



EXPLORING THE SIGNIFICANCE OF *RANJAKA PITTA* IN THE FORMATION OF *RAKTA DHATU* WITH RESPECT TO ERYTHROPOIESIS

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Submitted on- 13-09-24

Revised on- 02-10-24

Accepted on-03-10-24

ABSTRACT:

The body's foundational basis lies in the trinity of *Dosha* [bio-energy principles], *Dhatu* [structural components of body], and *Mala* [waste]. The body comprises of three *Dosha*, *Pitta* being one of them. Due to its *Ushna Guna* [hot attribute/quality], *Pitta* plays a crucial role in *Pachana* [digestion or biotic transformation]. *Pitta Dosha* is divided into five subtypes based on both their location and function. Amongst these, *Ranjaka* [coloring] *Pitta* is involved in the formation of *Rakta* [blood] *Dhatu*. *Ayurvedic* texts indicate *Yakrit* [liver], *Pleeha* [spleen], and *Amashaya* [stomach] as the locations of *Ranjaka Pitta*, emphasizing its synergy with *Raktagni* [transformation factors] in the intricate formation of *Rakta Dhatu*. The Liver, Spleen, and Bone Marrow are vital for Erythropoiesis in modern science. The liver stores essential nutrients like vitamin B₁₂, folic acid, and iron. Vitamin B₁₂ is critical for erythropoiesis (the process of origin, development and maturation of erythrocytes) and the intrinsic factor secreted by the stomach's parietal cells plays a key role in its absorption. There are similarities in the *Ayurvedic* & Modern processes. In this article, we explore the role of *Ranjaka Pitta* in *Rakta Dhatu* formation, bridging *Ayurvedic* insights with modern medical science for a comprehensive understanding.

Keywords: *Ranjaka Pitta*, *Rakta Dhatu*, Erythropoiesis, Intrinsic factor.

INTRODUCTION

Ayurveda is a time-honored system of holistic medicine that emphasizes natural healing, balance, and individualized wellness. The body's foundational basis lies in the trinity of *Dosha*, *Dhatu*, and *Mala* [1]. These components form the core of *Ayurvedic* physiology, regulating both physical and mental well-being. The *Dosha* are core bioenergetic principles, the *Dhatu* are structural tissues for form and function, and the *Mala* can be said to include vital waste products for functioning & detoxification [2]. The formation of *Dhatu* has been discussed in *Ayurvedic* literature in detail with mention being made to various factors playing important role in their formation. The formation of Blood (RBC specifically) has been described as the process of Erythropoiesis in modern medicine; while in *Ayurveda* the formation of *Rakta Dhatu* has inputs from *Raktagni* & *Ranjaka Pitta*. This review aims to give clear vision on *Ayurvedic* concept of *Ranjaka Pitta* in relation with modern medical science.

AIMS AND OBJECTIVES:

This article explores the role of *Ranjaka Pitta* in the genesis of *Rakta Dhatu* in the light of Erythropoiesis.

MATERIAL AND METHODS:

The literary study of *Ranjaka Pitta* was done using various *Ayurvedic* Texts, journals, and the internet sources for the review of this article. Modern views related to Erythropoiesis were taken from various medical textbooks, journals & internet sources.

Pitta Dosha

The body comprises of three *Sharirika Dosha* (*Vata*, *Pitta* and *Kapha*) and two *Manasika Dosha* (*Raja* & *Tama*), with *Pitta* being one of the *Sharirika Dosha*

[3]. All the *Dosha* are of equal importance and operate both independently as well as in cooperation with others. Among the three *Dosha*, *Pitta* plays a crucial role in the digestive and metabolic processes with in the human body along with functions like thirst regulation, vision, the maintenance of bodily softness, the promotion of radiance, the enhancement of mental clarity, the support of intellect, and the facilitation of transformative processes [4]. The chemical reactions occurring in the body involve enzymes, hormones, neurotransmitters etc. which generate heat or ATP-like energy-producing substances. These substances can be regarded as manifestations of the *Pitta Dosha* [5]. *Pitta* represents the various agents involved in the transformations occurring within a living system for the maintenance of homeostasis [6]. *Pitta* initiates physio-chemical actions in cells or tissues and aids in the digestion process within the gastrointestinal tract and at the tissue level. *Pitta* essentially governs and modifies these processes in the body [6].

