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REVIEW ARTICLE

Concept of *Raktadhatwagni* on the Formation of *Rakta Dhatu* Correlated with the Contemporary Modern Science

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ABSTRACT

Rakta – the fluid of life; the quantity of *raktadhatu* depends upon food intake. It possesses properties similar to pitta due to its elemental composition (agni and jal). It has qualities similar to *pitta dosha*, which is made up of *Agni* and *Jal*. In the formation of the *rakta dhatu*, *pitta* is the *mala* (waste product) produced during the formation of *raktadhatu*. The quality of the *rakta dhatu* is dependent upon the health of *agni*, or digestive fire. The condition of *agni* determines the quality of *rasa* produced. When the *rasagni* is sluggish, the efficiency of transformation is reduced. When the *rasagni* is too active, it efficiently converts *ahara rasa* to *rasa dhatu*, but also burns up some of the *rasa dhatu* that is being produced. Hemopoietic enzymes (ALAS, ALAD, porphobilinogen deaminase, uroporphyrinogen synthase, and enzyme ferrochalatase) are correlated with the Ayurvedic concept of *raktadhatwagni* in the formation of *raktadhatu*. Hematopoietic enzymes ensure stem cell replication, energy supply, hemoglobin synthesis, growth factor signaling, antioxidant defense, and proper differentiation of all blood cell types. *Raktadhatwagni* governs the digestion – metabolism of *rakta dhatu*, ensuring its proper formation, quality, nourishment of the next tissue (*mamsa*), vitality, complexion, and overall health. In this article, we intend to make a correlation of *raktadhatwagni* with modern perspectives to have a clearer view of the *rakta dhatu*.

1. INTRODUCTION

Food is composed of either *panchbhutas* (five primary elements – *prithvi, aap, tejas, vayu,* and *akash*) or of four kinds (*peya* – drinkables, *lehya* – lickables, *bhojya* – chewables, and *bhakshya* – eatables), or has six tastes (sweet, sour, salt, pungent, bitter, and astringent) and two potencies (hot and cold) or eight potencies (*sheeta, ushna, snigdha, ruksha, vishad, pichila, mridu,* and *tikshna*) and processing many properties, when ingested, it undergoes digestion in alimentary tract, after it is digested properly (by the *koshtagni* – fire agency present in the *pakvaamashyamadhyam*), there arises its vital essence known as *"Rasa*" which is very subtle and suitable to move even through minute *srotamsi.* Hridya (heart) is its seat, i.e., the chief place of stay, from the heart it travels through the 24 *dhamni*s (arteries), 10 of them going upward, 10 going downward, and 4 going sideward obliquely; nourishes the entire body constantly, makes it grow, supports and maintains it, by activities which are due to invisible causes. The decrease and increase of this rasa, which is traveling all over the body (constantly), have to be inferred from the signs and symptoms produced. This rasa is moving through the entire organ and organ system. According to Acharya Sushrut, the total number of *dhamnis* present in the body is 24, and rasa also travels through all 24 *dhamnis*. Hence, it can be concluded that rasa travels all over the body through all *dhamnis. Rasadhatu* circulates throughout the body in many ways, such as the continuity of sound, flame, and water.[1]

Dhalhana explains this stimulus, interpreting the continuity of sound as sideward movement, that of flame as upward movement, and that of water as downward movement. Shabd (sound) has maximum conduction velocity, *archi* has medium conduction velocity, and jala has minimum conduction velocity, so there is a gradual reduction in velocity as the rasa moves in the forward direction. In the same way, *rasadhatu* has maximum velocity at the aorta, medium in the arteries, and minimum in the capillaries, which means conduction velocity is minimum at the capillaries because capillaries have maximum cross-sectional area. The basic theory of Ayurveda is to maintain the state of equilibrium of *Tridosha, Saptadhatu,* and *Trimala*. All these are

