



World Journal of Pharmaceutical Science & Technology

Journal homepage: www.wjpst.com

Review Article

A REVIEW ON MALNUTRITION FROM AYURVEDA PERSPECTIVE

Dr. Sovanlal Patra¹, Dr. Apala Sengupta²

1. Assistant Professor, Department of Rog Nidan Avum Vikriti Vigyan, SMSJ Ayurved College & Hospital, Chhapra, Bihar, India.
2. Professor and Head, Department of Rog Nidan Avum Vikriti Vigyan, Institute of Post Graduate Ayurvedic Education and Research at Shyamadas Vaidya Shastra Pith Hospital, Kolkata, West Bengal, India.

Address for correspondence:

Dr. Sovanlal Patra, Assistant Professor, Department of Rog Nidan Avum Vikriti Vigyan, SMSJ Ayurved College & Hospital, Chhapra, Bihar, India, Pin code: 841301

Email: sovanlalpatra6@gmail.com

Received: 02-12-2024, Revised: 01-01-2025, Accepted: .03-02-2025

DOI

ABSTRACT

Introduction: *Ayu*, is described in *Ayurveda* as the union of the body, soul, mind, and senses. Fast food has caused changes or irregularities in diet and timing, and a sedentary lifestyle has disrupted the digestive system, leading to a host of diseases, including disorders related to digestion and absorption. *Grahani* is an *Agni Adhithana*, a functionally weak *Agni* that results in improper food digestion and *Grahani Roga*. Thus, reviewing the *Grahani* concept is the main objective of this article. **Material and Methods:** Available literature related to *Grahani* were searched from available printed form of *Samhita*, and various text books, journals, web-based search engines source were referred for updated research data. **Results:** Situated above the umbilical region of *Nabhi*, *Grahani* is the seat (*Adhithana*) of *Agni*. *Grahani* is the sixth *Kala*, also known as *Pitta Dhara Kala*, and it is located between *Amashaya* and *Pakwashaya*. Given the anatomical location of *Amashaya* and *Pakwashaya*, the duodenum, along with the ileum, caecum, and pyloric sphincter, can be regarded as *Grahani*. Because the *Grahani* secretes *Achcha Pitta* and the *Amla Bhava* of *Ahara* comes from the stomach, the digestion that takes place is extremely significant. Given its role in the *Dharana* of *Anna* in the stomach, Pylorus and the duodenum may be considered organs of *Grahani*. The function of *Grahani* depends upon *Agni* and impairment of *Agni* cause the disease. **Conclusion:** Based on current regional and applied anatomy, the duodenum and *Grahani* are related. The retention of food in *Amashaya* for *Sarabhaga's* digestion and absorption is attributed to *Grahani*.

KEYWORDS: *Agni*, *Amashaya*, duodenum, *Grahani*, *Pitta Dhara Kala*

1. INTRODUCTION

In *Ayurveda*, *Ayu* (life) is defined as conjunction of body, soul, mind and senses. Each has been given due importance in the maintenance of health and prevention and cure of disease. Principles of *Ayurveda* which are interwoven with basic concept of life have significant value even in the life of modern men.

In the era of fast food, there is change or irregularity in diet and diet timings and also sedentary life style. In addition to change in diet and life style, one is always under tremendous mental stress. All these causes disturb

in digestive system which results into many diseases amongst them digestive & absorption disorder constitute an important group.

Grahani and *Agni* are interdependent, (i.e. has *Adhara Adheya Sambandha*). *Grahani* is described as an *Agni Adhithana* by almost all *Acharyas* and commentators. This dependant nature of the two is responsible for proper functioning of the both and it is known fact that functionally weak *Agni* i.e. *Mandagni* causes improper digestion of ingested food which leads to *Grahani Roga*.

2. AIMS AND OBJECTIVES

To review concept of *Grahani* from Ayurvedic and modern science point of view.

3. MATERIALS AND METHODS

Information and data related to *Grahani* were searched from available printed form literature, i.e. from *Samhitagrantha* (Ayurvedic treaties) and also from various text books, journals, web-based search engines source were referred for research data and presented in systemic manner.