Pitta is formed from the "Teja" (fire) *Mahabhuta*. [7]. *Pitta Dosha* is divided into five subtypes based on both their location and function. [8] Amongst the subtypes of *Pitta Dosha*, *Ranjaka Pitta* has been mentioned to be directly involved in the formation of *Rakta dhatu* [9]

Nirukti of Ranjaka Pitta:

rañjayati iti rañjakaḥ // (Shabda Kalpa Druma)

"The one that bestows color is called *Ranjaka*". In this context, "*Ranjayati*" is derived from the root

"Ranj", meaning to color or make colorful, and "Ranjaka" is used to refer to something that imparts color. *Yakrit* and *Pleeha* are the locations of *Ranjaka Pitta* as per *Sushruta* [10] and *Sharangadhara* [11]; while *Vagbhata* mentions *Amashaya* [12] as the location. *Ranjaka Pitta* converts *Rasa* [nutrient portion of food] into *Rakta Dhatu* with help of *Ranjaka* factors. *Ranjaka Pitta*, therefore, can be said to include various factors involved in this conversion process.

Rakta Dhatu:

Human body is composed of seven essential components called *Dhatu* [13] each with specific functions crucial for maintaining good health. *Rakta Dhatu* is second amongst the seven *Dhatu*.

Panchabhautika composition of Rakta Dhatu:

Rakta Dhatu embodies the five *Mahabhuta* [basic elements]: *Prithvi* [earth element] for *Visrata* [putrid odor] (*Gandha* – smell), *Apa* [water element] for *Dravata* [liquidity], *Teja* [fire element] for *Raga* [color], *Vayu* [air element] for *Spandan* [movement/pulsation] and *Akasha* [space element] for *Laghuta* [lightness] [14]. *Dalhana* suggests the use of substances with *Teja Mahabhuta* predominance in case of *Rakta Kshaya* [15]. The *Rakta Dhatu* performs a crucial role in augmenting the radiance of complexion, and nourishment of the *Mamsa Dhatu* [16]. *Rakta Dhatu* grants a person strength, pleasing appearance, joy and life. The vitality of life relies on the quality of *Rakta* [17].

Nourishment of Rakta Dhatu:

According to *Ayurveda*, *Aahara Rasa* [the end product of food digestion] plays a vital role in

shaping and nourishing subsequent *Dhatu* in the body [18]. *Jatharagni* [digestive fire] processes food into *Aahar Rasa*, and *Mala* is also produced in this digestive process. All *Dhatu* derive nourishment from *Ahara Rasa*, and this nourishment is facilitated by the preceding *Dhatu* [18]. In the case of *Rakta Dhatu*, *Acharya Charaka* elucidates that the *Teja* inherent in *Rasa* harmoniously merges with the *Ushma* [heat] of *Ranjak Pitta*, thus playing a vital role in the vibrant coloration of *Rakta Dhatu* [19]. *Acharya Sushruta* states that *Rakta* is produced within the *Yakrit* and *Pleeha* with the assistance of *Ranjakagni*. The circulating *Apya Rasa*, upon passing through the *Yakrit* & *Pleeha*, undergoes coloration, leading to the formation of *Rakta Dhatu* [10].

Chakrapani details three *Nyaya* —*Kshiradadhi* [milk to curd], *Khalekapota* [field & pigeon], and *Kedarikulya* [field & water distribution] — involved in the systematic development and sustenance of the body's *Dhatu* [20]. *Kshiradadhi Nyaya* [theory] is involved in *Dhatu* formation, while *Kedarikulya Nyaya* and *Khalekapota Nyaya* can be said to contribute to *Dhatu* nourishment. Various factors play a crucial role in the formation of *Rakta Dhatu* viz. *Poshaka Dravya* essential for *Rakta Dhatu*, *Raktavaha Srotas* [channels for circulation of *Rakta*] supports nutrient flow, *Ranjaka Pitta* is vital in *Rakta* formation. *Vagbhata* states the formation of *Rakta Dhatu* is in the *Amashaya* [9]. Considering these viewpoints collectively, it becomes evident that *Rasa Dhatu* actively participates in the generation of *Rakta Dhatu*, under the influence of *Ranjaka Pitta*. *Ranjaka Pitta* imparts color to *Rasa Dhatu*, culminating in *Rakta Dhatu* formation. Both *Ranjaka*

