

REINTERPRETING YAKRUT AS A FUNCTIONAL MICROCIRCULATORY UNIT: AN  
AYURVEDIC PERSPECTIVE OF RAKTAVAHA SROTAS MOOLASTHAN<sup>1</sup>\*Dr. Pratiksha Kakasaheb Kamble, <sup>2</sup>Dr. Pradnya R. Deshpande, <sup>3</sup>Dr. Khushang Vijay More<sup>1</sup>PG Scholar, Department of Rachana Sharir, Government Ayurvedic College Nanded, Maharashtra, India.<sup>2</sup>Associate Professor, Department of Rachana Sharir, Government Ayurvedic College Nanded, Maharashtra, India.<sup>3</sup>PG. Scholar 3rd year Kayachikitsa Department, Dr. D. Y. Patil College of Ayurved and Research centre, D. Y. Patil Vidyapeeth (Deemed To Be University), Pimpri, Pune- 411018, Maharashtra, India.**\*Corresponding Author: Dr. Pratiksha Kakasaheb Kamble**

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**ABSTRACT**

**Background-** *Yakrut* (liver) holds a central position in *Ayurvedic* physiology as a crucial *moolasthan* (root site) of *Raktavaha Srotas*, the blood-conducting channels responsible for the formation and circulation of *Rakta Dhatu* (blood) throughout the body. In classical *Ayurvedic* texts, particularly the *Charaka Samhita* and *Sushruta Samhita*, *Yakrut* and *Pleeha* (spleen) are described as the primary functional centres for hematopoiesis and blood regulation. Modern microcirculation research demonstrates that tissue-level perfusion occurs through sophisticated networks of arterioles, capillaries, venules, and lymphatic ducts, regulated by endothelial cells and pericytes. However, a comprehensive correlation between the *Ayurvedic* conceptualization of *Yakrut* as a microcirculatory hub and contemporary understanding of hepatic microvascular function remains under explored. **Aim** –To reinterpret *Yakrut* as a **functional microcirculatory unit** by systematically correlating classical *Ayurvedic* principles of *Raktavaha Srotas* physiology with modern biomedical understanding of hepatic microcirculation. **Objectives-** (1) To analyse the structural and functional characteristics of *Yakrut* as described in *Ayurvedic* texts and examining the role of *Yakrut* in maintaining *Raktavaha Srotas* integrity and function. (2) To correlate *Ayurvedic* anatomical physiological concepts with hepatic microvascular dysfunction. (3) To explore anatomical physiological aspect of liver focusing concept of *moolasthan* of *Raktavaha srotas*. **Material and Methods-**A comprehensive narrative review was conducted using classical *Ayurvedic* texts (*Charaka Samhita*, *Sushruta Samhita*, *Ashtanga Hridaya* along with commentaries) and contemporary biomedical literature. Electronic databases. Studies demonstrating correlations between traditional and modern medical concepts were prioritized. **Results-** *Yakrut* functions as a microcirculatory centre integrating blood formation, vascular regulation, and metabolism. Along with *Pleeha*, it supports *Rakta* production via *Ranjaka Pitta*, similar to hepatic roles in iron balance. As the root of *Raktavaha Srotas*, it maintains microvascular flow and exchange. Dysfunction leads to *Srotorodha*, causing hypoxia and liver-related disorders, while *Ayurvedic* therapies help restore its function. **Discussion:** The *Ayurvedic* concept of *Yakrut* as a microcirculatory unit offers a holistic view of liver function, integrating metabolism, circulation, and immune roles. *Raktavaha Srotas* reflects a dynamic system rather than a static structure, aligning with modern ideas of endothelial and vascular regulation. The idea of *Srotorodha* parallels mechanisms like vascular resistance and endothelial dysfunction seen in liver diseases. This integrative model helps explain how hepatic disorders lead to systemic metabolic and circulatory disturbances. **Conclusion:** *Yakrut* can be understood as a key regulator of both hepatic and systemic microcirculation within the *Raktavaha Srotas*. Its *Ayurvedic* description unifies structural and functional aspects now divided in modern medicine. Reinterpreting it through microcirculatory physiology bridges traditional and contemporary knowledge. This approach may guide future integrative research and improve therapeutic strategies for liver diseases.