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nourished well initially by the influence of the potency of individual *Jatharagni* and productive nutrients *(Ahara Rasa*) are passed into each level of *Dhatu* (bodily tissues) for nourishment. Ultimately, the necessary nutrients for the formation and development of tissues are supplied by one stream of pool. They carry their support to the site where *Dhatus* are located, which is explained by *kedari kulya nayaya*. Thus*, rasa, rakta, mamsa*, *meda, asthi, majja,* and *shukra dhatus* develop sequentially and nourish further *dhatus* (*ksheer dadhi nayaya). Rasadhatvagni* plays an important role in the formation of *rasa dhatu* from *aahar rasa,* which further nourishes the *rakta dhatu* by the influence of *raktadhatvagni*.

Whenever the potency of any level of *dhatvagni* diminishes or elevates, the business of the production of the next *dhatu* is affected. During this process, *dhatumala (*tissue excreta) is produced. Any *atipravritti* (excessive secretion), sang (complete or partial obstruction), *siragranthi* (new growth inside the srotas), or *vimarg gaman* (leaving its own path and entering into another's path) causes *srotodusti* (vitiation of *srotas*) and may lead to abnormal formation of dhatus. In Ayurveda, some theories of tissue formation and development (*dhatu poshana nyaya*) are elucidated in *Rasa* – the fluid of life. The quantity of *rasadhatu* depends upon food intake. *Rasa* provides fluidity to circulating *rakta*; it is the fluid that carries dissolved nutrients. Salts and sugar are the most important nutrients. As a result, taking nutritional fluid is the best way to replenish *rasa*. The *rasadhatu,* being made up of the element water, has similar qualities to *kapha*. *Rasa dhatu* has qualities very similar to *kapha dosha*, which is made up of *jala* and *prithvi*. In the formation of the dhatus, *kapha* is the *mala* (waste product) produced during the formation of *rasadhatu*. This fluid then further undergoes metabolism by the *rasagni* to form rasa dhatu. The condition of agni determines the quality of rasa produced. When the *rasagni* is sluggish, the efficiency of transformation is reduced. When the *rasagni* is too active, it efficiently converts *ahara rasa* to *rasa dhatu*, but also burns up some of the *rasa dhatu* that is being produced.

2. MATERIALS AND METHODS

This research is a narrative review that seeks to investigate the notion of *Raktadhatwagni* and its relationship with the current scientific understanding of hematopoiesis and blood metabolism.

2.1. Materials

The materials utilized for this review were gathered from both classical Ayurvedic texts and contemporary medical literature, which include:

Ayurvedic sources:
- *Charaka Samhita* (along with available commentaries)
- *Sushruta Samhita*
- Standard textbooks on *Kriya Sharira*

Modern scientific sources:
- Textbooks on Physiology and Biochemistry
- Peer-reviewed journals focused on hematopoiesis and erythropoiesis.
- Articles concerning erythropoietin (EPO), heme synthesis, and hematopoietic enzymes

2.2. Methods

A thorough literature review was conducted to gather pertinent information regarding:
- The concept of *Agni* and *dhatvagni*, particularly *raktadhatwagni*
- The formation and function of *rakta dhatu*
- The role of *raktavaha srotas* and *ranjaka pitta*
- Corresponding modern concepts such as:
- Hematopoiesis
- Erythropoiesis
- The role of EPO
- Heme synthesis and hematopoietic enzymes were analyzed and compared.

3. CONCEPT OF *RAKTADHATWAGNI*

Raktadhatwagni assessment is a crucial concept in Ayurvedic medicine that pertains to the evaluation of the body's vital energies and metabolic processes, particularly concerning blood (*rakta*) and tissue (*dhatu*) metamorphosis. This assessment plays a pivotal part in understanding an existent's health status and acclimatizing individualized treatment plans.[1] *Raktavaha srotas* play an important part in the formation of *raktadhatu. Rakta* is formed by the action of *raktadhatwagni* on *rasa dhatu* in *raktavaha srotas*, where *teja* of *ahara rasa* and *ranjaka pitta,* Along with ushma , act on Rasa to be greenishness in the *rakta*. Rasa is acted upon by Raktadhatwagni along with Ranjaka Pitta and Ushma, resulting in the development of the characteristic reddish coloration of *Rakta Dhatu*. The *rasa* that comes to the heart with the help of *samana vata* is also converted by *pitta* to *rakta* and then circulates to the entire body.

