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AGNI CONCEPT AND ITS ASSOCIATION WITH VAGAL TONE – A COMPARATIVE PERSPECTIVE

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ABSTRACT

Ayurveda, the ancient Indian system of medicine, places the concept of *Agni* the biological “fire” at the centre of health and disease. *Agni* regulates digestion, absorption, metabolism, and assimilation of nutrients. Essential for maintaining physical vitality, mental clarity and disease resistance. Conversely, impaired *Agni* leads to the accumulation of *Āma* (toxins), systemic imbalance, and the development of chronic illness. In modern physiology, *vagal tone* refers to parasympathetic control, especially via the Vagus nerve, which regulates cardiac rhythm, gastrointestinal motility, and immune balance. Both concepts emphasize digestive regulation, systemic homeostasis, and resilience.

Aim: To explore conceptual and physiological parallels between *Agni* and vagal tone, with emphasis on heart rate regulation, blood pressure and Vagovagal reflexes in the gastrointestinal tract.

Methods: Comparative literature review from classical Ayurvedic texts and contemporary biomedical research. Proposed methodology for empirical studies includes standardized *Agni* assessment, heart rate variability (HRV) as an index of vagal tone, gastric motility measures, and inflammatory biomarkers.

Results: Normal functioning of *Agni* (*Samāgni*) conceptually aligns with high vagal tone and efficient vagovagal reflexes, supporting optimal digestion and systemic balance. Disturbances in *Agni* such as *Mandāgni*, *Tikshnāgni*, *Vishamāgni*, indicate reduced or dysregulated Vagal function, correlating with delayed gastric emptying, functional dyspepsia, or systemic inflammation.

Discussion: Comparative analysis highlights convergence between ancient and modern frameworks. *Agni* offers a holistic, multi-level understanding, while vagal tone provides measurable physiological

correlates. The integration of these perspectives may guide innovative research and interventions in integrative medicine.

Conclusion: Agni and vagal tone represent overlapping paradigms of digestive and systemic regulation. Future interdisciplinary studies can deepen these associations, offering novel insights into lifestyle-based interventions for holistic health.

Keywords: Agni, Ayurveda, Vagal tone, Heart rate variability, gastrointestinal physiology, Integrative medicine

INTRODUCTION

The concept of *Agni* occupies a foundational role in Ayurveda, describing the physiological and metabolic principles responsible for digestion, absorption and transformation of nutrients into *Dhatus* (bodily tissues) and for mental clarity [1]. According to Charaka Samhita, balanced *Agni* is indispensable for health, while impaired *Agni* underlies nearly all disease processes. Disturbances manifest as loss of appetite, indigestion, accumulation of *Ama* (toxic by-products), and systemic dysfunctions ranging from gastrointestinal disorders to inflammatory and metabolic conditions.

In modern biomedical science, the **Vagus nerve** – tenth cranial nerve is recognized as a master regulator of multiple system, including the gastrointestinal tract, heart, lungs and immune system [2]. The functional efficiency of Vagus nerve is represented as vagal tone, often measured indirectly via heart rate variability (HRV). High vagal tone reflects strong parasympathetic activity, which supports digestion, reduces inflammation, lowers

heart rate and stabilizes blood pressure. Conversely, low vagal tone is linked with gastrointestinal dysmobility, irritable bowel syndrome, hypertension, metabolic syndrome and mental health disorders [3].

The parallels between Agni and vagal tone invite the areas of exploration. Both frameworks, though arising from different epistemological traditions, converge on the idea of a central regulatory principle governing digestion, circulation, inflammation and mind-body integration. This article attempts to conceptually compare Agni and vagal tone with a focus on heart rate regulation, blood pressure control and gastrointestinal Vagovagal reflexes.

Aims and Objectives

1. To explain the Ayurvedic concept of Agni and its systemic relevance.
2. To summarize the physiological role of vagal tone.
3. To compare and correlate Agni with vagal tone in the domains of:
 - Heart rate
 - Blood pressure regulation

- Gastro intestinal reflexes
- 4. To identify lifestyle practices that enhances both Agni and vagal tone.
- 5. To highlight the potential for integrative models bridging Ayurveda and modern medicine.

