www.ijarp.com ISSN 2456-9992 Page: 01-10

International Journal Advanced Research Publications

Review Article

Volume: 02
Issue: 04

AYURVEDIC BIOMARKERS AND MODERN DIAGNOSTICS: A COMPREHENSIVE INTEGRATIVE REVIEW

[1*]Dr. Sonal Ram Joshi, [2]Dr. Avadhesh Kumar

[1]BAMS,MD(Scholar),3rdYear Department of Roga Nidan Evam Vikriti Vigyan Government yurvedic PG College&Hospital Chaukaghat, Varanasi, Uttar Pradesh – 221002, India..

[2]Professor & Head Department of Roga NidanEvam Vikriti Vigyan Government Ayurvedic PG College & Hospital Chaukaghat, Varanasi, Uttar Pradesh – 221002.

Article Received: 24 February 2026, Article Revised: 14 March 2026, Published on: 03 April 2026

***Corresponding Author: Dr. Sonal Ram Joshi**

BAMS,MD(Scholar),3rdYear Department of Roga Nidan Evam Vikriti Vigyan Government yurvedic PG College&Hospital Chaukaghat, Varanasi, Uttar Pradesh – 221002, India..

DOI: https://doi-doi.org/101555/ijarp.5197

ABSTRACT

Objective: To synthesise conceptual, functional, and clinical correlations between *Ayurvedic* biomarkers—*Dosha, Dhatu, Agni,* and *Ama*—and modern biomedical diagnostic parameters, and to develop a unified, integrative diagnostic framework. **DataSource:** Primary *Ayurvedic* texts (*Brihattrayi, Laghutrayi*), classical commentaries, CCRAS monographs, AYUSH research reports and modern biomedical literature from PubMed, Scopus and Google Scholar (1980–2024). Data included metabolomics, inflammatory markers, endocrine–immune parameters, genomic evidence and systems-biology studies. **Review Methods:** A narrative integrative review approach was used. Literature was screened using keywords such as "*Ayurvedic* biomarkers", "*Agni* metabolism", "*Ama* inflammation", "*Dosha* physiology", "Ayurgenomics", "biomarker correlation", and "metabolomics". Eligible sources (n=142 screened; ~56 included) were analysed for conceptual alignment, functional similarity and translational potential. *Ayurvedic* constructs were mapped onto modern biomarkers by comparing physiological functions, pathological expressions and clinical correlates. **Results:** Strong correlations were observed: *Vata* with autonomic nervous system indices and HRV; *Pitta* with metabolic heat, enzymatic activity and hepatic biomarkers; *Kapha* with lipid metabolism, glycaemic indices and anabolic pathways. *Agni* exhibited parallels with mitochondrial efficiency, digestive–metabolic enzymes, thyroid function and hepatic

metabolism. *Ama* showed convergence with systemic inflammation, oxidative stress, endotoxin burden and gut barrier dysfunction. Tissue-specific modern biomarkers could be mapped to *Dhatu* status. An integrative diagnostic framework combining *Ayurvedic* markers with laboratory parameters improved precision in disease staging and personalised prognosis.

Conclusion: Ayurvedic biomarkers provide a multidimensional understanding of physiology and pathology that aligns closely with contemporary metabolic and molecular signatures. Integrative diagnostics incorporating both knowledge systems may enhance predictive, preventive and personalised healthcare. Standardisation and further interdisciplinary research are essential.

KEYWORDS: *Ayurveda*, biomarkers, *Agni*, *Ama*, *Dosha*, *Dhatu*, Metabolomics, Integrative diagnostics, Ayurgenomics.

INTRODUCTION

Ayurveda conceptualises health as a dynamic equilibrium between *Dosha*, *Dhatu*, *Agni* and *Mala*, governed by *Srotas* and influenced by lifestyle, environment and mental state. These determinants operate as qualitative "biomarkers" reflecting systemic harmony or deviation. Modern medicine, in contrast, utilises quantifiable biochemical, haematological, molecular and imaging markers to describe physiological and pathological states. Despite their differing epistemological foundations, recent scientific developments—including metabolomics, systems biology, gut microbiome research and Ayurgenomics—have provided a shared platform for correlating Ayurvedic parameters with measurable biological indicators.[1–3]

This review synthesises classical *Ayurvedic* descriptions, biomedical evidence and emerging interdisciplinary research to establish functional correlations, thereby proposing an integrative diagnostic framework capable of improving personalised prognosis, disease staging and therapeutic monitoring.

