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Corelative study of Visceral Fats with *Medodhara Kala* (Membrane): A Review

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ABSTRACT

Background: The connection between *Dhatu* and *Aashay* is made up of seven *Kala*. The third *Kala* is the *Medodhara Kala*, and the literature that is currently available is unclear about its correlation. The structural objectivity of other *Kalas* is emphasized more than the physiological and pathological aspects, which need to be clarified for an applied perspective. This background article started a literature-based study of *Medodhara Kala* in relation to its relationship with visceral fats. **Material and Methods:** The relevant literature from contemporary textbooks on the topic was thoroughly reviewed, along with all available literature and other sources. **Result:** All animals' abdomens, as well as the *Anu- asthi*, contain "*Medodhara Kala*" or *Meda*. All body parts have *meda* or fat, but Acharya Sushrut placed more emphasis on the abdomen in Ayurvedic literature. Adipose tissue can be found in the abdomen in the form of visceral fat and camper's fascia. In the vicinity of the abdomen, there are numerous depots of adipose tissue. Regarding the *Meda Dhatu Anjali Praman* mentioned by Charak, its 2 *Anjali Praman* which is around 400 ml. Visceral fat in the abdomen resembles *Meda* very much when it is described in the context of *Medodhara Kala*. Additionally, visceral fat cells are more biologically active, and the metabolism of adipose tissue affects the metabolism of the entire body. Multiple hormones are produced and secreted by the endocrine organ known as visceral fat. The relationship between visceral fat and *Medodhara Kala* clarifies that organ's function in the body. **Conclusion:** Visceral fat and the *Medodhara Kala* described in Ayurveda are very similar. Understanding the physiological and pathological aspects of the *Kala* is made easier by this correlation.

Keywords: *Kala, Medodhara kala,* visceral fat

1. INTRODUCTION

One of the unique concept described in the Samhita is *Kala Sharir*, by Acharya Sushrut in the fourth chapter of Sharirsthana. According to legend, *Kala Sharir* has a similar structural makeup to other bodily organs. The connection between *Dhatu* and *Aashaya* is made up of the seven *Kalas*[1]. These are more than just limiting membranes that separate two entities in the body; they also serve other purposes. The current physiological, pathological, and clinical perspective of *Kala* is revealed by literature analysis. All animals' abdominal regions, including the *Anu-asthi*, contain *meda*. All parts of the body contain adipose tissue, or *Meda*, but Acharya Sushrut placed more emphasis on the abdomen. Since there is a lot of visceral fat in the abdomen, it is urgent that this fat be studied in relation to *Medodhara Kala*.

2. AIM AND OBJECTIVE

To review the concept of visceral fats from Ayurvedic as well as modern perspective.

3. MATERIAL AND METHODS

Descriptions related to visceral fat were collected from different Ayurvedic literature, modern texts as well as the data bases Google scholar, PubMed, AYUSH Research Portal, DHARA, studies available on Research Gate web-based search engines, journal, were used to searched and presented in an organized manner.

4. RESULT

4.1. Ayurvedic Review

Kala reflects the structural and functional boundaries of organs. As far as Acharya are concerned, they are separated from other organs mostly by the help of membranes. The membranes, which is carrying the typical corresponding structural qualities of the organ. *Dhatus* which are continuously transforming will also show the basic structural identity, which is seen just before it gets transformed will also show the basic. This is very similar to the tissues at the structural level[2].

The interface between *Dhatu* and *Aashaya* is *Kala* and they are 7 in number. These *Kala* are associated with embracing certain entity as well as regulate some mechanism of that unit. *Kalas* are comparable with membranes in the body which may be fibrous, serous or mucous in nature. There are so many meanings of term *Kala* in Ayurved, like time, thin layer or membrane of the body etc. Important meaning of *Kala* in context of *Sharir-Rachana* may be as follows[3]:

- Membrane (fibrous, serous or mucous)
- Parts of the body
- Qualities

Dalhan refers to *Kala* as body parts. He explained that body parts such as *Ras, Rakta,* or *Kapha, Pureesha,* when functions are normally called *Dhatu* in the context of "*Dhatwashayantar Maryada*." *Dhatwashaya*, or hollow structures, are found in these *Dhatu*. The partition or lining between these *Dhatu* and their *Ashayas* is known as a "*Kala*[4]." In a nutshell, *Kala* are the body's membranes, and they have physiological functions that regulate various body systems. The *kala* can be compared with the membrane or fascia which is covering for the viscera.