4. LITERATURE REVIEW

4.1. Definition of *Grahani*

The organ *Grahani* is described as an organ of digestion. Some *Acharyas* defined *Grahani* considering its functional aspects, while few others considered anatomical peculiarities. According to *Acharya Charaka*, *Grahani* is the seat (*Adhithana*) of *Agni* and is located above *Nabhi* (umbilical region), supported and nourished by the strength of *Agni*. Normally, it receives the ingested food, which is retained and restraining the downward movement (*Grahanati*). After digestion, it releases the food through sides of lumen to next *Ashaya* i.e. *Pakwashaya*. In abnormal conditions due to weakness of *Agni*, it gets vitiated and releases food in undigested form¹.

According to *Acharya Sushruta*, the sixth *Kala* described as *Pitta Dhara Kala* is situated between *Amashaya* and *Pakwashaya*, and stated to be *Grahani*². *Ashtanga Hridaya*, quoted *Grahani* as the organ of *Mahasrotasa*, which is a seat of *Agni* (i.e. *Pachaka Pitta*) and it receives and retains food³. *Vagbhata* also specifically mentioned that the organ *Grahani* acts like *Argala* (wooden bolt) of *Bhukta Marga*⁴. *Ashtanga Samgraha*, the sixth *Kala* namely *Pitta Dhara Kala*, situated between *Amashaya* and *Pakwashaya*, receives and retains the food (*Grahanama*) because of this it is called as *Grahani*⁵. *Madhukosha*, the organ *Grahani* defined as *Agni Adhithana*. *Sarangadhara Samhita Purva Khanda* the organ *Grahani* is defined a *Pitta Dhara Kala*, which lies between organ *Amashaya* and *Pakwashaya*. *Vaidyaka Shabda Shindu*, *Grahani* defined as *Agnivaha Dhamanis*⁶.

4.2. Etymology of *Grahani*

The etymological base of term '*Grahani*' lies in the addition of '*Dis*' *Pratyaya* in which the existence of *Agni* is very tersely construed. The word *Grahani* is attributed to '*Akarmate*' i.e. to 'invade upon' pointing towards the invasion of disease process or condition to the *Agni Adhithana* (base of *Jatharagni*) i.e. *Grahani*⁷.

4.3. Anatomical Concept of *Grahani*

Shri S. C. Dhyani, has effectively shown that the *Urdhva Amashaya* is the region of the stomach which extends from the fundus to the pyloric area and *Adho Amashaya* is the region which extends from the pyloric antrum to the ilio-cecal junction and also defined the latter portion as *Grahani*, provides the essential ingredients of *Jatharagni*, responsible for the completion of *Anupaka*, which forms part of *Jatharagni Vyapara*. The formation of *Sara* or *Annarasa*, chyle and the separation from *Kitta*. The undigested residue of the food takes place in the area. The *Sara Bhaga*, corresponding to chyle, is retained in the area for the duration, required for its *Sosana* or absorption, while the *Kitta* or undigested residue of food is removed and passed on to the *Pakwashaya* or large intestine under the influence of *Samana Vayu*⁸.

4.4. Location of the organ *Grahani*

Acharya Charaka states that *Grahani* is situated above *Umbilicus*, while *Acharya Sushruta* described its location between *Pakwashaya* and *Amashaya* and called as *Pitta Dhara Kala*. *Acharya Sushruta* described the location of *Amashaya* as, above the *Pittashaya* where food enters with the help of *Prana Vayu*⁹. *Charaka* described the site of *Amashaya* between *Nabhi* and *Stana*¹⁰. Hence, the organ Stomach can be considered as *Amashaya*.

Thus, the anatomical location of *Amashaya* and *Pakwashaya*, it can consider duodenum with pyloric sphincter, jejunum, ileum and caecum as *Grahani*. Thus, the part of small intestine and large intestine lying between

Amashaya and *Pakwashaya* should be considered as *Grahani*. This part is also described as the sole site of *Pitta*¹¹.

4.5. *Grahani* as a *Mahasrotasa*

Mahasrotasa can be divided into:

- ✓ *Amashaya* in which food is collected or entered and it is a sole site of *Kapha Dosha*.
- ✓ The part up to *Pakwashaya* is sole site for *Pitta*. This *Pakwa Amashaya Madhyastha Pitta* helps in *Pachana* of *Chaturvidha Ahara*.
- ✓ The *Kala* which synthesize this *Pitta* is *Pitta Dhara Kala* and it extends between *Pakwashaya* and *Amashaya* and termed as *Grahani* by *Sushruta*.