REVIEW OF LITERATURE

Agni is the root of life and health. When Agni is balanced, a person remains healthy and when disturbed, diseases arise [4]. Acharya Vagbhatta emphasize *Dinacharya* (daily regimens) and dietary habits for sustaining Agni [5]. Acharya Charaka mentioned 13 types of Agni such as [6].

- **Jatharagni** – the one Agni or the digestive fire present in the stomach and intestine, responsible for breaking down ingested food.
- **Dhatvagni** – seven Agni, each responsible for *Dhatu parinama* and *Dhatu nirmana* (do tissue-level metabolism converting nutrients into the seven *dhatu*s).
- **Bhutagni** – five Agni from five basic elements known as *Panchamahabhoota* and perform elemental metabolism aligning nutrients with the five *Mahabhutas* (elements).

Based on the predominance of *Dosha* (three humors) in *Koshta* (abdomen), digestive capacity of *Jatharagni* varies. Accordingly, *Agni* is classified into four states such as: [7]

- **Mandāgni (weak digestive fire):** slow or weak digestion, heaviness, production of *Ama*, linked to *Kapha* imbalance.
- **Tikshnāgni (sharp digestive fire):** excessive metabolism, linked to *Pitta* imbalance.
- **Vishamāgni (irregular fire):** alternating digestion patterns, linked to *Vata* imbalance.
- **Samāgni (balanced fire):** efficient digestion, assimilation and health maintenance.

As per modern Physiology the vagal tone refers to the functional output of the vagus nerve in modulating visceral organs. The measurement of vagal tone is based on the Heart rate variability (HRV), especially high-frequency components and respiratory sinus arrhythmia (RSA), serves as a non-invasive biomarker [8]. The most important functions of Parasympathetic – Vagus nerve.

- *Heart rate regulation:* Vagal activity slows the heart beat through Vagal tone – continuous stream of inhibitory impulses from vasodilator areas to heart through vagus nerve [9]. Increase in vagal tone decreases the heart rate - Marey's reflex, especially during expiration, stimulation of Preoptic and anterior nuclei of hypothalamus and when the baroreceptors get stimulated due to increased blood pressure. At the

same time heart rate increases during emotional conditions, stimulation of lateral hypothalamic nuclei of hypothalamus, decrease in blood pressure, increase in venous return, during inspiration, due to inhibition of vasodilator area and decrease in vagal tone – Bainbridge reflex [10].

- *Blood pressure modulation:* The vagal fibers cause dilatation of blood vessels by releasing acetylcholine and stabilize the increased blood pressure [11].
- *Gastrointestinal secretion and regulation:* The vagovagal reflex along with local myenteric reflex, play major role in the mechanism involved in cephalic and gastric phases of gastric secretion and in the cephalic phase of pancreatic secretions. Here both afferent and efferent impulses pass through vagus nerve for doing the functions such as gastric secretions, intestinal secretions and digestion of food [12].
- The preganglionic parasympathetic nerve fibers to esophagus, stomach, small intestine and upper part of large intestine pass-through vagus nerve and synapse with the cells in myenteric plexus and submucous plexus. These nerve fibers accelerate the GIT movements by secreting the neurotransmitter acetylcholine [13].

- *Immune modulation:* The cholinergic anti-inflammatory pathway attenuates systemic inflammation. Kevin J Tracey –a Physiologist, proposed the concept of inflammatory reflex and vagus nerve mediated mechanism for reducing systemic inflammation [14].
- The polyvagal theory emphasizes the role of vagal activity in emotional regulation, digestion, social engagement, underscoring its systemic relevance [15].

Agni–Vagal Parallels in Existing Literature: Recent integrative medicine scholarship has attempted to map Ayurvedic constructs onto measurable physiological correlates. Some authors propose vagal tone as a biomarker for aspects of *Vata* and Agni states. Functional dyspepsia, irritable bowel syndrome, and dysautonomia share features of Mandāgni and Vishamāgni, suggesting that vagal dysfunction may be a modern correlate of Agni imbalance [16].

METHODOLOGY

This study employed a narrative comparative review design, integrating classical Ayurvedic knowledge with contemporary biomedical literature. The methodology involved the following steps:

1. Textual analysis of Ayurvedic sources like Charaka samhita and Ashtanga hrudaya and Physiology textbooks.

2. Peer reviewed scientific databases such as Scopus journals, Google scholar.
3. Comparative mapping – extracted data from Ayurveda and modern physiology were thematically organized into domains: digestion, cardiovascular regulation, inflammation and mind-body integration. Comparative analysis was conducted to identify overlapping principles and divergences.