***Kala Utpatti* (formation of *Kala*):**

The *Kala* is created when '*Kleda*' (moisture), which is in between *Dhatu* and *Ashaya*, goes through *Pachana* (digestion) as a result of the heat it generates during *dhatu*-processes[5]. An illustration of the mucous membrane of the GIT can help one understand the "*Kleda"* between *Dhatu* and *Ashaya*, relating to the description of *Pittadhara Kala*. The biochemistry of the mucous membrane makes it clear that it is composed primarily of water[6.7]. This suggests that the relationship between the concept of *Kleda* and *Kala* and the moisture or water content of membranes can be understood. *Kala* described in Ayurved can be categorized as epithelium, mesothelium or endothelium coverings of mostly mesoderm and endodermal origin. As per all the Ayurved compendia *Kalas* are seven in number and their sequence according to Acharyas is as below (Table 1):

Table 1: According to various Acharya classification of *Kala*

Sr. No.	No. of Kala	Sushruta	Sharangdhara	Vagbhatta
1	First	*Mamsadhara*	*Mamsadhara*	*Mamsadhara*
2	Second	*Raktadhara*	*Asrugdhara*	*Raktadhara*
3	Third	*Medodhara*	*Medodhara*	*Medodhara*
4	Fourth	*Sleshmadhara*	*Yakrutplihodhara*	*Sleshmadhara*
5	Fifth	*Purishadhara*	*Antradhara*	*Purishadhara*
6	Sixth	*Pittadhara*	*Agnidhara*	*Pittadhara*
7	Seventh	*Shukradhara*	*Retodhara*	*Shukradhara*

Definition

The space occupied by a matter present in between *dhatu* and *ashaya* is called *Kala*. They are seven in number. By looking at its configuration and structure it is compared with its membrane.

Dhatu which is present in the *ashaya* contains some *meda-amsha*. Due to its own *agni* (*dhatvagni*) the *ushma* from the *pittadosha* help in the digestion of *medaja sneha*. Lastly the *medaja sneha* is converted to *kala*. The *kala* is like membrane. They usually affects all the seven *dhatu* and *kal*a by its *ruksha* and *ushna* nature.

Functional classification of *Kala*:

Functionally *Kala* can be classified in four groups viz.

- Absorption (*Shoshan*) of the nutrients e.g. absorption of water in the intestine.
- Secretion (*Sravan*)
- Selectivity (*Vivechan*)
- Protection (*Samrakshana*)

Medodhara Kala:

The third *Kala*, known as "*Medodhara*," is found in the *Anu-asthi* and every animal's abdomen. *Sarakta-meda* is present in "*Anvasthi*," as Sushruta had previously explained. The central location of *Medodhara Kala* is the *udara*, or abdomen[8]. The *meda* is found in *udarabhiti* (abdominal wall), *anvasthi* (small bones) of all human beings. The bone marrow is present in the long bone. The

majja (bone marrow) is specially found in the *sthulasthi* (long bone) *medodhara kala* is made up of *prithvi mahabhuta*. Although fat, or *meda,* can be found in all parts of the body, Acharya Sushrut places more emphasis on the abdomen in Ayurvedic literature. According to this viewpoint, a critical analysis of *Medodhara Kala* in relation to its relationship with visceral fats from a clinical standpoint is inconceivable[2].

The third *Medodhara Kala*, which is almost exclusively mentioned in the text, is found close to every animal's abdomen. *Meda* is comparable to adipose tissue, which has numerous locations throughout the human body. With a few exceptions, almost all of the body's fat is located beneath the skin. All animals' abdomens contain a lot of visceral fat as well. It is important to identify which fat-holding component *Medodhara Kala* is expected to provide in this context. If the formation sequences of the *Kala* and *Dhatu* are compared, it can be said that the sequence of the *Kala* as described by Sushruta or other authors differs from the formation sequence of the *Dhatu* (Table 2).