4.6. *Pitta Dhara Kala* in *Grahani*

The *Pitta Dhara Kala* is not only limited to *Laghvantra* but also part of *Brihadantra* up to *Pakwashaya* but it also covers the organs like *Yakrita* and *Agnyashaya*. The *Pitta* (digestive enzymes) formed in *Yakrita* (liver) and *Agnyashaya* (pancreas) brought into duodenum of small intestine through a common hepato-pancreatic duct which is guarded by hepato-pancreatic sphincter of Oddi.

4.7. Physiological aspects of *Grahani*

After intake of first bolus of food, while chewing it gets mixed with *Bodhaka Kapha*, helps in *Bodhana* (sensation of taste) of *Annarasa* in food. The *Bodhana* occurs with the help of *Prana Vayu* through *Rasa Vaha Dhamani*. The food after being swallowed, moves down the *Annanalika*, passes through the *Hardika Dwara* (cardiac sphincter) and reaches the *Urdhva Amashaya* (stomach). This movement is brought about by *Prana Vayu*. The *Shadarasatmaka Ahara* acquires *Madhura*, *Phenabhava*. Afterwards, *Madhura* and *Phenebhava Ahara* being partly digested by *Pitta* (*Pachaka Pitta*) and becomes *Amla*. Food is retained for 2 to 3 hours, initially quantity of *Kledaka Kapha* (mucin) and then *Pachaka Pitta* increases considerably. *Kledaka Kapha* breaks down the food material into finer particles (*Bhinna Samghata*), soaks it thoroughly and imparts necessary fluid consistency (*Klinnatva*) so that *Pachaka Pitta* can penetrate into each and every particles of food and bring about *Paka* (digestion). These actions of *Kledaka Kapha* and *Pachaka Pitta* are brought by *Vyana Vayu*. The churning movement (*Ankunchana- Prasarana*) of *Amashaya* is also brought about by *Vyana Vayu*. The secretion of *Pitta* in *Amashaya* is brought about by *Samana Vayu*¹².

Thus, digestion in *Amashaya* (stomach) can be broadly divided into two phase. Initial phase of with predominance of *Kapha* and then phase of *Pitta* predominance respectively called as *Madhura Avasthapaka* and *Amla Avasthapaka*.

The *Pitta* enters into the finer particles of food and brings about *Paka* (transformation) in both aspects *Parinamana* (physical stage) and *Pravrtti* (chemical stage). The *Amla Bhava* (acidity) has reached its maximum *Mudrika Dwara* (pyloric sphincter), opens and foods is allowed to pass slowly into *Grahani*. All this mechanism is under control of *Samana Vayu* and *Vyana Vayu*. The digestion occurring in *Grahani* is very important due to the *Amla Bhava* of *Ahara* coming from the stomach, *Achcha Pitta* is secreted in the *Grahani*. The meaning of word *Achcha* is pure, this *Pitta* is pure, *Katu* in taste and more *Ushna*, *Tikshna* in qualities than *Pitta* secreted in stomach.

According to modern physiology it can be considered as secretions from liver (*Yakrita*) and Pancreas i.e. *Taila Vartika* and glands present in small intestine. Thus process of *Paka* (digestion) continuous further in *AdhoAmashaya* or *Kshudantra*. The food which is thick liquid now slowly moves throughout the length of *Kshudantra* (small intestine). This part of *Antra* gives out its own *Pachaka Pitta* (intestinal juice). The movement of food is always in forward direction i.e. *Purasarana*. By the time the food comes into second half of *Kshudantra*, the process of *Paka* will have almost completed. Then separation of *Sara Kitta* occurs (*Sara Kita Pritthakarana*). The *Sukshma Shrotansi* (villi) begins to absorb the *Sara Bhaga* (nutrient portion). Here *Vivechana* of *Rasa*, *Dosha*, *Mutra* and *Purisha* also occurs. The word *Rasa* is used for all remaining *Raktadi Dhatus*, which are separated here. After this only small amount of water and residue food that is left over slowly moves through *Unduka Mukha Argala* (ileocec valve) to *Unduka* (cecum).

