

Physiological Role of Ranjaka Pitta in Haemoglobin Synthesis - An Ayurvedic Perspective

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Abstract: *Ranjaka Pitta, one of the five subtypes of Pitta Dosha described in Ayurveda, plays a crucial role in the process of blood formation, particularly in the synthesis of Rakta Dhatu (blood tissue). According to classical Ayurvedic texts, Ranjaka Pitta is located in the Yakrit (liver) and Pliha (spleen) and is responsible for imparting red color to Rasa Dhatu (nutritive plasma), thereby transforming it into Rakta Dhatu. This transformative function shows conceptual similarity to the modern physiological process of hemoglobin (Hb) synthesis, which predominantly occurs in the bone marrow, relying on the functions of liver and spleen for iron storage, metabolism, and erythrocyte destruction and recycling. The liver's role in producing erythropoietin precursors and regulating iron metabolism aligns with the Ayurvedic understanding of the Yakrit as the seat of Ranjaka Pitta. This review explores the Ayurvedic description of Ranjaka Pitta and correlates its functions with the modern biomedical framework of hemoglobin synthesis. Understanding Ranjaka Pitta from this integrative perspective offers deeper insight into the holistic Ayurvedic approach to blood disorders, particularly Pandu Roga (anemia), and opens avenues for combining traditional concepts with contemporary hematology.*

Keywords: Ranjaka Pitta, Pliha, Yakrit, Rasa dhatu, Rakta dhatu, Haemoglobin

1. Introduction

In Ayurveda, the concept of Pitta Dosha is central to the understanding of metabolic and transformative physiological processes within the body. Among its five subdivisions, Ranjaka Pitta holds a unique position due to its specific role in the formation and coloration of Rakta Dhatu (blood tissue)¹. Classical Ayurvedic texts such as the Charaka Samhita and Sushruta Samhita describe Ranjaka Pitta as residing in the Yakrit (liver) and Pliha (spleen)², where it is responsible for converting Rasa Dhatu (plasma) into Rakta Dhatu, primarily by imparting a red hue⁴. This function bears conceptual resemblance to the modern physiological process of hemoglobin (Hb) synthesis, which occurs in the bone marrow and is supported by the metabolic activities of the liver and spleen^{9,10}.

Hemoglobin synthesis is a complex biochemical process involving the production of heme⁵ and globin components, iron metabolism, and erythropoiesis⁷. The liver and spleen play critical supportive roles by regulating iron storage, recycling aged erythrocytes, and maintaining a suitable internal environment for red blood cell formation^{9,10}. These modern understandings parallel the Ayurvedic perspective of Ranjaka Pitta as the principle responsible for the qualitative aspect of blood, especially its color and vitality.

This paper aims to explore the physiological role of Ranjaka Pitta in the context of hemoglobin synthesis from an Ayurvedic viewpoint, drawing parallels with contemporary biomedical knowledge. By bridging ancient wisdom with modern science, the study seeks to enhance our understanding of blood physiology and support integrative approaches in the diagnosis and management of hematological conditions such as Pandu Roga (anemia).

2. Material and Methods

Authoritative Ayurveda text, Modern literature, available scientific information available on internet.

3. Discussion

The Ayurvedic concept of Ranjaka Pitta offers a profound insight into the physiological processes related to blood formation, particularly in the transformation of Rasa Dhatu into Rakta Dhatu. Described as residing in the Yakrit (liver) and Pliha (spleen), Ranjaka Pitta is responsible for imparting the characteristic red color to the blood, symbolizing its vital role in the synthesis and maintenance of healthy Rakta Dhatu. This function finds a striking parallel in the modern understanding of hemoglobin (Hb) synthesis and erythropoiesis.

In modern physiology, hemoglobin is synthesized in erythroid precursor cells within the bone marrow⁶. However, this process is heavily dependent on the metabolic and regulatory functions of the liver and spleen. The liver plays a key role in iron metabolism, detoxification, and synthesis of plasma proteins, including those involved in iron transport and storage such as transferrin and ferritin⁹. Similarly, the spleen is involved in the recycling of iron from senescent red blood cells and acts as a reservoir for blood components¹⁰. These organs, therefore, mirror the Ayurvedic concept of the sites of Ranjaka Pitta and substantiate its role in hematopoiesis.

The action of Ranjaka Pitta can be interpreted as the biochemical and energetic transformation that facilitates the incorporation of iron into heme, a core component of hemoglobin. Moreover, the association of Pitta with Agni

(biological fire) supports its role in catalyzing the metabolic reactions essential for Hb synthesis. The red color imparted by Ranjaka Pitta aligns with the color given to blood by hemoglobin³, emphasizing the symbolic and functional correlation.

In the context of Pandu Roga (anemia), Ayurveda attributes the pathology to an imbalance or depletion of Ranjaka Pitta, which results in insufficient transformation of Rasa into Rakta⁸. Modern medicine explains anemia as a condition marked by reduced Hb concentration, often due to iron deficiency, chronic disease, or impaired erythropoiesis. The Ayurvedic treatment protocols for Pandu often include herbs like Mandura Bhasma, Lohasava, and Draksharishta, which not only improve Ranjaka Pitta function but also possess hematinic properties supported by pharmacological studies.