4. *PANCHBHOUTIK* COMPOSITION OF *RAKTA DHATU*[2]

Water is 92–93, and rest it contains oxygen, carbon dioxide, and nitrogen.

The term *"agni*" in Ayurveda refers to the metabolic energy or digestive fire that controls the transformation of food into energy and Body tissues. *Raktadhatwagnii* is particularly concerned with blood metabolism and the apkins that are involved. For optimum health, a balanced raktadhatwagni is necessary because it guarantees appropriate blood volume and quality, which affects. A balanced state of Raktadhatwagni is essential for maintaining normal hematological functions, as it ensures proper formation of *Rakta Dhatu*, adequate hemoglobin synthesis, efficient oxygen transport, and nourishment of subsequent *Dhatus*, thereby supporting overall physiological homeostasis (Table 1).

5. MODERN ASPECT OF *RAKTADHATU* FORMATION

In modern science, *raktadhatu* is formed through the stages of erythropoiesis by the stimulation of a hormone called EPO.[3]

5.1. Sites of Hematopoiesis[4]

Hematopoiesis occurs in different anatomical locations during development:[5]
- Embryonic stage: Begins in the yolk sac (primitive hematopoiesis), producing mainly erythroid and myeloid cells.[6]
- Fetal stage: Shifts to the liver and spleen (definitive hematopoiesis), where multipotent hematopoietic stem cells emerge.[7]
- Postnatal life: Primarily occurs in the bone marrow of long bones, vertebrae, ribs, sternum, and pelvis.

5.2. Role of EPO in Blood Formation

EPO is a crucial hormone that plays a key role in erythropoiesis, the process of red blood cell production. It stimulates the bone marrow to produce red blood cells in response to low oxygen levels in the blood.[8]

5.3. Stimulates Red Blood Cell Production

EPO is a glycoprotein hormone produced primarily by the kidneys, with a smaller amount produced in the liver. It acts on erythroid precursor cells in the bone marrow, triggering their proliferation and differentiation into mature red blood cells.

5.4. Regulates Erythropoiesis

EPO production is regulated by a feedback mechanism involving oxygen levels in the blood. When oxygen levels are low (hypoxia), the kidneys release EPO, stimulating red blood cell production. Conversely, when oxygen levels are sufficient, EPO production is reduced.[9]

5.5. Essential for Survival and Maturation

EPO helps erythroid progenitor cells survive and proliferate, preventing apoptosis (programmed cell death). It also plays a role in the maturation of red blood cells from proerythroblasts to reticulocytes and finally to mature erythrocytes.

Hemopoietic enzymes (ALAS, ALAD, porphobilinogen deaminase, uroporphyrinogen synthase, and enzyme ferrochalatase) are correlated with the Ayurvedic concept of *raktadhatwagni* in the formation of raktadhatu. Hematopoietic enzymes ensure stem cell replication, energy supply, hemoglobin synthesis, growth factor signaling, antioxidant defense, and proper differentiation of all blood cell types.

While *Raktadhatwagni* governs the digestion – metabolism of *Rakta dhatu*, ensuring its proper formation, quality, nourishment of the next tissue (*mamsa*), vitality, complexion, and overall health.

6. DISCUSSION

6.1. Importance of Assessment

Diagnosis of conditions: Evaluating *raktdhatwagni* helps in diagnosing various conditions related to blood disorders, anemia, and other systemic issues.