The maximum *Sara Bhaga* absorption takes place in *Kshudantra* part of *Grahani*. The remaining *Sara Bhaga* is separated in *Brihadantra* part of *Grahani* from the food, which is predominantly in *Kitta* form. *Dravamsha* of *Mala* also absorbed along with *Sara Bhaga* and the function continues until the contents reach the *Pakwashaya*¹³. All this functions are carried out by the sole site *Agni*, (*Pachaka Pitta*) and *Samana Vayu* i.e. *Grahani*, *Pitta Dhara Kala* and *Mala Dhara Kala* in *Grahani*, *Adhogami Dhamanies*; the remaining functions

are carried out by *Pakwashaya*. In *Pakwashaya* the *Kittamsha* is dehydrated by *Agni* and it takes a bolous form (*Paripinda Rupa*) resulting in pungent taste and formation of *Vayu*¹⁴.

The remaining bulky material which is *Pakwansha* after completion of digestion lies in the part which is termed as *Pakwashaya*. The *Pakwansha* is brought into *Pakwadhana* by *Apana Vayu*, which is helped by *Vyana Vayu* called *Purisha*, termed by *Charaka* as *Purishadhara*. The *Purisha* is nothing but *Ghana Mala* of *Anna* remains in *Pakwadhana* for certain duration and carries the function *Avasthambhana* i.e. After *Deha Dharana* completion of the function, *Purisha* expelled through *Guda* by the active contribution of *Apana* and assisted by *Vyana Vayu*.

4.8. Duodenum as *Grahani*

In *Vaidyaka Shabda Shindhu*, it is clearly mentioned that the first part of intestine, which is seat of *Agni* is *Grahani*. According to B.D. Chaurasiya's, Human Anatomy regional and applied¹⁵, the duodenum lies above the level of Umbilicus, which was well correlated with the opinion of *Acharya Charaka* that the *Grahani* is located above umbilicus (*Nabhiruparya*). In the duodenum, the main digestive secretions i.e. bile from liver and gallbladder and pancreatic secretions or juices mix together to give all properties of *Pachaka Pitta*. Hence, may be considered as main seat of *Agni*. The process of digestion is initiated in the mouth itself, continued in stomach but it is almost completed in duodenum by the action of bile and pancreatic secretion and entire facts supports duodenum as *Grahani*.

4.9. Pyloric orifice with sphincter as *Grahani*¹⁶

The word *Grahani* itself is etymologically derived from the '*Graha*' Dhatu meaning - to hold, to retain. The word pylorus (pyloric sphincter) is derived from pylorus meaning - gate guard. Thus, in broader sense pylorus may be included as organ of *Grahani*, along with duodenum considering its function of *Dharana* of *Anna* in Stomach.

Grahani as extending from pylorus- Ileocecal junction - According to *Acharya Sushruta* the location of *Grahani* is strongly recommended between *Amashaya* and *Pakwashaya* so, in this context it can be said that the jejunum and ileum can be included as part of *Grahani*. This view is supported by following facts,

- ✓ To increase the surface area for absorption of digested food, the small intestine has mucosal folds (plicae circularis or valves of Kerkrings), villi and microvilli.
- ✓ The mucosal folds from complete or incomplete circles are permanent and never obliterated by distention, begin in the second part of duodenum, become large and closely set below duodenal papilla, continue to be closely set in proximal half of the jejunum, but diminish progressively in size and number in the distal half of the jejunum and in proximal half of jejunum, are almost absent in distal half of ileum.
- ✓ Apart from increasing the surface area of absorption the circular folds facilitate absorption by slowing down the passage of intestinal contents.

This explains the *Dharana Karma* of *Grahani* of food till its absorption. As these mucosal folds are termed as (valves of Kerkrings) can be compared with *Argala* in *Bhukta Marga*.

