



“Conceptual study of *Ranjak pitta* on the basis of modern science parameters”

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Abstract:

Background: Aim of this study, is to correlate the ayurvedic concept of ranjak pitta with its modern science counterpart. **Methods:** analysis of ranjak pitta according to ayurvedic literature and comparing or correlating it with similar functional modern science parameter with the help of modern science literature. Ranjak pitta is type of pitta who with help of rasa dhatvagni (type of metabolic power) colours rasa dhatu (plasma) red to convert it in rakta dhatu(blood). **Discussion:** After analysing both ayurvedic and modern science literature the action of ranjak pitta stated in ayurvedic texts can be correlated to combine action of ferrochelataase, apotransferrin, transferrin, apoferritin, ferritin. **Conclusion:** Combine action of ferrochelataase, transferrin,

apotransferrin, ferritin, apoferritin is similar to action of ranjak pitta, hence they can be considered as single acting principle.

Keyword: (Ranjak pitta, ferrochelataase, transferrin, ferritin, hemoglobin, rakta dhatu)

Aims:

- To study concept of ranjak pitta.
- To correlate ranjak pitta with modern science parameters.

Objects :

- To review ayurvedic literature about ranjak pitta and related terminologies.
- To review related modern science literature.

Introduction:

Ayurveda is ancient science based majorly on observations. Modern science is based majorly on

experiments. On many instances we came across, the similarity in principles of both medical sciences. By comparing or correlating similar principles from both medical sciences, those principles could be better understood. This can facilitate a perfect base for further fundamental & experimental research on those particular principles. *Ranjak pitta* is type of *pitta* which converts *rasa dhatu* into *rakta dhatu* by colouring it red with the help of *rasa dhatvagni*. By understanding concept of *ranjak pitta* and its modern science parameter, further *rakta dhatu dushti* and its management can be better understood.

Literature Review:

Rasa dhatu –

- “*Rasa gatau dhatu, aharaha gacchate*” gives origin to word “*Rasa*”. It means which circulates everyday .[1]
- *Panchbhautik, shadrasayukta, dvividhviryayukta, anekgunayukta ahar*[food] gets digested in digestive system and produce *ahar rasa* due to action of *jatharagni*. *Ahararasa* again undergoes the process of microdigestion with the help of *jatharagni*, which produces *Sara bhag*(usefull part) and *kittabhag*(waste); *Sara bhag* of digested *ahararasa* gives rise to *Rasa Dhatu*. *Rasa Dhatu* circulates in body by means of 24 *dhamanis* (arteries/vessels) of heart in all directions i.e. *urdhvaadho* and *tiryak*. [2]

- *Rasa Dhatu* carries out functions of *tushti, prinana,* and *raktadhatupushti*. [3]

Rakta dhatu –

- *Dravarupa dhatu*, colour of *raktadhatu* is *gunjaphalvarna* i.e. bright red colour. [4]
- *Karma – Bala, Varna, Sukha ayushya, prana pradan.* i.e. supply of energy, colour, good & long life, oxygen. [5]
- According to ayurvedic text *Rasa Dhatu* is converted in *rakta dhatu* by processing of *rasa dhatvagni*. *Rasa dhatvagni* digests *rasa dhatu* into *Sara bhag* and *kitta bhag*. *Sara bhag* of *rasa dhatu* is then converted into *raktadhatu* by colouring it red due to action of *ranjak pitta & teja*. [6][7].

Modern concepts. [8][9].

- Food is basically consists of carbohydrates, proteins, fats, electrolytes and macro & micro nutrients, which are digested and absorbed through digestive system. Absorption of these components are majorly took place in small & large intestine.
- After absorption from various sites of intestine these components gets in the blood, mainly in the part of blood which is called as plasma. Through plasma, they circulates in all parts of body with the help of heart. Some components from food especially fats from chyle are directly absorbed into lymph. Through lymph they circulates in lymphatic system. Ultimately goes to blood.
- Plasma contains various gases, proteins, electrolytes, water. It provides raw material for

production of various cells, enzymes, hormones & tissues.