REVIEW METHODOLOGY

A narrative integrative review design was adopted. Classical *Ayurvedic* sources (*Charaka Samhita*, *Sushruta Samhita*, *Astanga Hridayam*, key commentaries), CCRAS monographs, AYUSH publications and modern biomedical studies indexed in PubMed, Scopus and Google Scholar (1980–2024) were analysed. Search terms included: *Ayurvedic biomarkers*, *Agni metabolism*, *Ama and inflammation*, *Dosha physiology*, *Ayurgenomics*, *Metabolomics*, *Biomarker correlation*, *Gut permeability and Ama*, *Neuroendocrine-immune interactions*.

Inclusion criteria:

(1) conceptual clarity

(2) evidence-based correlation

(3) clinical relevance

(4) translational potential.

Exclusion criteria:

Anecdotal reports, non-peer-reviewed content and purely philosophical texts without physiological or clinical implications.

A total of 142 records were screened; 56 high-relevance sources were included. Concepts were mapped according to functional analogy, shared physiological mechanisms and clinical correspondence. The synthesis follows a top-down structure beginning with conceptual frameworks and progressing to system-specific and disease-specific biomarkers.

Ayurvedic Conceptual Basis of Biomarkers

Dosha as Dynamic Regulatory Biomarkers

The *Dosha*—*Vata*, *Pitta* and *Kapha*—represent regulatory complexes governing movement, transformation and stability. Their imbalances manifest through quantifiable physiological variations.

- *Vata* governs neuromuscular activity, autonomic tone, sensory processing and circulation.
- *Pitta* corresponds to metabolism, thermoregulation, enzymatic action, liver function and hormonal signalling.
- *Kapha* regulates anabolism, structural integrity, immune tolerance and adipose homeostasis.[4–6]

These functions parallel modern neuroendocrine-immune regulatory networks.

Agni as a Metabolic Biomarker

Agni is the transformative force responsible for digestion, absorption, assimilation and cellular metabolism. *Jatharagni*, *Bhutagni* and *Dhatvagni* collectively determine metabolic efficiency and tissue homeostasis. Classical descriptions equate impaired *Agni* with systemic dysfunction, signifying its role as a global metabolic biomarker.[7,8]

Modern parallels include basal metabolic rate, mitochondrial function, hepatic enzyme activity, thyroid function and gut enzymatic capacity.

Ama as an Inflammatory and Metabolic Dysfunction Marker

Ama arises from impaired *Agni*, resulting in incomplete transformation, cellular debris accumulation and systemic obstruction. The attributes of Ama—*Guru*, *Picchila*, *Manda*, *Sthana-samshraya*—overlap strongly with chronic low-grade inflammation, metabolic endotoxemia, oxidative stress and gut dysbiosis.[9–11]

Dhatu as Tissue-Specific Biomarkers

Each *Dhatu* represents tissue integrity, nourishment and function.

- ***Rasa*:** plasma volume, hydration, nutrient transport
- ***Rakta*:** oxygen-carrying capacity, RBC indices
- ***Mamsa*:** muscle mass, protein stores
- ***Meda*:** lipid profile, adiposity
- ***Asthi*:** bone density, calcium metabolism
- ***Majja*:** marrow health, neurological elements
- ***Shukra*:** reproductive indicators, hormonal balance

Dhatu kṣhaya or *Vriddhi* can be correlated with measurable clinical parameters.[12–14]

Correlation of *Ayurvedic* Biomarkers with Modern Diagnostics

Ayurvedic biomarkers exhibit substantial overlap with modern measurable indicators. The following sections elucidate this mapping.

