



## Metabolic Syndrome and Ayurveda: Understanding the Role of Agni, Ama and Medo Dhatu Dushti — A Critical Review

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### Abstract

Metabolic syndrome is not a single disease but a clinically important cluster of central obesity, insulin resistance, hypertension, dyslipidemia, and disturbed glucose regulation. Its growing prevalence reflects major changes in diet, physical activity, sleep, and psychosocial stress. Contemporary research links the syndrome with chronic low-grade inflammation, oxidative stress, altered adipose-tissue signaling, and impaired insulin action. Ayurveda approaches comparable metabolic disturbances through the interrelated concepts of impaired Agni, formation of Ama, and vitiation of Medo Dhatu. From this perspective, unsuitable food habits and an inactive or irregular lifestyle weaken digestion and tissue-level transformation, allowing poorly processed metabolic material to accumulate and normal tissue function to deteriorate. This narrative review brings modern pathophysiology into dialogue with descriptions from the Charaka Samhita, Sushruta Samhita, Ashtanga Hridaya, and Bhava Prakasha Nighantu, together with literature identified through PubMed, Scopus, Web of Science, and Google Scholar. The comparison suggests useful conceptual parallels between insulin resistance and Agni Dushti, between persistent inflammatory burden and Ama Sanchaya, and between abnormal lipid handling and Medo Dhatu Dushti. Measures such as individualized dietary correction, regular activity, Langhana, Deepana-

Pachana, Lekhana, selected herbal medicines, and Rasayana therapy may have a supportive role. These parallels should, however, be treated as interpretive models rather than direct biomedical equivalences. Carefully designed clinical studies are required before standardized integrative protocols can be recommended.

### Keywords

*Metabolic syndrome; Agni; Ama; Medo Dhatu; Ayurveda; obesity; insulin resistance*

### 1. Introduction

Metabolic syndrome has become a major lifestyle-related health concern because several cardiovascular and metabolic risk factors occur together in the same individual. The usual clinical picture includes abdominal obesity, hyperglycemia, raised blood pressure, elevated triglycerides, and reduced high-density lipoprotein cholesterol [1]. This clustering is important: affected individuals carry a greater risk of type 2 diabetes mellitus, cardiovascular disease, fatty liver disease, and other chronic inflammatory conditions [2].

Its rise cannot be explained by a single exposure. Energy-dense diets, prolonged sitting, inadequate physical activity, chronic stress, and disturbed sleep

often coexist and reinforce one another [3]. At the biological level, insulin resistance, low-grade inflammation, altered adipokine signaling, and mitochondrial dysfunction are among the mechanisms most often implicated [4].

Ayurveda describes health in terms of a dynamic balance among Dosha, Dhatu, Mala, Agni, and the channels through which nourishment and waste are transported. When digestion and tissue metabolism become inefficient, the disturbance is therefore understood as more than excessive body weight alone. Agni, Ama, Medo Dhatu, and Srotas Dushti together provide a framework for examining how faulty intake, impaired transformation, and abnormal tissue accumulation may interact [5]. Metabolic syndrome is a modern diagnostic construct and should not be equated with any one classical disorder. Nevertheless, features described under Sthaulya and Medoroga offer clinically relevant points of comparison.

## **Aim and Objectives**

The review aims to interpret metabolic syndrome through the Ayurvedic concepts of Agni, Ama, and Medo Dhatu Dushti while examining their possible relationship with modern metabolic mechanisms. Its objectives are to summarize current pathophysiology, review relevant classical concepts, identify areas of meaningful convergence without forcing equivalence, and discuss preventive and supportive therapeutic approaches.

## **2. Methodology of Literature Review**

A narrative review design was adopted. Classical material was drawn from the Charaka Samhita, Sushruta Samhita, Ashtanga Hridaya, and Bhava Prakasha Nighantu. Contemporary literature was searched in PubMed, Scopus, Web of Science, and Google Scholar using combinations of the terms “metabolic syndrome,” “insulin resistance,” “Agni Ayurveda,” “Ama Medo Dhatu,” and “Medoroga Ayurveda.” Clinical studies related to metabolic syndrome, Ayurvedic discussions of obesity and metabolism, and research on lifestyle-related metabolic disorders were considered. Reports unrelated to metabolic disease, animal studies without clear clinical relevance, and unauthenticated sources were excluded. As this was a narrative rather than a systematic review, the findings are intended as a critical conceptual synthesis and not as a pooled estimate of treatment efficacy.

## **3. Modern Understanding of Metabolic Syndrome**

Metabolic syndrome reflects disturbed energy regulation across several interconnected systems.

Visceral adiposity is especially important because abdominal fat is metabolically active. It releases mediators such as tumor necrosis factor-alpha and interleukin-6 and is associated with higher inflammatory activity, including C-reactive protein [6]. This inflammatory environment can interfere with insulin signaling and contribute to vascular injury.