- Particularly cellular components of blood consists of RBC(red blood cells), WBC(white blood cells) and platelets. Rbcs are produced inside red bone marrow. RBC are of red colour due to presence of haemoglobin. The colour of blood which is red comes from rbcs & ultimately from haemoglobin.
- Haemoglobin(Hb) is formed inside rbc precursor cells from bone marrow. It consists basically two components i.e. heme and globin. Heme component of Hb comprises protoporphyrin IX + iron and globin component comprises of amino acids chains. Iron part comes from plasma which is in transferrin form. Primarily iron is absorbed from food by intestinal cell(enterocytes) in ferric form. Immediately it is converted into ferrous form i.e. transferrin by combining with apotransferrin. Some part of this transferrin is utilised by rbc precursor cells to form heme component of Hb in bone marrow. Remaining iron is stored inside cells in the form of ferritin, by combining with apoferritin. Major storage of ferritin is liver (hepatocytes).
- After completion of lifespan rbc's are destroyed in spleen. Destroyed RBCs are fragmented and hemoglobin is released from the fragmented parts. Hemoglobin is immediately phagocytized by macrophages of the body, particularly the macrophages present in liver (Kupffer cells), spleen and bone marrow.
- Hemoglobin is degraded into iron, globin and porphyrin. Iron

combines with the protein called apoferritin to form ferritin, which is stored in the body and reused later. Globin enters the protein depot for later use. Porphyrin is degraded into bilirubin, which is excreted by liver through bile.

Rakta kshay lakshana[10][11][12]–

- *Amla Shishir Priti* i.e. urge to eat sour and cold food.
- *Sirashaithilya* (flaccid veins), *tvak rukshata*, *tvak -parushata*, *sphutita*, *mlanata*.(dry skin)

Rasa dhatvagni –

- Digestive juices from digestive tract does the work of digestion hence it can be called as *jatharagni*. *Jatharagni ansha* (micro components) is present in *rasadi (rasa, raktadi 7 dhatu) dhatu*. The production of *rasadi dhatu* depends on the intensity of *jatharagni ansha*, which can be called as *dhatvagni*. If it is *mand*(low) then *dhatu vridhi* happens, if it is *tivra* (high) then *dhatu kshay* took place, this indicates those components metabolize *dhatu*s.[13]
- If previous *dhatu* gets increased or decreased then it's successor *dhatu* also gets increased or decreased respectively.[13]
- *Rasadi dhatu* gets digested due to their respective *dhatvagni* into *Prasad* and *kitta rupa*. From *prasad* component successor *dhatu* is produced or nourished.[6]

Ranjak pitta –

- *Ranjak pitta* location according to *acharya wagbhat* is *amashaya*, and it responsible for colouring *rasa dhatu*.[14]

- According to *sushrutacharya* type of *pitta* resides in liver and spleen, which colours *rasa dhatu* is called as *ranjak agni*. [15]

Discussion & observation:

- According to Ayurvedic text *rasa dhatvagni* digest *rasa dhatu* and nourishes *rakta dhatu*. *Rasa dhatu* further bifurcated in *sara* and *kitta* part. *Sara* part nourishes *rakta dhatu*. In *yakrit* (liver) & *pliha* (spleen) this conversion of colourless *rasa dhatu* into red coloured *rakta dhatu* by action of *ranjak pitta* & *rasa dhatvagni* took place.
- According to modern science cellular components of blood are RBC, WBC & Platelet. Out of these cells rbc's are responsible for red colour of blood. Red colour of RBC is due to hemoglobin. And red colour of hemoglobin is due to its 'heme' component. Heme component is made from combination of porphyrin ring and iron molecule. Iron chelation with protoporphyrin IX results in hemeproduction, which ultimately gives RBC its red colour. This chelation of ferrous ions is catalysed by enzyme "Ferrochelataase". Ferrochelataase enzyme is present in the membrane of mitochondria. This whole process of iron chelation took place inside rbc precursor cells present in Bone marrow.
- Hence *ranjak pitta* can be correlated to Ferrochelataase enzyme, which helps in process of iron chelation, by means of which haemoglobin gets its unique red

colour. This type of phenomenon is also seen in muscle fibres. Myoglobin from muscle fibres gets its red colour due to chelation of iron with protoporphyrin by ferrochelataase. Only difference between myoglobin & haemoglobin is lack of multiple amino acid chains in globin component. Both possesses red colour[9]. Thus *ranjak pitta* gives colour to blood, muscles.

