



FROM GLOBAL NCD BURDEN TO PREVENTIVE ACTION: RELEVANCE OF AYURVEDA IN CONTEMPORARY PUBLIC HEALTH

Dr. Gunjan Mehra¹, Prof. (Dr.) Rakesh Kumar Verma²

¹MD Scholar, Department of Swasthavritta & Yoga, Ch. Brahm Prakash Ayurved Charak Sansthan, New Delhi, India

²Professor and Guide, Department of Swasthavritta & Yoga, Ch. Brahm Prakash Ayurved Charak Sansthan, New Delhi, India

Corresponding Author: Dr. Gunjan Mehra

ABSTRACT

Non-communicable diseases (NCDs) represent one of the major public-health challenges of the twenty-first century. Cardiovascular diseases, cancers, chronic respiratory diseases and diabetes account for the largest proportion of NCD mortality, while premature deaths disproportionately affect low- and middle-income countries. The burden is closely associated with modifiable behavioural and metabolic risk factors, including unhealthy dietary patterns, physical inactivity, tobacco use, harmful alcohol consumption, overweight and obesity, raised blood pressure and impaired glucose regulation. This epidemiological pattern emphasizes the importance of prevention, early detection and sustained lifestyle modification alongside disease treatment.

Ayurveda has a strong preventive orientation centred on preservation of health, appropriate food and lifestyle, physical activity, sleep, behavioural regulation and individualized approaches to health. Several of these principles have conceptual relevance to contemporary public-health approaches to NCD prevention. However, conceptual similarity between traditional and contemporary health frameworks should not be interpreted as evidence of clinical equivalence. Specific Ayurvedic interventions require evaluation through appropriate scientific methods.

Available clinical evidence presents a mixed but potentially relevant picture. A systematic review and meta-analysis of Ayurvedic medicines for type 2 diabetes reported improvements in several glycaemic outcomes, while also identifying limitations in methodological reporting and adverse-event assessment. Studies conducted within an Indian integrated-care programme have reported improvements in glycaemic and blood-pressure outcomes, although their non-randomized or open-label designs limit causal interpretation. Meta-analyses of yoga interventions have reported favourable effects on several glycaemic parameters, but the evidence is predominantly based on relatively short-term outcomes. For hypertension, a recent systematic review and meta-analysis reported that Ayurvedic interventions demonstrated blood-pressure outcomes comparable to those observed with placebo or standard antihypertensive treatment, although further well-designed studies are warranted to better characterize their clinical effects.

The World Health Organization's Global Traditional Medicine Strategy 2025–2034 provides an important contemporary policy framework by emphasizing evidence generation, safety and regulation, appropriate integration into health systems and cross-sectoral collaboration.

This article examines the global NCD burden and evaluates the potential relevance, evidence base, opportunities and limitations of Ayurveda within contemporary preventive public health. It proposes that the future role of Ayurveda should be evidence-led and complementary, with scientifically evaluated interventions integrated into preventive and healthcare systems where effectiveness, safety, quality and feasibility are demonstrated.

KEYWORDS: Ayurveda; Non-Communicable Diseases; Public Health; Prevention; Health Promotion; Lifestyle Modification; Diabetes; Hypertension; Yoga; Integrative Healthcare.

1. INTRODUCTION

The global pattern of disease has undergone a profound transition. Improvements in sanitation, vaccination, antimicrobial therapy, maternal and child healthcare and socioeconomic conditions have contributed to substantial gains in life expectancy. At the same time, population ageing, urbanization, changing food environments, sedentary occupations and other social and environmental changes have contributed to the increasing prominence of chronic diseases.

According to the World Health Organization (WHO), NCDs caused at least 43 million deaths globally in 2021, representing approximately 75% of deaths unrelated to the COVID-19 pandemic. Cardiovascular diseases accounted for the largest share of NCD deaths, followed by cancers, chronic

respiratory diseases and diabetes. Approximately 18 million people died from NCDs before the age of 70 years, with most premature deaths occurring in low- and middle-income countries. [1] The significance of NCDs extends beyond mortality. Chronic diseases frequently require prolonged healthcare, affect functional capacity and quality of life, and generate substantial economic consequences for individuals, households and health systems. NCD prevention is therefore simultaneously a health, social and developmental priority. Reducing NCD mortality also has implications for global development. Premature NCDs disproportionately affect populations experiencing socioeconomic disadvantage and can contribute to medical impoverishment, productivity losses and widening inequalities. [2] The determinants of NCDs operate at



