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## PHYSIOLOGY OF DIGESTIVE SYSTEM ACCORDING TO *AYURVEDA*

Dr. Richa Sharma<sup>1</sup>, Prof. (Dr.) Rajesh Kumar Sharma<sup>2</sup>, Dr. Dinesh Chandra Sharma<sup>3</sup>, Dr. Avadhesh Shandilya<sup>4</sup>

1. P.G. Scholar, P.G. Dept. of Kriya Sharir, DSRRAU, Jodhpur, Rajasthan, India
2. Professor & H.O.D., P.G. Dept. of Kriya Sharir, DSRRAU, Jodhpur, Rajasthan, India
3. Associate Professor, P.G. Dept. of Kriya Sharir, DSRRAU, Jodhpur, Rajasthan, India
4. Assistant Professor, P.G. Dept. of Swasthvritta & Yoga, DSRRAU, Jodhpur, Rajasthan, India

### ABSTRACT:

In *Ayurveda*, *ahara* (food), *swapna* (sleep) and *brahmacharya* (celibacy) are considered as *tryo-upastambha* or sub supporting pillars of life. Food is critical for the sustenance of life; it is the first of the three, followed by sleep and *brahmacharya*. Foods are any substances containing nutrients, such as carbohydrate, proteins and fats that can be ingested by a living organism and metabolized into energy and bodily tissues. Digestion is the process of breakdown of complex form of food into simplest monomers through enzymatic process in gastrointestinal tract. Concept of gastrointestinal tract is very much elaborated by the *Ayurvedic Samhitas*. A consistent, clear and precise anatomical description for the most part of the gastro-intestinal tract has been furnished by *Atreya Samhita* which has been quoted by *Vaidyaka-Sabda Sindhu*. The gastrointestinal tract is described by various terms like *Mahsrotas*, *Annavaha srotas* and *Kostha* etc. In *Ayurveda*, the digestive system is considered vital for overall health and is known as "*Agni*," meaning digestive fire. This article provides a concise overview of the *Ayurvedic* perspective on the physiology of the digestive system. According to *Ayurveda*, the digestive system consists of various organs and processes working in harmony to digest and assimilate food. The key organ systems involved include the mouth, stomach, small intestine, large intestine, liver, and pancreas. The proper functioning of these organs is essential for maintaining optimal health and preventing diseases.

KEYWORDS: *Annavaha srotas*, *Agni*, digestion.

## INTRODUCTION:

*Ayurveda*, the traditional system of medicine originating from India, offers a comprehensive and holistic approach to understanding the human body and its functions. One of the key areas of focus in *Ayurveda* is the digestive system, which is considered crucial for overall health and well-being. *Ayurvedic* principles provide unique insights into the physiology of the digestive system, emphasizing the concept of *Agni*, *doshas*, and the role of diet and lifestyle. The digestive system in *Ayurveda* is often referred to as "*Agni*," which translates to "digestive fire." This term represents the transformative power responsible for the digestion and assimilation of food. The *Ayurvedic* understanding of the digestive system encompasses a comprehensive view of its anatomical and physiological aspects. It recognizes several organs and processes involved in the digestion and absorption of nutrients, including the mouth, stomach, small intestine, large intestine, liver, and pancreas. Each organ and their functions are intricately connected to the overall digestive process. *Annavaha Srotas* is one of the types of *srotasa* described in all important *samhita*, it can be considered to Gastro Intestinal Tract except colon from modern view *Mahsrotas* and *Kostha* are describe synonymous to *Annavaha Srotas*. The *pakwashaya* (colon) and further part of alimentary tract are included in *Purishvaha srotasa*.

In contemporary science, digestion and absorption of carbohydrates, proteins, fats, electrolytes, vitamins, minerals etc. occur at different levels in GIT along with the formation of metabolic end products. This complete process involves secretions from endocrine glands, enzymes, acids etc. Variation in these alters the normal physiological process and paves way for manifestation of pathological conditions.

Due to action of *Agni*, *Aharapaka* starts and food is transformed through three *Avasthapaka*.

1. *Madhura Avasthapaka*

2. *Amla Avasthapaka*

3. *Katu Avasthapaka*

The processes that are explained under *Avasthapaka* can be correlated with the digestion of food according to modern science. For correlation, process of Digestion can be divided into three places of Alimentary canal.

1. Mouth and upper part of stomach

2. Lower part of stomach and small Intestine

3. Large intestine.

## AIM AND OBJECTIVES:

a) To explain the physiology of digestion in *Ayurveda*.

## MATERIALS AND METHODS:

References of *Agni* and Food digestion process have been described in *Ayurved samhitas* and Modern Physiology texts are studied and collected. All the data were compiled, analyzed and discussed below.

## PROCESS OF DIGESTION:

*Annavaha Srotas* has got its roots situated in stomach, especially on its left side. *Purishavaha Srotas* has got its roots in large intestine, especially at rectum. *Annavaha Srotas* and *Purishavaha Srotas* together form the complete gastrointestinal tract. *Annavaha Srotas* includes upper and middle part of the gut whereas *Purishavaha Srotas* is lower GIT.