Thus, integrating the concept of Ranjaka Pitta with the modern understanding of hemoglobin synthesis not only validates traditional Ayurvedic knowledge but also enhances its applicability in clinical practice. This integrative approach opens avenues for developing holistic strategies in the prevention and treatment of blood disorders, reaffirming the relevance of Ayurvedic physiology in the modern era.

4. Conclusion

The Ayurvedic concept of Ranjaka Pitta provides a holistic and insightful understanding of the physiological process of blood formation, particularly in relation to hemoglobin synthesis. Rooted in the functions of the Yakrit (liver) and Pliha (spleen), Ranjaka Pitta is described as the vital force responsible for transforming Rasa Dhatu into Rakta Dhatu by imparting its characteristic red color and vitality. This ancient explanation closely aligns with the modern biomedical understanding of the liver and spleen's supportive roles in iron metabolism, erythropoiesis, and hemoglobin production.

By examining Ranjaka Pitta through both classical Ayurvedic texts and contemporary physiological science, a meaningful correlation emerges, bridging traditional knowledge with modern medical insights. Such an integrative perspective not only enhances our understanding of the pathophysiology of blood disorders like Pandu Roga (anemia) but also supports the use of time-tested Ayurvedic therapies alongside conventional treatments.

Recognizing the physiological role of Ranjaka Pitta in hemoglobin synthesis underlines the depth of Ayurvedic wisdom and its continued relevance in today's health care landscape. This reinforces the need for further interdisciplinary research to validate and apply Ayurvedic principles in modern clinical practice for comprehensive and personalized patient care.

Knowledge Gap

Despite the classical Ayurvedic texts describing Ranjaka Pitta as the principle responsible for imparting color to Rakta Dhatu, its correlation with the modern understanding of hemoglobin synthesis remains insufficiently explored. While scattered references suggest a functional resemblance between Ranjaka Pitta and liver or bone marrow activities

related to hematopoiesis, there is a lack of integrative research that scientifically validates this association.

Current literature does not adequately elucidate the biochemical or physiological mechanisms through which Ranjaka Pitta influences hemoglobin synthesis. Moreover, there is a gap in interdisciplinary studies that bridge Ayurvedic principles with modern physiology, especially concerning Pitta subtypes and their systemic roles in hematological functions.

Research-Oriented Scope

This study offers a multidisciplinary platform to explore and validate the ancient Ayurvedic concept of Ranjaka Pitta in the context of modern hematological science. The research-oriented scope includes the following key dimensions:

1) Conceptual Correlation

To systematically analyze classical Ayurvedic references of Ranjaka Pitta in relation to Rakta Dhatu and its Ranjana (coloring) function.

To draw theoretical parallels between Ranjaka Pitta and modern physiological components involved in hemoglobin synthesis—such as the liver, bone marrow, heme pathway, and erythropoietin activity.

2) Physiological Exploration

To explore the anatomical localization of Ranjaka Pitta (notably in Yakrit and Pliha) and compare it with known sites of erythropoiesis and iron metabolism.

3) Experimental and Clinical Research

Designing clinical studies or observational trials to assess the impact of Ayurvedic interventions (like Pitta-balancing or Raktavardhak therapies) on hemoglobin levels.

Evaluating the effect of Ayurvedic herbs associated with Ranjaka Pitta (e.g., Punarnava, Mandura Bhasma) on hematological parameters.

4) Implications in Ayurvedic Pathophysiology

To analyze how disturbances in Ranjaka Pitta might contribute to Pandu Roga (anemia) and other blood-related disorders.

5. Clinical Application

Understanding the physiological role of Ranjaka Pitta in hemoglobin synthesis offers significant clinical relevance in both preventive and therapeutic aspects within Ayurvedic practice. The following clinical applications can be derived:

1) Holistic Management of Anemia (Pandu Roga)

The study helps refine the diagnosis and management of Pandu Roga (anemia) through the lens of Ranjaka Pitta dushti.

By recognizing the imbalance of Ranjaka Pitta as a root cause, targeted use of Pitta-shamana and Raktavardhaka formulations like Mandura Bhasma, Punarnava Mandoor, and Drakshasava can be more appropriately applied.

2) Preventive Health in At-Risk Populations

The Ranjaka Pitta model can be used in screening individuals with subclinical symptoms of Pandu or at risk of iron-deficiency anemia, especially in adolescent girls, pregnant women, and the elderly.

Early dietary and herbal interventions (e.g., Pitta-balancing ahara and Rakta-poshak herbs) can help maintain healthy hemoglobin levels.

3) Integration with Modern Diagnostics

Modern blood parameters (Hb%, MCV, MCH, serum iron, ferritin) can be correlated with Ayurvedic clinical observations, creating evidence-based integrative protocols.

This opens possibilities for collaborative clinical trials that validate the efficacy of Ayurvedic formulations in enhancing hemoglobin synthesis

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