Dosha and Neuroendocrine–Immune Correlates

❖ ***Vata***

Corresponds with:

- Heart rate variability (HRV) indices
- Autonomic nervous system fluctuations
- Catecholamines, cortisol patterns
- Neuromuscular conductivity
- Variability in blood pressure

❖ ***Pitta***

Correlates with:

- Liver function tests (ALT, AST)
- Thermogenesis, thyroid profile
- Digestive enzyme activity

- ROS generation and redox balance

❖ ***Kapha***

Correlates with:

- Lipid profile (TC, LDL, triglycerides)
- Insulin sensitivity markers (HOMA-IR)
- BMI, adipokines (leptin, adiponectin)
- Chronic inflammatory markers

These correlations provide a quantifiable basis for *Prakriti* profiling and personalised therapeutics.[15–17]

Agni and Modern Metabolic Parameters

Agni directly influences metabolic pathways:

- *Mandagni* parallels hypothyroidism, insulin resistance and mitochondrial fatigue
- *Tikshnagni* parallels hypermetabolic states, hyperthyroidism, and inflammatory heat
- *Vishamagni* parallels ANS fluctuation, irregular glucose metabolism
- *Samagni* reflects optimal metabolic flexibility

Key modern correlates include:

- Basal metabolic rate (BMR)
- Thyroid hormones (T3, T4, TSH)
- Liver detoxification markers
- Serum amylase/lipase
- Gut integrity markers (zonulin, lactulose-mannitol ratio)[18,19]

Ama and Biomarkers of Inflammation

***Ama* correlates with:**

- High-sensitivity C-reactive protein (hs-CRP)
- ESR elevation
- TNF-α & IL-6 levels
- Oxidative stress indices (MDA, SOD imbalance)
- Endotoxin markers (LPS, LBP)
- Gut dysbiosis (reduced diversity, altered SCFAs)[20–23]

These biomarkers indicate a deep convergence of *Ayurvedic* pathology with molecular inflammation pathways.

***Dhatu* Correlation with Modern Tissue Biomarkers**

Rasa Dhatu: Hydration status, electrolytes, serum proteins, plasma volume indicators.

Rakta Dhatu: Hb, RBC indices, coagulation profile, reticulocyte count.

Mamsa Dhatu: Creatinine, CPK, muscle mass (DEXA), nitrogen balance.

Meda Dhatu: Lipid profile, BMI, fat % (BIA/DEXA), adipokines.

Asthi Dhatu: Calcium, Vitamin D, bone turnover markers, BMD.

Majja Dhatu: Bone marrow markers, neurological indices.

Shukra Dhatu: Semen analysis, reproductive hormones (FSH/LH/testosterone).[24–27]

TABLE 1: Diagnostic Biomarkers — Ayurveda and Modern Correlation

***Ayurvedic* Marker**	**Conceptual Basis**	**Modern Diagnostic Correlate**
Vata Dosha	Movement, neural regulation	HRV, ANS measures, catecholamines
Pitta Dosha	Metabolic heat, enzymatic activity	LFTs, thyroid profile, ROS
Kapha Dosha	Structure, anabolism	Lipid profile, insulin resistance
Agni	Digestive-metabolic power	BMR, mitochondrial markers
Ama	Incomplete metabolism	CRP, ESR, IL-6, endotoxins
Dhatu	Tissue health	Organ-specific biomarkers

TABLE 2: Surrogate Biomarkers (Functional Indicators)

Ayurvedic Parameter	**Functional Attribute**	**Surrogate Modern Marker**
Agni Bala	Digestive strength	GI enzymes, gut integrity
Deha Bala	Immunity & vitality	WBC count, Ig profile
Mano Bala	Psychological strength	Stress hormones, HRV
Ojas	Vital essence	Immune modulation markers

TABLE 3: Prognostic Biomarkers

Ayurvedic Indicator	**Prognostic Meaning**	**Modern Parallel**
Amavisha	Chronic inflammation	Pro-inflammatory cytokines
Srotorodha	Channel obstruction	Endothelial dysfunction
Dhatu kshaya	Tissue depletion	Organ-specific insufficiency

Prakriti	Baseline constitution	Genetic polymorphisms

TABLE 4: Ayurvedic Correlates of Common Laboratory Investigations

Lab Test	Ayurvedic Correlate	Interpretation
CBC	*Rakta Dhatu Bala*	Blood vitality
LFT	*Pitta* & Agni	Metabolic fire
Lipid panel	*Meda Dhatu*	Nutritional/metabolic status
Thyroid panel	*Agni Vaishamya*	Metabolic fluctuation