Pitta and *Raktagni* play pivotal roles in this intricate process. *Harita* gave the seven-day transformation of Rasa to *Rakta Dhatu*, employing distinct colors for each day as:[21]

1st Day: *Shweta* [White]

2nd Day: *Kapota* [Pigeon – Grey white]

3rd Day: *Harita* [Greenish]

4th Day: *Haridra* [Yellow]

5th Day: *Padma* [Red]

6th Day: *Kinshuka* [Bright orange red]

7th Day: *Aalakta* [Lac – Dark Red]

Modern Aspects

Erythropoiesis is the process of origin, development and maturation of erythrocytes (RBC) [24]. During fetal life, erythropoiesis progresses through Mesoblastic (first two months), Hepatic (third month onward involving liver, spleen, and lymphoid organs), and Myeloid (last three months with red bone marrow and liver involvement) stages [22]. In newborns, growing children, and adults, RBCs are initially produced from red bone marrow in all bones, shifting to membranous bones and long bone ends after age 20 when the shafts become yellow marrow with diminished erythropoietic function due to fat deposition [23].

Stem cells, particularly uncommitted pluripotent hemopoietic stem cells (PHSC) in bone marrow, serve as the origin for blood cells, including lymphoid stem cells (LSC) generating lymphocytes, and colony forming blastocytes giving rise to myeloid cells [23]. Colony forming units include CFU-E for erythrocytes, CFU-GM for granulocytes/monocytes, and CFU-M for

megakaryocytes that produce platelets; umbilical cord blood is a rich source of PHSC [24].

The erythropoietic process begins with proerythroblast originating from CFU-E, progressing through stages of early, intermediate, and late normoblasts before transforming into a reticulocyte, an immature RBC; maturation completes with the formation of a biconcave mature erythrocyte, with a timeline of 7 days from proerythroblast to RBC, 5 days to reticulocyte, and 2 days to mature RBC [25]. Erythropoiesis is regulated by Erythropoietin, thyroxine, hemopoietic growth factors, and essential vitamins [26].

Erythropoietin (EPO), a glycoprotein, is predominantly secreted by the kidneys in response to hypoxia, initiating erythropoiesis over 4-5 days. It promotes proerythroblast production, development through normoblast stages, and mature erythrocyte release [27].

Thyroxine accelerates erythropoiesis [28]. Hemopoietic growth inducers like interleukins (IL-3) induce pluripotent hemopoietic stem cell proliferation [24]. Essential vitamins for erythropoiesis include Vit. B, C, D, E and Folic acid [28].

Maturation factors for red blood cells (RBCs) include Vitamin B12, intrinsic factor, folic acid, Iron, & Copper [29]. Vitamin B12, sourced from the diet, relies on intrinsic factor for intestinal absorption. Stored in the liver and muscle, it's transported to the bone marrow for RBC maturation [29].

Intrinsic Factor of Castle & Vit. B12:

Intrinsic Factor (IF) is secreted from Gastric Parietal cells. It is essential for Vitamin B12 absorption [30].

B12 binds to IF, forming IF-Cbl (Cyanocobalamin) complex. Absorbed in the Ileum, it travels via Transcobalamin II (TC-II) to target tissues. IF separates from the complex, releasing B12 into portal blood. From there, Vitamin B12 reaches Liver and is stored there [31]. It is essential for DNA synthesis [Thymidine Triphosphate] within the RBC's [29]. Nuclear maturation and cell division is dependent upon Vit. B12 and Folic acid. Folic acid is also crucial for maturation as it is also essential for DNA synthesis. IF is very much important for the absorption of B12 in the body. In the absence of IF, Vit. B12 is not absorbed in the body leading to maturation failure in the process of Erythropoiesis [29].