This approach allows a conceptual bridge-building exercise rather than a direct casual equivalence, respecting both system' epistemologies.

DISCUSSION

The comparative analysis revealed significant overlaps between Agni and vagal tone in maintaining systemic balance. These are discussed thematically:

1. Digestion and gastrointestinal function: Vagal tone regulates gastric motility, secretion and digestion of food through vagovagal reflex. Low vagal tone contributes to dyspepsia, gastroparesis and IBS [17]. In the same way, *Agni* governs the activities of *Pachaka Pitta*, *Samana Vata*, *Kledaka Kapha* (secretions of GIT) and in the transformation of ingested food into *Ahara rasa* (more assumable form) [18]. *Mandagni* leads to indigestion (*ajirna*), bloating and malnutrition [19]. Here we can interpret that the disturbed vagal activity may be seen as a modern physiological correlate of weakened *agni*.
2. Cardiovascular Homeostasis: Vagal tone modulates Sino atrial node activity, modulate the heart rate, improve heart rate variability and stabilize blood pressure. *Agni*, indirectly supports circulation ensuring *Rasa samvahana* along with *Vyanavata* [20] (venous return) and modulate the heart rate through Bainbridge reflex and involved in *Rasa dhatu*, *Rakta dhatu* formation (bodily tissues). Thus *Mandagni* (weaker digestive fire) results in metabolic derangements leading to *dhatu vrudhi lakshana* [21] (disorders associated with increased bodily tissue), hypertensive symptoms and so on. Both terms highlight the link between metabolism and cardiovascular resilience.
3. Inflammation and immunity: Vagal tone activates cholinergic anti-inflammatory pathway, reducing cytokine storms and promoting immune tolerance. *Agni* prevents *Ama* formation, considered the root of inflammatory and autoimmune disorders [22]. Both concepts

converge on the digestion-immunity axis with vagal activity offering measurable correlates for Agni's anti-inflammatory role.

4. Mind-body integration: High vagal tone is associated with emotional regulation, reduced anxiety and stress resilience via enhanced HRV. Balanced Agni is said to promote clarity of mind and emotional stability, thereby enhancing the *satva guna*, [23], which is associated with purity, wisdom and harmony while impaired Agni causes irritability, depression or confusion. Both stress the Gut-brain axis, emphasizing mental clarity and emotional resilience as dependent on digestive / metabolic health.
5. Therapeutic Convergence: Ayurvedic practices that enhance Agni (dietary moderation, fasting, herbal formulations, *dinacharya*, *ritucharya*) [24], overlap with vagal tone – enhancing interventions like yoga, pranayama and meditation. Modern evidence suggests these interventions indeed increase HRV, supporting the hypothesis that strengthening *Agni*, that may enhance vagal activity.

CONCLUSION

This comparative review suggests that Agni in Ayurveda and vagal tone in modern

physiology represent parallel regulatory constructs, both central to digestion, systemic circulation, inflammation control and mind-body balance. When viewed comparatively, *Agni* may be regarded as the functional metabolic analogue of vagal tone, each offering a lens to assess systemic balance. Clinically, this alignment offers significant implications. Conditions attributed to *Agni mandya* in Ayurveda such as indigestion, hypertension, chronic inflammation and mental disturbances-show parallels with low vagal tone including irritable bowel syndrome, metabolic syndrome, depression, CVS disorders. Furthermore, therapeutic practices traditionally prescribed for enhancing Agni, such as dietary moderation, herbal formulations, yoga and meditation, are now supported by evidence showing their ability to improve HRV and vagal function. The integrative potential of this comparative perspective is substantial. By using vagal tone as a measurable correlate of Agni, researchers can bridge subjective Ayurvedic diagnostics with objective biomedical metrics. This not only validates classical insights but also opens pathways for interdisciplinary models of preventive and therapeutic healthcare.

Future studies should focus on well-designed clinical studies evaluating the effects of Agni-enhancing regimens on vagal biomarkers (HRV, baroreflex

sensitivity, inflammatory markers). Such work can provide a scientific framework to harmonize Ayurveda and modern medicine, ultimately offering a more holistic, patient-centered approach to health and disease management.

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