Insulin resistance develops when skeletal muscle, liver, and adipose tissue respond inadequately to circulating insulin. Glucose uptake declines, hepatic glucose output remains inappropriately high, and the pancreas compensates by secreting more insulin. Persistent demand may eventually contribute to impaired glycemic control and pancreatic stress [7]. Dyslipidemia commonly appears as elevated triglycerides, reduced HDL cholesterol, and abnormal handling of circulating lipids. Hypertension adds a further layer of risk through endothelial dysfunction, increased sympathetic activity, renal influences, and inflammatory change [8]. These abnormalities are distinct, but they share drivers and often intensify one another.

## **4. Ayurvedic Concept of Metabolism**

Ayurvedic physiology does not locate metabolism in one organ or biochemical pathway. Transformation depends on the coordinated function of Agni, Dosha, Dhatu, and Srotas. Food must first be digested appropriately and its nutritive fraction must then be progressively transformed and delivered to the tissues. A disturbance at either stage can affect the quality of subsequent tissue nourishment. This systems-based view is particularly relevant to a syndrome in which digestion, fat storage, glucose regulation, circulation, and lifestyle are closely linked.

## **5. Role of Agni in Metabolic Health**

Agni denotes the body's capacity for digestion and transformation. Classical descriptions distinguish Jatharagni, Bhutagni, and Dhatvagni, emphasizing that metabolic processing occurs at more than one functional level [9]. When Jatharagni is impaired, food may not be digested or assimilated properly, producing heaviness, irregular appetite, and nutritionally inefficient processing. Dhatvagni Dushti refers to disturbed transformation at the tissue level. In the context of metabolic syndrome, dysfunction associated with Medo Dhatvagni may help explain the coexistence of excessive adipose accumulation and poor metabolic efficiency. This is a conceptual interpretation; Agni should not be reduced to a single enzyme, hormone, or laboratory value.

## **6. Concept of Ama**

Ama is generally understood as inadequately processed material arising when transformation is incomplete. Weak Agni, unsuitable dietary combinations or quantities, irregular eating, and inactivity may favor its formation. Clinically, Ama is described through patterns such as heaviness, fatigue, sluggish digestion, and obstruction of normal channels. Its comparison with inflammatory or metabolic waste products can be heuristically useful, but Ama is a broader Ayurvedic construct and is not synonymous with any single biomarker.

## 7. Concept of Medo Dhatu Dushti

Medo Dhatu supports lubrication, energy reserve, stability, and nourishment. Disturbance may involve either deficient function or excessive and poorly regulated accumulation. In Sthaulya and related states, disproportionate Medo Dhatu can coexist with inadequate nourishment of other tissues, reduced mobility, and metabolic sluggishness. Thus, Medo Dhatu Dushti encompasses more than visible obesity and may be used to discuss abnormal lipid handling and adipose-tissue function [10].

## 8. Correlation Between Metabolic Syndrome and Ayurveda

The relationship between the two knowledge systems is best presented as a set of cautious conceptual correspondences rather than one-to-one translations. Insulin resistance may be discussed in relation to impaired Agni and Dhatvagni; persistent metabolic and inflammatory burden may resemble aspects of Ama accumulation; and central obesity and dyslipidemia may be interpreted through Medo Dhatu Vriddhi or Medo Dushti. Mithya Ahara-Vihara provides a useful behavioral frame for the dietary and lifestyle exposures that initiate and sustain these changes.

| Modern concept              | Possible Ayurvedic correlation          |
|-----------------------------|-----------------------------------------|
| Insulin resistance          | Agni Dushti / Dhatvagni impairment      |
| Chronic inflammatory burden | Features interpreted in relation to Ama |
| Central obesity             | Medo Dhatu Vriddhi                      |
| Dyslipidemia                | Medo Dushti                             |
| Lifestyle-related causation | Mithya Ahara-Vihara                     |

## 9. Pathophysiological Correlation

Modern pathophysiology places insulin resistance and inflammation near the center of the syndrome. Enlarged and dysfunctional visceral

adipose tissue releases mediators that disrupt insulin signaling, reducing peripheral glucose uptake and promoting hyperglycemia with compensatory hyperinsulinemia [11]. At the same time, excess production of reactive oxygen species can damage cells, impair mitochondrial function, and amplify inflammatory pathways [12]. The gut microbiome has added another dimension: altered microbial composition and intestinal signaling have been associated with obesity, insulin resistance, and chronic inflammation [13].

An Ayurvedic reading would describe this progression as beginning with Agni Mandya, followed by incomplete transformation and Ama Sanchaya, obstruction or dysfunction of relevant Srotas, and progressive Medo Dhatu Dushti. This sequence offers a coherent clinical narrative linking digestive disturbance, systemic heaviness, abnormal tissue deposition, and reduced metabolic responsiveness. It does not prove that the classical terms represent the same biological processes, but it can guide testable research questions.

## 10. Modern Management of Metabolic Syndrome

Management begins with sustained lifestyle change and treatment of each identified risk factor. A calorie-appropriate diet, weight reduction when indicated, regular physical activity, better sleep, and stress management can improve several components simultaneously. At least 150 minutes of moderate-intensity activity per week is commonly advised for adults who can exercise safely, with individual adjustment for age, comorbidity, and functional capacity [14]. Dietary patterns generally emphasize fiber-rich foods, minimally processed carbohydrates, appropriate protein, and unsaturated fats.