Table 2: Sequence of *Kala* described by Sushruta & the order of *Dhatu* formation

Sr. No.	No. of Kala	Sequence of Kala (Sushruta)	Sequence of Dhatu Formation
1	First	*Mamsadhara*	*Rasa*
2	Second	*Raktadhara*	*Rakta*
3	Third	*Medodhara*	*Mamsa*
4	Fourth	*Sleshmadhara*	*Meda*
5	Fifth	*Purishadhara*	*Asthi*
6	Sixth	*Pittadhara*	*Majja*
7	Seventh	*Shukradhara*	*Shukra*

The description of *Kalas* moves from the surface to the deeper layers of the body. *Mamsadhara Kala* is likened to the body's deep fascia and septa. Inside the muscles is *Raktadhara Kala,* which is similar to the endothelial lining of blood vessels. It is possible that *Medodhara Kala* may be located in a deeper plane of muscles in this account. The visceral fat in the peritoneum, abdominal viscera, and abdomen may closely resemble *Medodhara Kala*. Understanding *Meda* and its related *Kala* may aid in determining its function in body physiology and pathology in the event of vitiation, which will be useful to know its practical application[9].

One of the seven basic tissues that make up the body and are found all over is the *meda*. Although there are many small and large fat depots in the body, Ayurveda correctly notes that the *Udara,* or abdomen, is a prime location for *Meda* or *Medodhara Kala*. Visceral fat is a type of fat that is particularly prevalent in this context when it comes to the abdomen.

Modern review

Body fat tissue is traditionally distributed into two main compartments with different metabolic characteristics: subcutaneous adipose tissue (SAT) and visceral adipose tissue (VAT).

Visceral fats:

It is located inside the abdominal cavity, also packed between the organs like stomach, liver, intestines, kidneys etc. It is different from subcutaneous and intramuscular fat. Visceral fat is composed of several adipose depots[10].

Adipose tissue is loose connective tissue composed of adipocytes and originally derived from lipoblasts. Historically, fat was considered to cushion and insulate the body; however, more recently its critical role in the human body as a form of energy storage and endocrinological signalling has been recognised. Various physiological, psychosocial, and clinical factors influence the amount and distribution of the adipose tissue throughout the human body[11].

Adipose tissue is anatomically distributed in different proportions throughout the human body, and the pattern of distribution is dependent upon many factors including sex, age, race, ethnicity, genotype, diet, physical activity, hormone levels and medication. The percentage of adipose tissue is higher in women, the elderly and overweight individuals[12].

VF accumulation is associated with CVS risk profile, increase susceptibility to IHD and arterial hypertension[13]. VAT or VF releases many bioactive molecules and hormones, such as adiponectin, leptin, tumour necrosis factor, resistin and interleutin 6 (IL-6). Adiponectin is of particular importance owing to its protective antiangiogenic activity. Circulating adiponectin is inversely correlated with the amount of VF[14]. The decreased adiponectin concentrations are associated with Type 2 DM, elevated glucose levels, hypertension, CVD and certain malignancies[15].

Visceral fat is associated with a constellation of metabolic abnormalities, including insulin resistance, hyperinsulinemia, glucose intolerance, type 2 diabetes, high triglycerides, dyslipidaemia, inflammation, and altered cytokine profile[16].

5. DISCUSSION

Subcutaneous fat under the skin, visceral fat around internal organs, marrow-yellow bone marrow in bones, intermuscular fat in muscles, and breast tissue fat are the body's various locations for adipose tissue. Diet and hunger are both influenced by metabolism; if there is an abnormality in this tissue, it may disrupt the cycle of hunger. In India, the prevalence of metabolic syndrome is currently 33.5% overall. The majority of these cases involve an imbalance in the body's adipose tissue. According to Ayurveda, *Meda Dhatu* is focused on the body's *snehana* (oiling). There are numerous dimensions of *Meda Dhatu* in the body in addition to *Snehana.*

