. 2017 May 08;9(5):e1228. [PMC free article] [PubMed]
20. Shah R, John S. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Jul 19, 2021. Cholestatic Jaundice. [PubMed]
21. Othman MO, Harb D, Barkin JA. Introduction and practical approach to exocrine pancreatic insufficiency for the practicing clinician. *Int J Clin Pract*. 2018 Feb;72(2) [PMC free article] [PubMed]
22. Monstein HJ, Folkesson R. Phorbol 12-myristate-13-acetate (PMA) stimulates a differential expression of cholecystokinin (CCK) and c-fos mRNA in a human neuroblastoma cell line. *FEBS Lett*. 1991 Nov 18;293(1-2):145–8. [PubMed]
23. Shashri Girijashankar Gujarati, Charak Samhita, Part 3, 3rd Edition 1996. *Sastu sahitya vardhak karyalaya*, Ahmedabad. Chikitsasthanana, 15/50-51, page no.651-
24. Sushruta, Uttartantra 40, Atisar Pratishedham, shloka171-172, edited by Shastri Ambikadutta, Sushruta Samhita part I, reprint edition, Varanasi, Chaukhamba Prakashan,2005,pg.307
25. Ferguson CM. An Overview of the Gastrointestinal System. In: Walker HK, Hall WD, Hurst JW, editors. *Clinical Methods: The History, Physical, and Laboratory Examinations*. 3rd ed. Butterworths; Boston: 1990. [PubMed]
26. Aparna Singh, Girish Singh, Kishor Patwardhan, Sangeeta Gehlot. Development, Validation, and Verification of a Self-Assessment Tool to Estimate Agnibala (Digestive Strength). *Journal of Evidence-Based Complementary & Alternative Medicine*, Volume: 22 issue: 1, page(s): 134-140. <https://doi.org/10.1177/2156587216656117>
27. Acharya YT, editor. Ch. 15, Ver. 14 Reprint ed. Varanasi: Chaukhamba Prakashan; 2007. Charaka Samhita of Agnivesha, Chikitsasthanana; p. 466.

28. Zuvarox T, Belletieri C. Malabsorption Syndromes. [Updated 2021 Jul 30]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK553106/>
29. Matsuda S, Motosugi U, Kato R, Muraoka M, Suzuki Y, Sato M, Shindo K, Nakayama Y, Inoue T, Maekawa S, Sakamoto M, Enomoto N. Hepatic Amyloidosis with an Extremely High Stiffness Value on Magnetic Resonance Elastography. *Magn Reson Med Sci*. 2016 Jul 11;15(3):251–2. [PMC free article] [PubMed]