- Another concept of *ranjak pitta* is iron in the form of ferritin and transferrin. If protoporphyrin relatives (not protoporphyrin IX, but similar structure from pyrrole family i.e. chlorine ring) reacts with magnesium instead of iron then the product formed is chlorophyll which is green in colour. This is well known phenomenon in plant biology [16]. Hence the red colour of heme component of hemoglobin is due to iron molecule also, which is in ferrous form Fe^{++} . Thus from above description if we consider *Ranjak pitta* as ferritin & transferrin. *Sthana* (location) of *ranjak pitta* correlates to *yakrit* i.e. liver, *pliha* (spleen) & intestine (enterocytes).
- Apoferritin & ferritin can be considered as inactive form of *ranjak pitta*, because they do not take part directly in the formation of colouring pigment (hemoglobin). Apotransferrin, transferrin and ferrochelataase can be considered as active form of *ranjak pitta*, because they actually participate in the process of forming heme component.

- The hormone ‘hepcidin’, a 25-amino-acid (aa) peptide, is the principal regulator of iron absorption and its distribution to tissues. Hecpidin is synthesized predominantly in hepatocytes, but its low levels of expression in other cells and tissues, including macrophages, adipocytes and brain. Hecpidin acts by inhibiting ferroportin which facilitate iron export from inside cell to plasma. Due to inhibition of ferroportin by hepcidin, intra cellular iron from enterocytes, hepatocytes and macrophages is prohibited to pour in plasma. Thus decreasing plasma iron level. Thus hepcidin prohibits conversion of inactive *ranjak pitta* to its active form. Ferroportin facilitates conversion of inactive *ranjak pitta* to its active form. [17]
- *Rakta dhatu kshay* symptoms like *Aamla-Shishir Priti* indicates nutritional deficiencies of iron, vitamin C. That indicates *rakta dhatukshay* i.e. reduced production of RBC due to malnourishment. Deficiency of iron can lead to *Shishir Priti* (cravings for ice eating- a form of pica). Deficiency of iron can be correlated to decreased *ranjak pitta* leading to *rakta dhatu kshay* and ultimately creating symptoms like *aamla-shishir priti*.
- Increase iron load in body is termed as hemochromatosis. Abnormal color (bronze, reddish or ashen-gray) of skin is one of the common symptom of hemochromatosis. This indicates presence of *ranjak pitta* in skin. If left untreated liver enlargement, spleen enlargement with many

more complications can be developed. This signifies existence of *ranjak pitta* in those organs i.e. liver and spleen.[18][19][20]

Conclusion:

- The function of *ranjak pitta* is similar to combined action of Ferrochelataase, transferrin, ferritin, apotransferrin & apoferritin.
- On the basis of above conclusion *ranjak pitta* can be classified in active and inactive forms. Active form – ferrochelataase, apotransferrin, transferrin. Inactive form – apoferritin, ferritin.
- Conversion of *ranjak pitta* from inactive to active form is governed by hepcidine and ferroportin.
- *Sthana* of *ranjak pitta* (location) can be stated as - bone marrow, plasma, liver (hepatocytes & macrophages), spleen (macrophages), and intestine (enterocytes).
- *Ranjak pitta* colours *rasa dhatu* and converts into *rakta dhatu* by means of formation of ‘heme’ component of haemoglobin. This action took place in bone marrow. *Ranjak pitta* also colours *snayu* (skeletal muscles) in red colour, by forming ‘heme’ component of myoglobin.
- Increase in *Ranjak pitta* can lead to darkening of skin, hepatomegaly, splenomegaly, liver disorders. That signifies its presence in liver, spleen and skin.

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