Medication is selected according to the patient's abnormalities rather than for the label of metabolic syndrome alone. Metformin may be prescribed for impaired glucose regulation or diabetes; statins are used according to lipid levels and overall cardiovascular risk; and antihypertensive therapy is individualized to blood pressure and comorbidity [15]. Drug selection and dosing require clinical assessment and monitoring.

## 11. Ayurvedic Management of Metabolic Syndrome

Ayurvedic management seeks to correct Agni, reduce Ama, regulate excessive Medo Dhatu, and restore healthier patterns of food, activity, and sleep. Treatment must be individualized after assessment of Prakriti, Vikriti, strength, age, digestive capacity, associated disease, and medication use. Langhana may include lighter meals, appropriate restriction, and increased activity rather than indiscriminate

fasting. Deepana-Pachana measures are selected when impaired digestion and Ama features predominate, whereas Lekhana approaches are considered when excessive accumulation is clinically prominent.

Formulations such as Trikatu Churna and Chitrakadi Vati are traditionally used to support digestion, but their suitability depends on Pitta status, gastrointestinal tolerance, and concurrent illness. Guggulu-based preparations, including Triphala Guggulu and Medohara Guggulu, are used in practice for Medo Dushti and related lipid disturbances [16]. Guduchi (*Tinospora cordifolia*), Amla (*Emblica officinalis*), and Haridra (*Curcuma longa*) have been studied for antioxidant, anti-inflammatory, or metabolic effects [17,18]. Evidence varies by preparation and outcome, and these medicines should not be treated as substitutes for necessary diabetes, lipid, or blood-pressure care.

Panchakarma may be considered in selected, adequately assessed patients. Vamana is traditionally associated with Kapha-predominant states, Virechana with conditions requiring Pitta-oriented elimination, and forms of Basti with regulation of Vata and systemic function. Lekhana Basti protocols may incorporate ingredients such as Triphala, Madhu, Saindhava, and suitable decoctions. These procedures require supervision by a qualified Ayurvedic physician, proper preliminary measures, and attention to contraindications; fixed schedules cannot be generalized to every patient.

## 12. Diet and Lifestyle According to Ayurveda

The practical foundation is a regular routine that the patient can sustain. Meals should be light enough to digest comfortably yet nutritionally adequate, with portions matched to appetite and activity. Excess sweets, refined foods, frequent oily or heavy meals, prolonged inactivity, and habitual daytime sleep are generally discouraged when Kapha and Medo are increased. Regular exercise, consistent sleep timing, mindful eating, and avoidance of repeated eating before the previous meal is digested are equally important. The value of this approach lies in coordinated behavioral correction rather than reliance on a single herb or procedure.

## 13. Comparative Understanding

Both approaches recognize that metabolic syndrome develops gradually and is strongly influenced by daily behavior. Modern medicine provides measurable diagnostic thresholds, risk prediction, and effective pharmacological control of individual components. Ayurveda contributes a personalized account of digestive capacity, tissue transformation, constitution, and behavioral

causation. Integration is most credible when these strengths are used together while preserving the conceptual boundaries of each system.

## 14. Research Gaps

The available literature is limited by small samples, heterogeneous formulations, variable treatment duration, and inconsistent reporting of diet and co-interventions. Large, well-controlled trials of standardized yet clinically appropriate Ayurvedic protocols remain uncommon. There is also no accepted biomarker that directly represents Agni or Ama. Future studies should therefore define classical diagnostic criteria prospectively, record Prakriti and relevant clinical features transparently, and use validated metabolic outcomes rather than claiming direct equivalence from terminology alone.

## 15. Future Perspectives

Promising directions include pragmatic trials in integrative metabolic clinics, careful evaluation of Lekhana-based interventions, and studies that connect clinical Ayurvedic phenotypes with lipid, inflammatory, glycemic, and anthropometric outcomes. Gut-microbiome research, metabolomics, and personalized nutrition may help generate hypotheses about individual variation in treatment response. Such work will be most useful when classical reasoning, reproducible interventions, safety monitoring, and contemporary research methods are brought together.

## 16. Conclusion

Metabolic syndrome arises from the interaction of lifestyle, adiposity, insulin resistance, inflammation, and vascular risk. Ayurveda offers a complementary systems-level interpretation through Agni, Ama, Medo Dhatu, and Srotas. Impaired transformation, accumulation of inadequately processed material, and dysfunctional fat metabolism provide clinically meaningful parallels with modern descriptions, but they should not be presented as identical entities. Dietary correction, regular physical activity, Deepana-Pachana, Lekhana, and selected herbal or procedural therapies may support prevention and management when they are individualized and coordinated with standard medical care. Stronger clinical evidence and clearer reporting are still required before broadly applicable Ayurvedic protocols can be established.

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