Iron, essential for hemoglobin formation in RBCs, is absorbed in the small intestine with vitamin C, transported in plasma as transferrin, and stored as ferritin in Hepatic cells [32]. Copper influences iron absorption and deficiency can lead to anemia by affecting marrow cell production and erythrocyte compound erythrocyte [28]. Iron obtained from RBC & Hb disintegration in Spleen is recycled via Portal blood to Liver & from there to general circulation [33].

DISCUSSION

Ayurveda places significant emphasis on the crucial role of *Aahara Rasa* in the development and nourishment of the subsequent *Dhatu* within the body. *Vata*, *Pitta* and *Kapha* are the functional principles of the body. Within the domain of *Pitta*, the *Ranjaka Pitta* assumes a pivotal responsibility in the formation of the *Rakta dhatu* (blood tissue). This process is facilitated by *Raktagni* during

hemopoiesis, particularly in the formation of *Rakta dhatu*.

As seen in above deliberation, *Ayurvedic* texts present varying perspectives on the site of *Ranjaka Pitta*. While *Acharya Sushruta* mentions the involvement of the *Yakrit* and *Pleeha*, *Acharya Sharngadhar* points to the *Yakrit*, and *Acharya Vagbhata* specifies the *Amashaya* (as the location for *Ranjaka Pitta*). *Acharya Charaka* does not mention the site for *Ranjaka Pitta*. Functionally, *Sushruta* and *Vagbhata* emphasize its role in coloration, while *Acharya Sharngadhar* highlights its involvement in converting *Rasa Dhatu* into *Rakta Dhatu*. *Acharya Charaka* mentions that the combination of the *Teja* portion of *Ahara Rasa* with the *Ushma of Pitta (Ranjaka Pitta)* contributes to the coloration of *Rakta Dhatu*.

In contemporary understanding, the gastric glands, particularly the parietal cells, are known to produce Intrinsic Factor and hydrochloric acid in the stomach [30]. Intrinsic factor plays a vital role in the absorption of vitamin B12, a key contributor to RBC formation. This prompts consideration of potential parallels between the location and function of *Ranjaka Pitta* and the Intrinsic Factor.

Additionally, *Acharya Sushruta* associates *Ranjaka Pitta* with the *Yakrit* (liver) and *Pleeha* (spleen) [10], while *Sharngadhara* specifically designates the *Yakrit* as the site [11] for *Ranjaka Pitta*.

In the context of modern science, the main maturation factor for erythropoiesis (Vitamin B12) is predominantly stored in the liver. Both the Liver and Spleen are acknowledged for their significant roles in Erythropoiesis [24]. Notably, during intrauterine

life, the hepatic stage is identified as the primary period when the liver serves as the main organ for RBC production with the spleen also participating in erythropoiesis [24]. The similarity in functions and locations between the Intrinsic factor-Vit. B12-Iron and *Ranjaka Pitta* could be considered.

In *Ayurveda*, *Raktagni* might be taken to correspond with growth and differentiation inducers, including erythropoietin and certain hormones. *Ranjaka Pitta* can be said to be associated with Intrinsic Factor, Vit. B12, Folic Acid, Iron, and Copper. Some research suggests the potential therapeutic use of liver meat, renowned for its richness in Iron & B12, in addressing anemia in humans [34].

CONCLUSION

Ayurveda emphasizes the importance of *Aahara Rasa* in nourishing the *Dhatu* in the body. *Pitta*, one of the functional principles, plays a vital role in the digestive and metabolic processes, including the formation of *Rakta Dhatu*. Modern scientific understanding also supports the importance of nutrients like Vitamin B12, Iron, and Copper in Erythropoiesis, which align with the functions of *Ranjaka Pitta* in *Ayurveda*. The concept of *Ranjaka Pitta*, located in the liver and spleen, bears similarities with the production of Intrinsic Factor and storage of Vitamin B12 in the body. This connection highlights the potential therapeutic benefits of aligning Ayurvedic principles with modern medical practices.

REFERENCES

1. Yadavaji Trikamaji (editor). Sushruta Samhita of Sushruta, Sutrasthana, chapter 15, verse no.3.

Reprint edition, Varanasi; Chaukhambha Surbharati Prakashan;2018:67.