## Deglutition, Mucous secretion and Secretion of Enzymes:

- Prana vayu* helps in ingestion of food into the esophagus and *samana vata* facilitates the peristaltic movement in alimentary tract.
- Secretion of digestive juices and digestion of food can be compared with the action of *samana vayu* and *jathragni*. *Samana vayu* intensifies the action of *jathragni* and *pachak pitta*.

## Digestion in Upper GIT:

First stage of digestion is called '*Madhura Avasthapaka*'. This takes place in the stomach. During this stage, there occurs the release of froth-like '*Kapha*'. Salivary juice and mucous secreted in the stomach serve many protective functions but do not directly participate in the actual process of digestion. The *Madhura bhava* is the stage of digestion carried out by *bodhaka-kapha*, i.e. salivary digestion and also *kledaka-kapha* in the fundus portion of the stomach. saliva actually starts the whole process by working on breaking down your food into particles. This is one of the many reasons why Ayurveda advocates mindful eating, by eating slowly and chewing your food thoroughly you allow your saliva time to work properly. saliva contains the enzyme amylase, which is responsible for breaking down sugars. In the first hour after eating, your body absorbs the simple sugars found in your food, causing your blood sugar levels to rise, this is the reason why the first stage of digestion is called the sweet stage.

After a meal you will feel full and satisfied (or heavy if it was a particularly large meal) and the water and earth elements of your body increase, which is why this stage is related to your *Kapha Dosha*.

## Digestion in Small Intestine:

*Pitta* that is present in between stomach and large intestine is called '*Pachak Pitta*'. Though made up of five basic elements, it is dominant in fire principle. So, it is devoid of liquidity and is called '*Anala*' ('Agni'). *Pachak pitta*, *agni* is secreted in the form of various pancreatic digestive enzymes, functions collectively at *grahni*. According to *Acharya Charaka*, *grahani* is located above the umbilical region & it is the seat of *agni*. *Grahani* holds the undigested food on which *agni* acts and vigorously digest the food and *samana vayu* helps in absorption of *sara bhag* and remaining undigested food is propelled forward by the peristaltic movement. *Acharya Sushruta* has stated that *grahni* is situated between *amashya* & *pakvashya*, also called as *pachyamanashya*. Internally, it is covered with a special type of membrane named as *Pittadharakala* & it is the seat of *agni*. The '*Pāchak Pitta*' is directly responsible for digestion of the food and therefore stands for all amylolytic, proteolytic, lipolytic and nucleic acid splitting enzymes. Gastrointestinal hormones like gastrin, secretin, cholecystokinin etc. also must be regarded as the representatives of '*Pāchaka Pitta*'. '*Sara*' (Nutrient) portion separated at this stage gets absorbed and thereafter it is called '*Rasa Dhātu*'.

## Release of Bile Juice:

In the small intestine, '*Accha Pitta*' (Bile) is released during the second stage of digestion. This stage is called '*Amla*' '*Avasthāpāka*'. Various secretions are secreted from different *ashaya* like pancreas, intestine & liver. I-cells of duodenum and jejunum secrete cholecystokinin which increases pancreatic enzyme secretion to contract gall bladder and relax sphincter of oddi to release bile (*achchha pitta*). *Achchha pitta* plays an important role to bring pH at optimum level so that various enzymatic secretions of small intestine (*agni*) acts on partially digested food. As a result, end products like peptone, proteoses, fatty acids and glycerol is formed, thereafter food becomes *vidagdha* & retaining the properties of *amla rasa* so, it called as *amlavastha*. After digestion, the ahararasa is absorbed through the *pittadharakala* (mucosal membrane of duodenum and jejunum) & remaining apakva food is expelled into *pakvashaya* with the help of *samana vayu*.

In parlance to the modern physiology, this stage of the digestive process begins when your stomach's hydrochloric acid takes over the digestion process from amylase and starts to work on breaking down any proteins that you have eaten. The hydrochloric acid produced by the stomach begins to denature or breakdown protein molecules, kills off and destroys and traces of dangerous bacteria or viral matter in your food and converts a digestive enzyme called pepsinogen to pepsin, which is its active version. This is the reason why the second stage is named sour, because of all the acid activity in your gut your food literally turns sour in your stomach.

### **Digestion in Large Intestine:**

After the nutrients are absorbed from the small intestine, the remaining undigested portion of food reaches the large intestine. Here, it experiences the drying effect of '*Agni*' and there is formation of solid fecal matter along with the release of '*Vāta*' of '*Katu*' (pungent) nature. This stage is the third stage of digestion and is called '*Katu Avasthāpāka*'. *Katu Avasthāpak* refers to the bitter taste and its impact on the functioning of the large intestine. According to *Ayurveda*, the bitter taste is one of the six primary tastes, and it is associated with the elements of air (*Vayu*) and ether (*Akasha*). Bitter taste has certain properties that influence the digestive system, including the large intestine.

The large intestine, is responsible for the final stages of digestion, absorption of water and electrolytes, and elimination of waste products from the body. It plays a crucial role in the formation and elimination of feces.

