



Rasayana Therapy and Healthy Ageing: Connecting Ayurvedic Rejuvenation with Contemporary Geroscience

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Opinion

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Abstract

Healthy ageing has emerged as an important scientific and public-health priority as life expectancy increases worldwide. Contemporary geroscience investigates biological processes that influence ageing and seeks strategies capable of maintaining functional capacity and reducing the burden of age-associated disease. Ayurveda contains a longstanding concept of Rasayana, traditionally associated with rejuvenation, maintenance of vitality, resistance to disease, and preservation of physical and cognitive functions. Although Rasayana and modern geroscience arise from fundamentally different knowledge systems, selected areas of conceptual overlap provide opportunities for scientific investigation. These include resilience to physiological stress, maintenance of tissue function, cognitive health, immune regulation, metabolic balance, and lifestyle modification. This mini review examines the traditional understanding of Rasayana and considers how its principles might be investigated using contemporary approaches to healthy ageing. Particular attention is given to phytochemical research, inflammation, oxidative stress, cellular senescence, mitochondrial function, autophagy, and multidimensional assessment of healthspan. The available evidence remains heterogeneous, and traditional Rasayana classifications should not be regarded as direct equivalents of individual geroscience pathways. Future research should therefore combine rigorous clinical methods with appropriate documentation of traditional formulations, preparation procedures, dosage, and therapeutic context. Such an approach may help determine whether selected Rasayana practices have measurable contributions to healthy ageing while maintaining scientific and conceptual integrity.

Keywords: Rasayana; Ayurveda; Healthy Ageing; Geroscience; Longevity; Healthspan; Rejuvenation; Cellular Senescence; Oxidative Stress; Traditional Medicine

Introduction

Population ageing is transforming healthcare priorities. Extending lifespan without preserving physical independence, cognitive function, and quality of life remains a major challenge. Consequently, contemporary geroscience increasingly focuses on biological processes that contribute

to ageing and on interventions that may preserve healthspan.

Ayurveda approaches ageing through a broader framework that includes lifestyle, diet, mental well-being, disease prevention, and therapeutic practices. Within this framework, Rasayana occupies an important position. Traditionally, Rasayana is associated with rejuvenation,

vitality, longevity, preservation of strength, and maintenance of healthy tissues. Rather than interpreting Rasayana simply as an “anti-ageing treatment,” it may be more appropriate to consider it as a multidimensional Ayurvedic approach to maintaining function and resilience [1].

Traditional Understanding of Rasayana

Classical Ayurvedic texts describe Rasayana among approaches intended to support longevity and healthy functioning. Different Rasayana approaches include medicinal formulations, dietary practices, behavioral recommendations, and specialized therapeutic procedures. Their traditional objectives may include maintaining strength, supporting cognition, improving resistance to illness, and promoting healthy ageing.

An important characteristic of Rasayana is that it should be understood within the broader Ayurvedic framework. The selection of an intervention may depend on individual characteristics, age, digestive status, lifestyle, and therapeutic objectives. Consequently, the term Rasayana encompasses more than a single pharmaceutical substance [2].

Geroscience and the Biology of Ageing

Modern geroscience examines biological processes that influence ageing and age-related disease. Research has identified interconnected processes such as cellular senescence, mitochondrial dysfunction, chronic low-grade inflammation, altered nutrient sensing, loss of proteostasis, impaired autophagy, genomic instability, and stem-cell exhaustion.

These processes provide potential biological endpoints for investigating traditional interventions. However, conceptual similarity does not establish equivalence. For example, the traditional concept of rejuvenation cannot automatically be interpreted as activation of autophagy or reduction of cellular senescence. Such relationships must be experimentally demonstrated [3].

Rasayana and Oxidative Stress

Oxidative imbalance has been investigated extensively in ageing biology. Certain medicinal plants traditionally used in Rasayana practices contain compounds with antioxidant activity in experimental models. This has encouraged investigation of whether such plants can influence oxidative and inflammatory pathways.

However, antioxidant activity observed in a laboratory assay does not necessarily translate into improved human healthspan. Future studies should therefore move beyond

simple radical-scavenging tests and investigate clinically meaningful biomarkers and functional outcomes.

Inflammation and Immune Function

Ageing is associated with changes in immune function and persistent low-grade inflammation, sometimes described as inflammageing. Rasayana formulations have attracted interest because some botanical constituents demonstrate immunomodulatory or anti-inflammatory properties in experimental studies.

This area warrants carefully controlled investigation. Researchers should determine whether standardized Rasayana preparations influence validated inflammatory or immune biomarkers in humans and whether such changes correspond with meaningful improvements in function or disease risk [4].

Cellular Senescence and Mitochondrial Health

Cellular senescence and mitochondrial dysfunction are increasingly recognized as important components of biological ageing. Certain plant-derived compounds are being investigated for their potential effects on mitochondrial signaling, cellular stress responses, and senescence-associated pathways.

Rasayana research could potentially incorporate these modern endpoints. Cell-based and animal studies may provide mechanistic hypotheses, while human studies could examine combinations of molecular biomarkers and functional measurements. Nevertheless, claims regarding “senolytic,” “mitochondrial rejuvenating,” or lifespan-extending effects should require direct evidence rather than inference from traditional use [5].

Beyond Herbal Products: Lifestyle and Healthspan

A major opportunity in Rasayana research lies in its broader lifestyle dimension. Healthy ageing is influenced not only by pharmacological interventions but also by physical activity, nutrition, sleep, stress management, social relationships, and cognitive engagement.

Some traditional Rasayana practices incorporate behavioral and dietary principles that may be studied alongside contemporary healthy-ageing interventions. Rather than isolating one herb, researchers could evaluate comprehensive Rasayana-inspired programs using outcomes such as physical performance, cognitive function, metabolic health, psychological well-being, and quality of life.

Research Challenges

Scientific investigation of Rasayana faces several challenges. Formulations may contain multiple botanicals and numerous constituents, while preparation methods can affect their chemical profiles. Traditional terminology may also lack direct biomedical equivalents.

Therefore, future studies should document botanical identity, formulation composition, processing, dosage, administration, and traditional rationale. Randomized controlled trials should use validated outcome measures and appropriate safety monitoring. Longitudinal studies could be particularly valuable because ageing-related outcomes often require extended observation.

Future Research Directions

An interdisciplinary research agenda could combine Ayurvedic clinical expertise with geroscience, pharmacology, analytical chemistry, nutrition, epidemiology, and biostatistics. Research should investigate both individual Rasayana formulations and broader lifestyle-based approaches.

Importantly, future studies should prioritize healthspan rather than relying solely on lifespan or surrogate biomarkers. Measures such as mobility, muscle strength, cognitive performance, frailty, independence, and quality of life may provide more clinically meaningful evidence.

Conclusion

Rasayana represents a distinctive Ayurvedic approach traditionally associated with rejuvenation, vitality, longevity, and preservation of health. Contemporary

geroscience provides a sophisticated framework for investigating the biological processes that influence ageing, creating opportunities for carefully designed interdisciplinary research. Potential areas of investigation include inflammation, oxidative stress, mitochondrial function, cellular senescence, metabolic regulation, and functional resilience. However, Rasayana should not be reduced to a collection of modern molecular mechanisms without appropriate evidence. Future research should preserve the traditional therapeutic context while applying rigorous standards for formulation characterization, safety, reproducibility, and clinical evaluation. A balanced research strategy may determine whether selected Rasayana interventions can contribute meaningfully to healthy ageing and improved healthspan.

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