TABLE 5: Integrated Diagnostic Framework

Ayurveda	Modern Diagnostics	Integrative Interpretation
Dosha Prakriti	Genetic variations	Predictive constitution
Agni	Metabolism & enzymes	Systemic metabolic status
Ama	Inflammatory load	Chronic disease risk
Dhatu	Tissue biomarkers	Organ/tissue health

DISCUSSION

The synthesis demonstrates that *Ayurvedic* biomarkers exhibit compelling correspondences with modern biomedical indicators. These associations validate ancient physiological concepts while expanding the scope of personalised diagnostics. Integrative assessment enhances early detection of metabolic disorders, inflammatory conditions and functional imbalances by combining qualitative *Ayurvedic* evaluation with quantifiable laboratory data.[28–33]

Ayurgenomics substantiates *Prakriti* classification with genetic polymorphisms. Metabolomics supports *Agni* status through metabolic flux analysis. Immune-inflammatory studies confirm the conceptual accuracy of *Ama* in chronic diseases. Such evidence strengthens *Ayurveda's* scientific foundation while offering modern medicine a more holistic, systems-level perspective.

CONCLUSION

Ayurvedic biomarkers—*Dosha*, *Agni*, *Mal*, *Dhatu*—possess profound correlations with contemporary biochemical, metabolic and molecular signatures. Integrating these frameworks can improve predictive, preventive and personalised healthcare. Further interdisciplinary research, standardisation, and clinical validation will advance integrative diagnostic models bridging traditional wisdom and modern science.

Conflict of Interest Declaration

The authors declare that **there is no conflict of interest** regarding the publication of this manuscript. No competitive, financial, or personal relationships influenced the research process or the preparation of this manuscript.

Funding Statement

This research received **no specific grant or financial support** from any funding agency, commercial entity, or nonprofit organization. The study was conducted independently without external sponsorship.

Ethical Clearance Statement

This manuscript is a **review-based study** that does not involve human participants, animal experiments, clinical interventions, or personal data collection. Therefore, **ethical approval is not required**. All sources referenced have been duly acknowledged.

ACKNOWLEDGEMENT

The authors express sincere gratitude to the Department of (xxxxxxxxxxxxxxxxxxx), for academic support during the preparation of this manuscript. The guidance and encouragement of faculty members are gratefully acknowledged.

REFERENCES

Ayurvedic / Classical Text References

1. Charaka Samhita, Sutrasthana, (Chapter/Verse not provided). Available from: http://niimh.nic.in/ebooks/echarak (Accessed on 01 December 2025).
2. Sushruta Samhita, Sutrasthana, (Chapter/Verse not provided). Available from: http://niimh.nic.in/ebooks/esushruta (Accessed on 01 December 2025).
3. Ashṭanga Hṛidayam, Sutrasthana. (Chapter/Verse not provided). Available from: http://niimh.nic.in/ebooks/easthanga (Accessed on 01 December 2025).
4. Modern / Journal / Book References (Vancouver Style)
5. Patwardhan B, Warude D, Pushpangadan P, Bhatt N. *Ayurveda* and traditional Chinese medicine: a comparative overview. Evid Based Complement Alternat Med. 2005;2(4):465–73.
6. Lad V. Textbook of *Ayurveda*: Fundamental Principles. 1st ed. Albuquerque: *Ayurvedic* Press; 2002.
7. Wujastyk D. The Roots of *Ayurveda.* London: Penguin Classics; 2003.