4.10. Important facts about *Grahani*

There are few important facts regarding *Grahani*, which are very important in comprehending the concept of *Grahani Dosha* viz

- ✓ *Agni Adhithana*
- ✓ *Pitta Dhara Kala*
- ✓ *Argala*
- ✓ Main function of *Grahani*

4.10.1. *Agni Adhithana*

All the *Acharyas* and Commentators in extant *Samhitas* described *Grahani* as *Agni Adhithana*. The relation that exists between *Grahani* and *Agni* is reciprocal i.e. *Agni* supports the function of *Grahani* and *Grahani* supports the function of *Agni*. Thus, integrity of *Grahani* depends upon *Agni* and the latter is located in the former. Any impairment of *Agni* involves ipso facto the integrity of *Grahani* and vice versa. So any defect or pathology in the functioning of any these two, leads to *Maladi* (disease condition). It can be concluded that, *Grahani* and *Agni* are interdependent and are said to have *Adhara Adheya Sambandha*. It is the very basic concept in understanding pathology, course of disease, treatment of *Grahani Dosha*. The interdependent nature of these two is entirely responsible for proper functioning of both so proper functioning of one will

ultimately boost the functioning of other and combined effect of both these will results in procurement of *Bhavas* needed for *Pushti* of *Ayuradi*. *Acharya Charaka* has clearly mentioned that *Grahani* is the seat of *Agni* and situated above *Nabhi* region and is supported and nourished by the strength of *Agni*.

4.10.2. *Pitta Dhara Kala*

Sushruta has defined *Kala* as the ‘fine structure that separates the *Dhatus* from their *Ashayas*. *Sushruta* and *Vagbhata* have described *Pitta Dhara Kala*. *Sushruta* mentioned “the sixth *Kala* situated between *Pakwashaya* and *Amashaya* is the *Pitta Dhara Kala* (*Agni Dhara Kala*) and is known as *Grahani*.

Pitta Dhara Kala is stated to cover part of *Koshtha* known as *Grahani*. Its main function is to provide *Pachaka Pitta*, which is necessary for the process of digestion of the food brought to this part of *Koshtha* from the *Urdhvamashaya* (stomach) on its way to the *Pakwashaya* (large intestine) and to retain the food in this part, for duration of its digestion, and separation of *Sara* from *Kitta*. The description, in the present context of the *Pittadhara Kala* draws attention to the covering membranes of small intestine composed of columnar epithelium with striated border (due to microvilli).

In addition, it not only serves the purpose of covering membrane but also

- ✓ A system of Glands which provide various enzymes.
- ✓ As a surface on which various kind of digestive reaction takes place.
- ✓ As a surface area from which absorption of the digested *Ahara Rasa* takes place.

The *Pitta Dhara Kala* through the *Strotamsi* which compose it perform two fold of function viz.

- ✓ It draws raw materials from the circulating *Rasa Rakta* contrives them as *Pachaka Pitta* and secretes the *Pita* complex into the *Grahani* to facilitate *Anna Pachana*.
- ✓ Permits the *Rasa* or *Annarasa* (to permeate through it and pass on the circulating *Rasa Rakta* by means of *Dhamanies*.

Acharya Vagbhata in *Astanga Hridaya* has described the position of *Grahani* as *Pakwashaya Dwara* i.e. at the door of *Pakwashaya*, regulates the passage of food from *Adho Amashaya* to *Pakwashaya* with the help of sphincters.

According, C. Guyton medical physiology opines that, the wall of ileum for several centimetres immediately upstream from the ileocecal valve has a thickened muscular coat called ileocecal sphincter. This sphincter normally remains constricted and slows the emptying of illial contents into the caecum. The resistance to emptying of the ileocecal valve prolongs the stay of chyme in this ileum these by facilitating absorption. Normally, only about 1500ml of chyme empty in to the caecum each day.

4.10.3. Main Function of the *Grahani*

From above description, it appears that *Grahani* performs following functions,

- ✓ Receives the food
- ✓ Retention of food for proper digestion
- ✓ Helps in the process of digestion
- ✓ Provides adequate time to digest the food.