1. Personalized treatment: Understanding the state of *raktdhatwagni* allows practitioners to create individualized treatment protocols, including dietary recommendations, herbal supplements, and lifestyle changes.
2. Preventive healthcare: Regular assessment can aid in the early detection of imbalances, enabling preventive measures to avoid.

Imbalances in *raktadhatwagni* may manifest as:

- Fatigue or weakness
- Poor circulation
- Skin issues (pallor and rashes)
- Digestive disturbances
- Emotional instability.

7. CONCLUSION

Raktadhatwagni assessment is a vital tool in Ayurveda for understanding and maintaining blood health and overall vitality. By evaluating this aspect of metabolism, practitioners can effectively diagnose, treat, and prevent various health issues, promoting holistic wellness. Integrating traditional assessment methods with modern techniques can enhance the efficacy of health interventions and improve patient outcomes.

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11. ETHICAL STATEMENT

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12. CONFLICT OF INTERESTS

The authors declare no conflicts of interest regarding the publication of this paper.

13. DATA AVAILABILITY STATEMENT

The data analyzed in this review were obtained from publicly available sources, including peer-reviewed articles, observational studies, and surveys accessible through databases.

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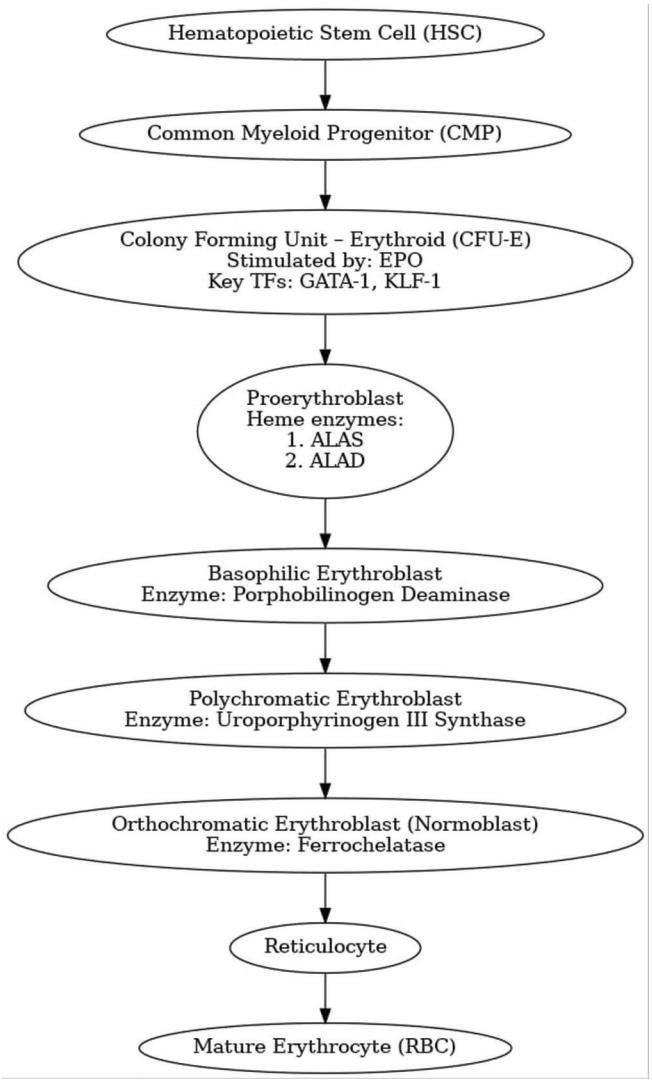

Table 1: *Panchbhoutik* component of *rakta dhatu* in the blood

Mahabhuta	Component in Blood	Function
Prithvi (Earth)	Cellular elements (RBCs, WBCs, Platelets)	Structure and stability
Jala (Water)	Plasma (90–92%)	Fluidity and transport
Agni (Fire)	Hemoglobin, enzymes	Metabolism and coloration
Vayu (Air)	Gases (O_2, CO_2)	Circulation and movement
Akasha (Ether)	Plasma spaces, channels	Space for circulation