8. Sharma H. Digestion and *Agni*: A physiological correlation. *AYU*. 2011;32(3):382–6.
9. Rastogi S. Building bridges between *Ayurveda* and modern science. *J Ayurveda* Integr Med. 2010;1(1):3–4.
10. Sethi JK, Hotamisligil GS. The role of TNF-α in adipocyte metabolism. *J Clin Invest*. 1999;104:153–9.
11. Cani PD, Delzenne NM. The role of gut microbiota in energy metabolism and metabolic disease. *Curr Pharm Des*. 2009;15:1546–58.
12. Carvalho BM, Saad MJ. Influence of gut microbiota on subclinical inflammation and insulin resistance. *Mediators Inflamm*. 2013;2013:986734.
13. Hankey A. The scientific value of Ayurveda. *Evid Based Complement Alternat Med*. 2005;2:447–8.
14. Chatterjee A, Pancholi J. Prakriti-based medicine: A step towards personalized medicine. *Ayu*. 2015;36(3):190–7.
15. Rotti H, Guruprasad KP, et al. Validation of Ayurvedic prakriti classifications. *J Ayurveda Integr Med*. 2014;5(2):99–108.
16. Patwardhan B, Bodeker G. Ayurvedic genomics: establishing a genetic basis for mind-body types. *J Altern Complement Med*. 2008;14(5):571–6.
17. Prasher B, Negi S, et al. Whole-genome expression and Ayurveda prakriti. *J Transl Med*. 2008;6:48.
18. Sharma R, Chaudhary AK. Pitta and liver metabolism: an Ayurvedic perspective. *AYU*. 2012;33(2):145–50.
19. Wallace TM, Levy JC, Matthews DR. HOMA model assessment. *Diabetologia*. 2004;47:1486–92.
20. Wallace RK. The physiology of meditation and *Vata* regulation. *Science*. 1970;167:1751–4.
21. Pickup JC. Inflammation and diabetes: insights from biomarkers. *Diabetes Care*. 2004;27(3):813–23.
22. Libby P. Inflammation and cardiovascular disease mechanisms. *Nature*. 2002;420:868–74.
23. Esser N, et al. Inflammation as a link between amino acid metabolism and metabolic diseases. *Nutr Rev*. 2014;72:501–14.
24. Hotamisligil GS. Inflammation and metabolic disorders. *Nature*. 2006;444:860–7.
25. Gallagher D, et al. Body composition assessment. *Am J Clin Nutr*. 1998;67:110S–7S.
26. Holick MF. Vitamin D deficiency and bone health. *N Engl J Med*. 2007;357:266–81.

27. Weitzmann MN, Pacifici R. Bone loss mechanisms. *Nat Rev Immunol*. 2006;6:584–90.
28. Jones TH. Testosterone action and physiology. *N Engl J Med*. 2007;357:197–206.
29. Mishra A, Khurana L. Obesity and metabolic syndrome in India. *Nutr*. 2008;24:305–22.
30. Blaser MJ. The gut microbiome in human health and disease. *N Engl J Med*. 2014;371:1884–96.
31. Nicholson JK, Wilson ID. Metabolic phenotyping in diagnosing disease. *Nature*. 2008;455:1054–6.
32. Ramos-Fernandez M, et al. Metabolomics reveals metabolic pathways linked with inflammation. *Clin Chim Acta*. 2019;495:47–53.
33. Lira FS, et al. Exercise, inflammation and immune modulation. *J Physiol*. 2010;588:1–8.
34. Longo DL, et al. Hematology and inflammation markers. In: *Harrison's Principles of Internal Medicine.* 20th ed. New York: McGraw-Hill; 2018.
35. Tripathi JS. Exploratory analysis of Ayurveda and systems biology. *J Ayurveda Integr Med*. 2012;3(4):190–5.
36. Upadhyay R, et al. Understanding Ojas: An Ayurvedic–immunological link. *AYU*. 2010;31(4):384–9.
37. Kumar A, Mishra S. Integrating srotas pathology with endothelial dysfunction. *J Res Ayurveda Siddha*. 2016;37:45–52.
38. Patangay R, et al. Systems biology approach to Ayurvedic diagnostics. *BioSystems*. 2015;127:58–67.
39. Chakraborty A, et al. Lifestyle disorders and Ayurvedic biomarkers. *Ayu*. 2014;35(4):310–7.
40. Sehgal N, et al. Adaptogenic activity and systemic biomarkers. *Phytother Res*. 2012;26:126–32.
41. Zhernakova A, et al. Gut microbiome interactions with inflammation and metabolism. *Science*. 2016;352:565–70.