When the bitter taste is consumed, it stimulates the receptors in the taste buds, which send signals to the brain and subsequently influence the functioning of the large intestine. The bitter taste is believed to have a drying and cooling effect on the body, which can help regulate excess heat and moisture in the digestive system.

### **Katu Avasthāpak in the large intestine involves several processes:**

**Absorption:** The large intestine absorbs water and electrolytes from the digested food, allowing for the formation of feces. The bitter taste helps in regulating the absorption process, ensuring a balanced absorption of fluids and electrolytes.

**Peristalsis:** Peristalsis refers to the rhythmic contractions of the intestinal muscles that propel the digested food through the large intestine. The bitter taste can support proper peristaltic movements, promoting healthy bowel movements and preventing issues like constipation.

**Detoxification:** The large intestine plays a role in detoxification by eliminating waste products and toxins from the body. Bitter taste compounds may have detoxifying properties, aiding in the removal of harmful substances and promoting a cleaner internal environment.

**Balancing Pitta Dosha:** In *Ayurveda*, bitter taste is known to have a cooling effect on the body and can help balance Pitta dosha, which governs metabolic processes, including digestion. By balancing Pitta dosha, bitter taste can contribute to maintaining a healthy digestive system.

remaining undigested material is hard and this material is called feces. Due to the activity of bacterial flora, some pungent gases like methane and ammonia are also produced here. These represent '*Katu*' nature of '*Vāta*' released during this stage.

## Comparison of ayurvedic and modern perspective on digestion:

Table 1: Comparison of *Madhura avasthapaka* and digestion of food according to modern science.

<b>Madhura avasthapaka according to ayurveda</b>	<b>Digestion in oral cavity and fundus of stomach according to modern science.</b>
In <i>mukha</i> , <i>bodhaka kapha</i> is mixed with food.	In oral cavity, saliva is mixed with the food.
In <i>amashaya</i> , <i>kledaka kapha</i> is mixed with food.	In stomach, mucine is mixed with food.
<i>Rasa</i> of <i>ahara</i> becomes <i>Madhura</i> (sweet)	Digestion of carbohydrates starts due to salivary amylase. End products formed are glucose and maltose which are sweet in nature.
<i>Kapha</i> is formed during <i>Madhura avasthapaka</i> .	Symptoms like dizziness, lethargy, heaviness in stomach are seen which are similar as symptoms of <i>kapha</i> .

Table 2: Comparison of *Amla avasthapaka* and digestion of food according to modern science.

<b>Amla avasthapaka according to ayurveda</b>	<b>Digestion in pylorus in stomach and small intestine according to modern science.</b>
In <i>amashaya</i> , <i>pachaka pitta</i> is mixed with <i>ahara</i> .	In pyloric end of stomach, HCL is mixed with food.
<i>Rasa</i> of <i>ahara</i> becomes <i>amla</i> .	Due to HCl food becomes acidic and sour.

Table 3: Comparison of *katu avasthapaka* and digestion of food according to modern science.

<b>Katu avasthapaka according to Ayurveda</b>	<b>Digestion in large intestine according to modern science.</b>
In this phase, after absorption of water other nutrients, <i>ahara</i> becomes dry and <i>katu</i> .	Food is digested by bacteria. After absorption faeces are formed.
<i>Vata</i> dosha is formed during <i>katu avasthapaka</i>	During digestion of bacteria, various gases are formed. E.g. CO <sub>2</sub> , methane, indole, skatol etc.

## DISCUSSION:

The *Madhura bhava* is the stage of digestion carried out by *bodhaka-kapha*, i.e. salivary digestion and also *kledaka-kapha* in the fundus portion of the stomach. The second *avasthapaka* starts in the stomach and here the food partially digests. *Charaka* has described this kind of food as the '*Vidagdha-Aharara*' i.e. *Pakwapakwam* (partially digested food). After the food enters in the duodenum (the first part of the Grahani) and stimulates the Brunner's glands through which numbers of internal secretions are secreted. Bile and pancreatic juices are also poured in the duodenum to carry-out further digestion of the partially digested acid-chyme. So in *Avasthapaka* ingested food of any *rasa* which will be transformed into the sweet taste and leads to the *kapha* formation and gradually it takes the form of *Amla* and *Katu-bhava*, step by step it leads to the formation of *pitta* and *vata*, respectively.

## CONCLUSION :

In conclusion, *Ayurveda* offers a unique and comprehensive understanding of the physiology of the digestive system. According to *Ayurvedic* principles, the digestive system, known as *Agni*, *Ayurveda* recognizes thirteen types of *Agni*, highlighting the individuality of digestion and the importance of balanced *Agni* for optimal health. *Agni*, is usually employed for digestion and metabolism of food and rendering it fit for utilization of the body. In *Ayurved* the process of digestion has been classified into three phases i.e. *Madhura avastha paka*, *amla avastha paka* and *katu avastha paka*. These stages of *avastha paka* can be compared with contemporary modern physiology .The three *doshas*, *Vata*, *Pitta*, and *Kapha*, also play a significant role in digestion.

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