The majority of the visceral and semi-fluid fat is in the abdomen. Charak has described two *Anjali Praman* of *Meda* while describing *Anjali Praman* of various liquid entities of the body. According to Ayurveda, 1 Anjali weighs about 192 Gm[17]. According to recent research, the total amount of adipose tissue in the body is between 10 and 15 kg. There is a significant disparity between the 400 grams of *Meda* described in Ayurveda and the 15 kg of fat. Only liquid entities are used to describe the *Anjali Praman*. Considering this, it can be assumed that *Anjali Praman Charakacharya* is referring to liquid visceral fat, which is comparable to semi-fluid visceral fat.

The remaining 10% of body fat, known as visceral fat, has more blood flow and hormone receptors than other types of fat. An endocrine organ[18], visceral fat is in charge of producing and secreting

a number of hormones, including those that regulate nutrient intake (leptin, angiotensin), insulin sensitivity, and inflammatory process mediators (including resistin, visfatin, and adiponectin) as well as pathways (plasminogen activator inhibitor 1 (PAI-1), and acylation stimulating protein (ASP)[19].

Numerous studies have found a positive correlation between visceral fat and serum triglycerides as well as FBS, but a negative correlation between visceral fat and serum HDL cholesterol in obese adults[20]. Clinically, visceral fat is more significant because dyslipidaemia is a root cause of many lifestyle disorders. Through the expression of different TLRs (Toll-like receptors), adipocytes can detect and react to bacterial, fungal, or viral components[21]. In observation it is learned that abdomen is the prime location of adipose tissue and literature of visceral fat revels its major role in body physiology. It is more relevant to accept visceral fat in context of *Medodhara Kala* as *kala* is both structural and functional entity.

All the *Kala* described in Ayurved is comprehended as membrane by many authors and it is present between the *Dhatu* and *Ashay*. In context of *Medodhara Kala* a large membrane peritoneum which is present between the abdominal wall and its cavity or coelom comply the definition of *Kala*. Peritoneum covers most of the abdominal contents except few exceptions and is composed of a layer of mesothelium supported by a thin layer of connective tissue. Large amount of adipose tissue is present between its folds and near the viscera., This peritoneal lining of the cavity supports many of the abdominal organs and serves as a conduit for their blood vessels, lymphatic vessels, and nerves. Kala provides support to the entity to which it holds and peritoneum also does same at some extent.

It is crucial to comprehend *Kala* in the context of *Vishvegas* in order to effectively treat modern diseases brought on by toxins consumed through food (chemicals). Adipocytes are now recognized as a complex cell type that produces a variety of signals, including cytokines, hormones, and growth factors that not only have an impact on the cells around them but also have an effect on target tissues involved in energy metabolism and pathologic and physiological processes. Understanding the signaling pathways by which adipokines regulate metabolism and looking for new treatments for diseases associated with adipose tissue are becoming more and more crucial. When compared to visceral fat, *Medodhara Kala* exhibits many physiological and pathological conditions in both its normalcy and abnormality. Studying *Medodhara Kala* in correlation with visceral fat or adipose tissue reveals its more recent dimensions.

6. CONCLUSION

The *Kala* are the body's internal covering, like other organs. *Dhatu* and *Aashaya* are connected by a thin interface. In terms of physiology, each *Kala* plays a specific function. The type of *Kala* determines whether it is susceptible to a certain pathology. The Ayurvedic concept of *Medodhara Kala* and visceral fat in the body are strikingly similar. As opposed to *Snehana* as described by Ayurved, visceral fat and adipose tissue both play multiple roles in the body, including those of the immune system and endocrine system. The vitiation of *Medodhara kala* can lead to a variety of pathological conditions. *Kala* can be considered as a treatment site in practice. Peritoneum or its some parts provide shelter for accumulation of either adipose tissue or visceral fat. Considering

the similarity of Kala with membranes it may be understood that *Medodhara Kala* described in Ayurveda has some resemblance with peritoneal parts laden with adipose tissue.

COMPETING INTEREST

Authors have declared that no competing interest exist.

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