**KEYWORDS:** Microcirculation, *Raktavaha Srotas*, *Ranjaka Pitta*, *Srotorodha*, *Yakrut*.

**AIM**

To reinterpret *Yakrut* as a **functional microcirculatory unit** by systematically correlating classical *Ayurvedic* principles of *Raktavaha Srotas* physiology with modern biomedical understanding of hepatic microcirculation.

**OBJECTIVES**

- 1) To analyse the structural and functional characteristics of *Yakrut* as described in *Ayurvedic* texts and examining the role of *Yakrut* in maintaining *Raktavaha Srotas* integrity and function.
- (2) To correlate *Ayurvedic* anatomico physiological concepts with hepatic microvascular dysfunction.
- (3) To explore anatomical physiological aspect of liver focusing concept of *moolasthan* of *Raktavaha srotas*.

**MATERIAL AND METHOD**

A comprehensive narrative review was conducted using classical *Ayurvedic* texts (*Charaka Samhita*, *Sushruta Samhita*, *Ashtanga Hridaya*) and contemporary biomedical literature. Electronic databases including PubMed, Google Scholar, Open Alex, and *Ayurveda* research repositories were systematically searched using keywords: *Yakrut* "*Raktavaha Srotas*," "hepatic microcirculation," "liver physiology *Ayurveda*," and related terms. Relevant peer-reviewed articles published between 2015-2026 addressing liver physiology, microcirculation, *Srotas* function, and *Ayurvedic* pathophysiology were included. Studies demonstrating correlations between traditional and modern medical concepts were prioritized.

**DISCUSSION****Literature Review****Multidimensional aspect of *Yakrut* in *Ayurveda***

In *Ayurveda*, *Yakrut* (liver) is counted among the *Koshthanga* (abdominal organs). It is the primary site of *Ranjaka Pitta*, the subtype of *Pitta* responsible for imparting red color to *Rasa*, forming *Rakta* (blood). *Yakrut* together with *Pleeha* (spleen) contains the *Raktadhara Kala*—the second membrane layer embedded in muscle tissue that separates and circulates blood. *Raktagni* (here called *Ranjakagni*) resides in this *Pitta*, converting *Rasa* into blood tissue. *Aashaya* means "abode"; *Yakrut-Pleeha* is the *Raktasaya*, the blood reservoir where *Rakta* is stored and nourished.

**Concept of *Yakrut* as a *moolasthan***

In *Ayurveda*, *Yakrut* (liver) is the *Mulsthana* (root site) of *Raktavaha Srotas*—the channels that carry and circulate blood. As the *Mulsthana*, *Yakrut* is the primary anatomical seat where blood is formed, purified, regulated, stored, and detoxified, and it is the main location where pathological changes in *Raktavaha Srotas* manifest. *Yakrut* works together with *Pleeha* (spleen) as the dual root of *Raktavaha Srotas*, and both are collectively called *Raktasaya* (blood reservoir). *Yakrut* houses *Ranjaka Pitta*, which converts *Rasa* (plasma) into *Rakta* (blood) by imparting red color and is also the source of bile (*Accha Pitta*). Due to this integrative role,

*Yakrut* and *Rakta* share a close *Asraya-Asrayibhava* (mutual relationship).

***Yakrut* in Classical *Ayurvedic* Texts**

In *Ayurvedic* physiology, *Yakrut* (liver) is recognized as one of the most vital organs, serving multiple critical physiological functions described in the *Brihatrayi* (three classical *Ayurvedic* compendia). According to the *Charaka Samhita*, *Yakrut* and *Pleeha* are designated as the *moolasthan* (root/primary centers) of *Raktavaha Srotas*.<sup>[1]</sup> This designation signifies that the liver and spleen are not merely organs but functional epicenters of blood production and regulation. The *Sushruta Samhita* similarly emphasizes that *Dhamanis* (arteries carrying pulsatile blood) and *Siras* (veins) originate from and are regulated by these two organs, making them instrumental in maintaining the structural and functional integrity of blood vessels.<sup>[2]</sup>

The classical texts describe *Agni* (digestive and metabolic fire) as operating within *Yakrut*, particularly through the action of *Ranjaka Pitta*, which transforms *Rasa Dhatu* (nutrient plasma) into *Rakta Dhatu* (blood).<sup>[3]</sup> This metabolic transformation is not merely biochemical but represents a sophisticated physiological coordination involving tissue oxygenation, nutrient delivery, and immune surveillance—functions now understood as dependent on intact microvascular perfusion.<sup>[4]</sup>