5. DISCUSSION

The definition of *Grahani* is based on two considerations / views. Different *Acharyas* have given different opinions about both anatomical and physiological consideration of *Grahani*. According to *Acharya Charaka*, *Grahani* is situated above *Nabhi* (Umbilicus).¹⁷ *Acharya Vagbhata* in *Ashtanga Hridaya* states that *Grahani* is situated at the *Dwara* of *Pakvashaya*¹⁸. Both *Acharya Vagbhata* in *Ashtanga Samgraha* and *Acharya Sushruta* described *Grahani* as *Pittadharakala*, situated between *Amashaya* and *Pakvashaya*¹⁹. *Mahasrotasa* is considered as *Madhyama Rogamarga* and *Grahani* is one of the organ of *Mahasrotasa* situated above *Nabhi* (Umbilicus) between *Amashaya* and *Pakvashaya*, as a *Dwara* of *Pakvashaya*. *Amashaya* is the place where gastric digestion takes place and chyme, is being produced which later becomes acidified. The *Kshudrantra* commences from *Amashaya* and the first part of the *Antra* is spoken as *Grahani* – *Pittadharakala*.

Acharya Charaka described in *Vimanasthana*, *Amashaya* is situated between *Nabhi* and *Stana*²⁰. *Amashaya* was further divided in *Urdhva Amashaya* and *Adho Amashaya*. *Urdhva Amashaya* is the region of the stomach that extends from the fundus to the pyloric area and *Adho Amashaya* is the region that extends from pyloric antrum to the ileocecum, known as *Grahani*²¹, situated above *Nabhi*.

The duodenum that lies above the level of Umbilicus according to modern regional and applied anatomy²² can be correlated with *Grahani* mentioned by *Acharya Charaka*. The pyloric sphincter that retains the food in the stomach till the end of gastric digestion is similar with the *Dharana Karma* of *Grahani*. The small intestine has mucosal folds, villi and microvilli that increase the surface area for absorption of digested food²³ is similar with the *Dharana Karma* of *Grahani* until food absorbed. *Grahani* situated between *Amashaya* and *Pakvashaya* so, the jejunum and ileum can be included as part of *Grahani*.

Sixth, the *Pittadharakala* that is situated between *Amashaya* and *Pakvashaya* is described as *Grahani* according to *Acharya Sushruta*²⁴ that retains the food for the duration of its digestion and absorption with the help of *Pachaka Pitta* provided by *Grahani*, similar to the function of the covering membrane and the glands of small intestine that provide various enzymes²⁵. According to *Acharya Vagbhata*, the function of *Grahani* depends upon *Agni* and impairment of *Agni* cause the disease²⁶.

6. CONCLUSION:

It can be concluded that various *Acharyas* described *Grahani* as *Pittadharakala*, situated between *Amashaya* and *Pakvashaya*. *Grahani* can be correlated with the duodenum according to modern regional and applied anatomy. *Dharana Karma* of *Grahani* is similar with the pyloric sphincter that retains the food in the stomach till the end of gastric digestion. *Grahani* is responsible for retention of food in *Amashaya* for digestion and absorption of *Sarabhaga*. *Karmas* of *Grahani* described are essential factors in the body responsible for *Swastha Avastha*.

COMPETING INTEREST

No competing interest exist.

ACKNOWLEDGEMENTS

The authors are thankful to the Director, Institute of Post Graduate Ayurvedic Education and Research at Shyamadas Vaidya Shastra Pith Hospital, Kolkata for providing facilities, support and to carry out the research work in the institute