2. Moharana Pritam & Roushan Rakesh. (2019). A CRITICAL REVIEW OF PACHAKA PITTA IN MODERN PHYSIOLOGICAL PERSPECTIVE. International Journal of Research in Ayurveda and Pharmacy. 10. 18-20. 10.7897/2277-4343.10015. Available from:

https://www.researchgate.net/publication/331468154_A_CRITICAL_REVIEW_OF_PACHAKA_PITTA_IN_MODERN_PHYSIOLOGICAL_PERSPECTIVE

3. Yadavaji Trikamaji (editor). Charaka Samhita of Charaka, Sutrasthana, chapter 1, verse no.57. Reprint edition, Varanasi; Chowkhambha Prakashan;2007:16.

4. Yadavaji Trikamaji (editor). Charaka Samhita of Charaka, Sutrasthana, chapter 18, verse no.50. Reprint edition, Varanasi; Chowkhambha Prakashan;2007:109.

5. Moharana Pritam & Roushan Rakesh. (2019). A CRITICAL REVIEW OF PACHAKA PITTA IN MODERN PHYSIOLOGICAL PERSPECTIVE. International Journal of Research in Ayurveda and Pharmacy. 10. 18-20. 10.7897/2277-4343.10015. Available from:

https://www.researchgate.net/publication/331468154_A_CRITICAL_REVIEW_OF_PACHAKA_PITTA_IN_MODERN_PHYSIOLOGICAL_PERSPECTIVE

6. Yadavaji Trikamaji (editor). Sushruta Samhita of Sushruta, Sutrasthana, chapter 21, verse no.10. Reprint edition, Varanasi; Chaukhambha Surbharati Prakashan;2018:101.

7. Shivprasad Sharma (editor). Ashtanga Samgraha of Vriddha Vagbhaṭa, Sutrasthana, Chapter 20,

verse no. 2. Third Edition, Varanasi; Chaukhambha Sanskrit Series office;2012:156.

8. Hari Sadashiva Shastri Paradkar (editor). Ashtanga Hridaya of Vagbhata, Sutrasthana, chapter 12, verse no.10. Reprint edition, Varanasi; Chaukhambha Sanskrit Sansthan;2017:193.

9. Hari Sadashiva Shastri Paradkar (editor). Ashtanga Hridaya of Vagbhata, Sutrasthana, chapter 12, verse no.13. Reprint edition, Varanasi; Chaukhambha Sanskrit Sansthan;2017:194.

10. Yadavaji Trikamaji (editor). Sushruta Samhita of Sushruta, Sutrasthana, chapter 21, verse no.10. Reprint edition, Varanasi; Chaukhambha Surbharati Prakashan;2018:101.

11. Brahmanand Tripathi (editor). Sharangdhara Samhita of Pandit Sharangdhara, Purvakhand, chapter 5, verse no. 49. Reprint edition, Varanasi; Chaukhambha Surbharati Prakashan; 2011:61.

12. Hari Sadashiva Shastri Paradkar (editor). Ashtanga Hridaya of Vagbhata, Sutrasthana, chapter 12, verse no.10. Reprint edition, Varanasi; Chaukhambha Sanskrit Sansthan;2017:194.

13. Hari Sadashiva Shastri Paradkar (editor). Ashtanga Hridaya of Vagbhata, Sutrasthana, chapter 1, verse no. 13. Reprint edition, Varanasi; Chaukhambha Sanskrit Sansthan;2017:10.

14. Yadavaji Trikamaji (editor). Sushruta Samhita of Sushruta, Sutrasthana, chapter 14, verse no.9. Reprint edition, Varanasi; Chaukhambha Surbharati Prakashan;2018:60.

15. Yadavaji Trikamaji (editor). Commentary: Nibandha Samgraha of Dalhana on Sushruta Samhita of Sushruta, Sutrasthana, chapter 15,

verse no.10. Reprint edition, Varanasi; Chaukhambha Surbharati Prakashan;2018:69.

16. Yadavaji Trikamaji (editor). Sushruta Samhita of Sushruta, Sutrasthana, chapter 15, verse no.5(1). Reprint edition, Varanasi; Chaukhambha Surbharati Prakashan;2018:67.

17. Yadavaji Trikamaji (editor). Charaka Samhita of Charaka, Sutrasthana, chapter 24, verse no.4. Reprint edition, Varanasi; Chowkhambha Prakashan;2007:124.