multiple levels. Individual behaviours interact with social, economic, commercial and environmental conditions. Consequently, effective prevention requires more than treatment after disease becomes clinically apparent. Within this context, traditional systems of medicine have attracted increasing attention as potential contributors to health promotion and preventive care. Ayurveda is particularly relevant because of its longstanding emphasis on maintaining health through diet, daily routine, physical activity, sleep and behavioural regulation. The appropriate contemporary question, however, is not whether Ayurveda should replace biomedical healthcare. It is whether specific Ayurvedic principles and interventions can be scientifically evaluated and appropriately incorporated into preventive healthcare where evidence demonstrates benefit, safety and feasibility.

2. THE CONTEMPORARY NCD BURDEN

NCDs generally develop through prolonged interactions between genetic susceptibility, environmental exposure, behaviour and metabolic changes.

The progression may be conceptualized as:

Social and environmental determinants → behavioural exposure → metabolic risk → subclinical disease → clinical disease → complications → disability and premature mortality.

This continuum demonstrates that opportunities for prevention exist long before a clinical diagnosis is established.

Public-health interventions can therefore operate at several stages:

- prevention of risk-factor development;
- reduction of established risk factors;
- early detection;
- prevention of complications; and
- maintenance of function and quality of life.

The major modifiable behavioural determinants include unhealthy diets, physical inactivity, tobacco exposure and harmful alcohol use. These interact with metabolic risk factors such as obesity, elevated blood pressure and abnormal glucose regulation. An effective NCD strategy consequently requires both individual-level interventions and population-level policies. Individual counselling can support behaviour change, but food systems, transportation, urban design, employment, education and socioeconomic conditions also shape health behaviour. Ayurveda-informed health promotion should therefore be considered one potential component of a broader public-health strategy rather than a substitute for population-level interventions.

3. LIFESTYLE RISK FACTORS AND OPPORTUNITIES FOR PREVENTION

3.1 Diet

Diet is a major determinant of metabolic and cardiovascular health. WHO describes a healthy diet in terms of adequacy, balance, moderation and diversity and emphasizes consumption of nutrient-dense foods while limiting excessive intake of free sugars, unhealthy fats and sodium. Dietary patterns should also reflect individual characteristics, cultural context and locally available foods. [3] This emphasis on dietary quality and individual context provides an area of

potential dialogue with Ayurveda. Ayurvedic dietary concepts consider factors such as quantity, preparation, timing, suitability and individual tolerance. These principles may provide culturally meaningful frameworks for dietary counselling. Ayurvedic dietary classifications and contemporary nutritional categories are rooted in distinct conceptual frameworks and should therefore be understood within their respective contexts. A meaningful integration of the two approaches requires systematic evaluation of specific dietary practices using appropriate nutritional, metabolic, and health outcomes.

3.2 Physical activity

Physical inactivity is another major modifiable determinant of chronic disease. WHO guidelines recommend that adults undertake 150–300 minutes of moderate-intensity aerobic physical activity or 75–150 minutes of vigorous-intensity aerobic activity per week, or an equivalent combination, together with regular muscle-strengthening activity. Reduction of sedentary behaviour is also recommended. [4] Physical activity need not be limited to structured exercise. Walking, occupational activity, active transportation, household activity and recreational movement can contribute to overall physical activity. The Ayurvedic concept of *Vyayama*, or physical exertion, therefore provides a potentially relevant traditional framework for promoting regular movement. Its contemporary application should nevertheless be individualized according to age, physical capacity, disease status and functional limitations.

3.3 Tobacco and alcohol

Tobacco exposure and harmful alcohol use remain major preventable contributors to chronic disease. Lifestyle counselling may support risk reduction, but tobacco and alcohol prevention also require regulation, taxation, health education and supportive environments. This illustrates an important principle: Ayurveda-informed counselling may complement established public-health interventions but cannot replace broader policy measures.

3.4 Metabolic risk factors

Behavioural exposures may manifest through measurable metabolic abnormalities, including elevated blood pressure, hyperglycaemia, obesity and dyslipidaemia. These intermediate risk factors provide opportunities for screening and early intervention. A preventive programme should therefore combine lifestyle education with objective assessment. Individuals with clinically significant abnormalities should be appropriately evaluated and referred when required.