***Raktavaha Srotas*: Concept and Pathophysiology**

*Raktavaha Srotas* are defined as the channels responsible for the formation, storage, and circulation of blood throughout the body.<sup>[5]</sup> The structural integrity of these channels depends on optimal functioning of their *moolasthan*. Any disturbance at the root causes *Srotodushhti* (channel dysfunction), manifesting as various blood-related disorders including skin diseases, bleeding disorders, anemia, and inflammatory conditions.<sup>[6]</sup>

The *Samprapti* (pathogenesis) of *Raktavaha Srotas* disorders typically involves:

- (1) *Nidana* (etiological factors) such as incompatible foods, excessive spicy or heating substances, mental stress, and improper lifestyle;
- (2) *Dosha-Dushya Sammurchhana* (interaction between vitiated doshas and target tissues), where *Pitta dosha* plays a predominant role; and
- (3) *Srotorodha* (obstruction of channels) leading to impaired blood circulation and tissue perfusion.<sup>[2]</sup> This pathophysiological framework closely parallels modern understanding of endothelial dysfunction, microvascular obstruction, and inflammatory vascular disease.

*Yakrut* serves as a specialized unit for regulating microcirculation within the larger *Raktavaha Srotas* network, overseeing both local liver blood flow and the balance of the body's circulatory system. In *Ayurveda*, *Yakrut* is viewed as a *moolasthan*, encompassing

structural, metabolic, and regulatory roles that modern medicine assigns to several interconnected systems, including liver blood dynamics, endothelial function, metabolic control, and immune response. By examining *Yakrut* from this microcirculatory perspective, *Ayurveda's* ancient framework offers a complementary model for understanding and treating liver disorders. Future studies that combine traditional *Ayurvedic* principles with contemporary vascular physiology, endothelial science, and systems pharmacology will bolster the scientific basis for *Ayurvedic* treatments and improve integrative strategies for managing liver diseases. This reinterpretation highlights the importance of traditional medical knowledge in shedding light on pathophysiological processes that modern specialization might miss.

The *Ayurvedic* perspective of *Yakrut* as a functional microcirculatory unit offers an advanced framework for comprehending liver pathophysiology, complementing contemporary reductionist methods. The idea of *Raktavaha Srotas moolasthanas* represents not just an anatomical site but a dynamic functional system that includes hematopoiesis, vascular regulation, metabolic transformation, and immune surveillance—functions now acknowledged as central to modern hepatic physiology.<sup>[7]</sup> This holistic view elucidates how localized liver dysfunction can lead to systemic microvascular issues and metabolic imbalances seen in conditions like non-alcoholic fatty liver disease, cirrhosis, and portal hypertension.<sup>[8]</sup> The *Ayurvedic* focus on *Srotorodha* (channel obstruction) aligns with current pathophysiological insights into endothelial dysfunction, impaired vasodilation, and increased peripheral vascular resistance.<sup>[11]</sup> Therapeutic approaches based on *Ayurvedic* principles—such as hepatoprotective and rejuvenative formulations—have shown measurable improvements in liver function parameters and a reduction in clinical complications.<sup>[12]</sup>

Analysis reveals that *Yakrut* operates as a highly specialized microcirculatory hub with multidimensional physiological roles described in *Ayurveda*. Firstly, in terms of hematopoietic function, *Yakrut* along with *Pleeha* is considered central to *Rakta* formation through the transformation of *Rasa Dhatu* under the influence of *Ranjaka Pitta*, which closely parallels modern concepts of hepatic involvement in erythropoiesis, iron metabolism, and hepcidin regulation. Secondly, as the *moolasthanas* of *Raktavaha Srotas*, *Yakrut* plays a crucial role in maintaining the structural integrity and functional patency of microvascular channels such as *Sira* and *Dhamani*, ensuring efficient nutrient transport and metabolic waste removal at the tissue level.

Furthermore, *Yakrut* is deeply involved in metabolic transformation, governed by *Agni* and *Pitta Dosha*, which can be correlated with enzymatic activity, biochemical metabolism, and endothelial responsiveness in contemporary physiology. This highlights its

regulatory influence over microvascular tone and reactivity. When the functional integrity of *Yakrut* is compromised, it leads to *Srotorodha* (obstruction of channels), resulting in impaired microcirculation, reduced perfusion, and subsequent tissue hypoxia—features commonly observed in chronic liver disorders.