REFERENCES

1. Charaka Samhita, Comm. Chakrapanidatta Ed. R.K. Sharma, Bhagawandash, Chowkhamba Sanskrita Series, Varanasi, 2001. Chikitsa Sthana 15/56-57
2. Sushruta Samhita by Sushruta, Dalhana Comm. - Nibandhasangraha, Chowkhambha Orientalia Varanasi, 2002. Uttara Tantra 40/169
3. Ashtanga Hridaya with the commentaries, Sarvangasundara of Arundatta and Ayurveda Rasayana of Hemadri, edited by Pandit Hari Sadasiva Sastri Paradakara Bhisagacarya; Chaukhamba Orientalia, Ninth Edition, 2002. Sharira Sthana 3/50
4. Ashtanga Hridaya with the commentaries, Sarvangasundara of Arundatta and Āyurveda Rasayana of Hemadri, edited by Pandit Hari Sadasiva Sastri Paradakara Bhisagacarya; Chaukhamba Orientalia, Ninth Edition, 2002. Sharira Sthana 3/51
5. Astanga Samgraha, Shashilekha Commentary, Chaukhambha series offices 2006, Sharira Sthana 5/22
6. Shabda Kalpa Druma, Raja Radha Kanta Deva, Chaukhamba Sanskrit Series office, Varanasi, 1961. Page no 380
7. Amaroakosha by Amarasinha, Ed. by Ramashrami: Rashtriya Samskrita Samsthan, New Delhi, 2003. 2nd part, Page no. 220
8. Concept of Agni in Ayurveda with special reference to Agnibala Pariksha, Vd. Bhagvan Dash, Chaukhambha Amarbharti Prakashana, Second edition, 1993. Page no. 36
9. Sushruta Samhita by Sushruta, Dalhana Comm. - Nibandhasangraha, Chowkhambha Orientalia Varanasi, 2002. Sutra Sthana 21/12
10. Charaka Samhita, Comm. Chakrapanidatta Ed. R.K. Sharma, Bhagawandash, Chowkhamba Sanskrita Series, Varanasi, 2001. Vimana Sthana 2/14
11. Sushruta Samhita by Sushruta, Dalhana Comm. - Nibandhasangraha, Chowkhambha Orientalia Varanasi, 2002. Sutra Sthana 21/10
12. Sharangadhara Samhita, by Dr. Brahmanand Tripathi, Chaukhambha Surabharati Prakashana, Varanasi, Purva Khand 4/5
13. Sushruta Samhita by Sushruta, Dalhana Comm. - Nibandhasangraha, Chowkhambha Orientalia Varanasi, 2002. Sharira Sthana 4/17

14. Charaka Samhita, Comm. Chakrapanidatta Ed. R.K. Sharma, Bhagwandash, Chowkhamba Sanskrita Series, Varanasi, 2001. Chikitsa Sthana 15/11
15. B. D. Chaurasiya, Human Anatomy regional and apply, CBC publishers, 2003, page no 213
16. Text book of medical physiology, Auther C. Gayton, Elsevier India private limited, 10th edition, page no. 762
17. Agnivesha. Charaka Samhita, Comm. Chakrapanidatta, Ed.R.K.Sharma. Bhagwandash, Chaukhambha Sanskrita Series Office, Varanasi, Reprint 2006. Chikitsa Sthana 15/56.
18. Vagabhata. Ashtanga Hridaya with the commentaries, Sarvangasundara of Arundatta and Ayurveda Rasayana of Hemadri, edited by Pandit Hari Sadasiva Sastri Paradakara Bhisagacarya; Chaukhamba Orientalia, Ninth Edition, 2002. Sharira Sthana 3/50, 51.
19. Sushruta. Sushruta Samhita of Sushruta, with the Nibandhasandraha Commentary of Shri Dalhanacharya, Edited by Vaidya jadavaji Trikamaji Acharya, Chaukhambha Surbharati Prakashana, Varanasi. Uttaratantra 40/169. A.S.Sha.5/36
20. Agnivesha. Charaka Samhita, Comm. Chakrapanidatta, Ed.R.K.Sharma. Bhagwandash, Chaukhambha Sanskrita Series Office, Varanasi, Reprint 2006. Vimana Sthana 2/17-19.
21. C. Dwarkanath, Digestion and Metabolism in Ayurveda. Chaukhambha KrishnadasAcademy, Varanasi. Page: 13.
22. B. D. Chaurasiya, Human Anatomy regional and apply, CBC publishers, 2003, Page 213.
23. B. D. Chaurasiya, Human Anatomy regional and apply, CBC publishers, 2003, Page 212.
24. Sushruta. Sushruta Samhita of Sushruta, with the Nibandhasandraha Commentary of Shri Dalhanacharya, Edited by Vaidya jadavaji Trikamaji Acharya, Chaukhambha Surbharati Prakashana, Varanasi. Sharira Sthana 4/18.
25. C. Dwarkanath, Digestion and Metabolism in Ayurveda. ChaukhambhaKrishnadas Academy, Varanasi. Page: 13.
26. Vagabhata. Ashtanga Hridaya with the commentaries, Sarvangasundara of Arundatta and Ayurveda Rasayana of Hemadri, edited by Pandit Hari Sadasiva Sastri Paradakara Bhisagacarya; Chaukhamba Orientalia, Ninth Edition, 2002. Sharira Sthana 3/53.