18. Yadavaji Trikamaji (editor). Charaka Samhita of Charaka, Sutrasthana, chapter 15, verse no.16. Reprint edition, Varanasi; Chowkhambha Prakashan;2007:514.

19. Yadavaji Trikamaji (editor). Charaka Samhita of Charaka, Chikitsasthana, chapter 15, verse no.28. Reprint edition, Varanasi; Chowkhambha Prakashan;2007:515.

20. Yadavaji Trikamaji (editor). Commentary: Ayurveda Deepika of Chakrapani on Charaka Samhita of Charaka, Chikitsasthana, chapter 15, verse no.16, Reprint edition, Varanasi; Chowkhambha Prakashan;2007:514.

21. Yadavaji Trikamaji (editor). Commentary: Shivadasa Sen on Sushruta Samhita of Sushruta, Sutrasthana, chapter 14, verse no.10. Reprint edition, Varanasi; Chaukhambha Surbharati Prakashan;2018:248.

22. Sembulingam K. Essentials of Medical Physiology, chapter 10. 5th edition, New Delhi: Jaypee Brothers Medical publishers; 2010: 69-70.

23. John E. Hall (editor). Textbook of Medical Physiology, chapter 32.12th Reprint South Asia edition, Elsevier Inc.; 2012:414.

Jyoti Bala, Narind Khajuria, Rakesh Thamman. Exploring the significance of Ranjaka Pitta in the formation of Rakta Dhatu with respect to Erythropoiesis. *Jour. of Ayurveda & Holistic Medicine*, Vol.-XII, Issue-IX (Sept. 2024).

24. John E. Hall (editor). *Textbook of Medical Physiology*, chapter 32.12th Reprint South Asia edition, Elsevier Inc.; 2012:415.
25. Sembulingam K. *Essentials of Medical Physiology*, chapter 10. 5th edition, New Delhi: Jaypee Brothers Medical publishers; 2010:71-72.
26. Sembulingam K. *Essentials of Medical Physiology*, chapter 10. 5th edition, New Delhi: Jaypee Brothers Medical publishers; 2010:72.
27. John E. Hall (editor). *Textbook of Medical Physiology*, chapter 32.12th Reprint South Asia edition, Elsevier Inc.; 2012:416.
28. Sembulingam K. *Essentials of Medical Physiology*, chapter 10. 5th edition, New Delhi: Jaypee Brothers Medical publishers; 2010:73.
29. John E. Hall (editor). *Textbook of Medical Physiology*, chapter 32.12th Reprint South Asia edition, Elsevier Inc.; 2012:417.
30. AK Jain. *Textbook of Physiology* (vol. 1), chapter 27. 10th Reprint Edition, New Delhi: Arya Publishing Company; 2023:232.
31. Guéant JL, Guéant-Rodriguez RM, Alpers DH. Vitamin B12 absorption and malabsorption. *Vitam Horm.* 2022;119:241-274. Available from: <https://pubmed.ncbi.nlm.nih.gov/35337622/>
32. John E. Hall (editor). *Textbook of Medical Physiology*, chapter 32.12th Reprint South Asia edition, Elsevier Inc.; 2012:419.
33. Sembulingam K. *Essentials of Medical Physiology*, chapter 10. 5th edition, New Delhi: Jaypee Brothers Medical publishers; 2010:78-79.
34. Bassouni R, Soliman M, Hussein LA, Monir Z, Abd El-Meged AA. Development and evaluating the biopotency of ready to eat liver meat balls in fighting anaemia and vitamin A deficiency, improving selected nutritional biochemical indicators and promoting the cognitive function among mildly anaemic Egyptian children aged 3-9 years. *Public Health Nutr.* 2022 Nov;25(11):3182-3194. Available form: <https://pubmed.ncbi.nlm.nih.gov/35451359/>

CITE THIS ARTICLE AS

Jyoti Bala, Narind Khajuria, Rakesh Thamman. Exploring the significance of Ranjaka Pitta in the formation of Rakta Dhatu with respect to Erythropoiesis. *J of Ayurveda and Hol Med (JAHM)*. 2024;12(9):31-38

Conflict of interest: None

Source of support: None