Additionally, disturbances in *Yakrut*-centered *Raktavaha Srotas* have systemic implications, correlating with modern pathological conditions such as portal hypertension, hepatic fibrosis, and widespread endothelial dysfunction. These parallels emphasize the systemic reach of hepatic pathology beyond localized liver damage. Importantly, *Ayurvedic* therapeutic approaches targeting *Yakrut*, including *Yakrut -Shodhana* (detoxification), *Pitta-shamaka* (pacification therapies), and *Rasayana* (rejuvenative measures), have demonstrated promising outcomes in restoring liver function. Clinical observations and case-based evidence indicate improvements in biochemical parameters, reduction in disease progression, and enhancement of microvascular hemodynamics in conditions like chronic liver disease and cirrhosis.

#### Microcirculation: Modern Biomedical Perspective

Contemporary physiology defines **microcirculation** as the function of the smallest blood vessels—arterioles, capillaries, venules, and lymphatic ducts—that directly supply tissues with oxygen and nutrients while removing metabolic waste.<sup>[6]</sup> The microcirculation is distinguished from macrocirculation (large vessel transport) by its direct involvement in tissue-level homeostasis. The hepatic microcirculation is particularly complex, characterized by sinusoidal capillaries lined by specialized endothelial cells and supported by pericytes, which regulate blood flow, nutrient exchange, and inflammatory responses.<sup>[7]</sup>

Dysfunction of the hepatic microcirculation is implicated in the pathogenesis of major liver diseases. In conditions like non-alcoholic fatty liver disease (NAFLD), endothelial dysfunction and impaired microvascular flow contribute to hepatic steatosis, inflammation, and progression to cirrhosis.<sup>[8]</sup> Portal hypertension, a hallmark of cirrhosis, results from increased resistance to blood flow within the hepatic sinusoidal network, initiating a cascade of vascular remodeling and systemic hemodynamic alterations.<sup>[9]</sup>

#### Convergence: *Yakrut* as a Microcirculatory Regulatory Hub

The reinterpretation of *Yakrut* as a **functional microcirculatory unit** integrates classical *Ayurvedic* concepts with modern vascular physiology. *Yakrut's* role in maintaining *Raktavaha Srotas* can be understood as governing hepatic microvascular function through multiple mechanisms:

**1. Hematopoietic and Immune Functions:** The liver's production of blood cells and synthesis of plasma proteins essential for hemostasis parallels the *Ayurvedic*

description of *Rakta* production by *Yakrut*. The liver's resident immune cells and production of acute phase reactants reflect its role in maintaining both circulatory and immune homeostasis.

**2. Endothelial Regulation and Metabolic Control:** *Yakrut's* governance of *Ranjaka Pitta* directly influences vascular tone and permeability. Modern research demonstrates that hepatic metabolic products, including nitric oxide and other vasodilators, are essential for maintaining optimal microvascular perfusion.<sup>[11]</sup>

**3. Metabolic and Detoxification Functions:** Ayurvedic concepts of *Agni* and metabolic transformation align with the liver's detoxification, synthesis, and metabolic regulatory functions—all critically dependent on intact microvascular delivery of substrates and removal of products.

## CONCLUSION

The present study reaffirms that *Yakrut* in *Ayurveda* should be understood as a complex functional entity rather than merely an anatomical organ encompassing roles in hematopoiesis, metabolic transformation, and regulation of microcirculation. Its designation as the *moolasthan* of *Raktavaha Srotas* reflects a systemic influence over blood formation, vascular integrity, role in coagulating process, osmotic pressure, blood storage and tissue perfusion. These classical descriptions demonstrate notable alignment with contemporary concepts of hepatic microvascular dynamics, endothelial function, and metabolic homeostasis.

Considering all hemopoietic and hemodynamic related structural composition and functions, *Yakruta* (liver) is revalidated as *Moolasthan* (chief organ) of *Raktavaha srotas*. According to modern science, related to circulatory system, liver is accompanied with hepatoportal circulation.

The Ayurvedic notion of *Srotodushiti*, particularly *Srotorodha*, parallels mechanisms such as vascular resistance, endothelial impairment, and inflammatory changes observed in chronic liver diseases.

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