4. AYURVEDA AND PREVENTIVE HEALTH

Ayurveda places considerable emphasis on preservation of health. The preventive principle commonly expressed as *Swasthaya Swasthya Rakshanam* emphasizes maintaining the health of healthy individuals. This orientation has conceptual relevance to contemporary health promotion because it places prevention alongside treatment rather than treating prevention as an afterthought. Ayurvedic descriptions of health also extend beyond a narrow disease-based definition and include broader



aspects of physiological and mental well-being. Nevertheless, Ayurvedic and biomedical definitions of health are not identical. Their conceptual similarities should therefore not be interpreted as proof that Ayurvedic constructs correspond directly to contemporary clinical or epidemiological measures. The scientific opportunity lies in identifying specific preventive practices and evaluating whether they produce measurable improvements in health outcomes.

5. AHARA AND PREVENTIVE NUTRITION

Ahara, or food, occupies a central position in Ayurvedic health practice. Ayurvedic dietary thought considers not only food itself but also quantity, preparation, timing, suitability and individual response.

Selected principles may potentially be translated into contemporary preventive counselling through emphasis on:

- appropriate portions;
- dietary diversity;
- regular eating patterns;
- culturally appropriate foods;
- moderation;
- adequate intake of nutrient-dense plant foods;
- appropriate protein intake; and
- limitation of excessive consumption of highly processed foods.

The potential contribution of Ayurveda is strongest when traditional dietary concepts are translated into nutritionally appropriate and measurable recommendations. The objective should not be to establish Ayurveda as superior to modern nutrition science, but to determine whether culturally grounded approaches can improve adherence to healthy dietary behaviours.

6. DINACHARYA AND BEHAVIOURAL REGULARITY

Modern lifestyles frequently involve irregular working hours, prolonged screen exposure, sedentary occupations, disturbed meal patterns and inconsistent sleep. The Ayurvedic concept of *Dinacharya* emphasizes regularity in daily activities. In contemporary health promotion, this may be interpreted through practices such as:

- regular sleep and waking schedules;
- consistent meal patterns;
- daily movement;
- appropriate work-rest balance;
- personal hygiene; and
- periods of relaxation.

The potential public-health value of *Dinacharya* may therefore lie in promoting sustainable routines. However, contemporary implementation should account for occupation, age, social circumstances and individual health needs rather than reproducing traditional routines without adaptation or evaluation.

7. RITUCHARYA AND ENVIRONMENTAL ADAPTATION

Ayurveda also describes seasonal adaptation through *Ritucharya*. Contemporary public health recognizes that

environmental conditions can influence physical activity, food availability, infectious exposure and patterns of illness. Seasonal variation may also influence opportunities for outdoor activity and dietary behaviour. *Ritucharya* should not be represented as equivalent to modern environmental medicine. Nevertheless, its emphasis on adapting health behaviour to environmental circumstances provides a potentially useful cultural framework for seasonal health education. This is primarily a conceptual area at present and requires empirical investigation before specific health claims can be made.

8. NIDRA AND SLEEP HEALTH

Sleep is an important component of overall health. Irregular work schedules, night-shift employment, excessive digital exposure and psychosocial stress can interfere with sleep and may subsequently influence mood, appetite, physical activity and health behaviour. Ayurveda recognizes *Nidra* as an important component of healthy living.

A contemporary preventive approach can incorporate practical sleep-health measures such as:

- maintaining regular sleep and wake times;
- allowing adequate sleep opportunity;
- maintaining a suitable sleep environment;
- reducing unnecessary stimulation before bedtime; and
- seeking clinical assessment for persistent sleep problems.

Persistent or severe sleep disturbances should not be managed solely through traditional lifestyle advice.

9. SADVRITTA AND BEHAVIOURAL WELL-BEING

NCD prevention is closely related to psychological and behavioural health. Stress can influence eating patterns, sleep, physical activity and treatment adherence. Unhealthy coping behaviours may further increase chronic disease risk. Ayurvedic concepts associated with *Sadvritta* emphasize self-regulation and appropriate social and behavioural conduct. These principles may provide culturally meaningful material for health education. However, they should complement established psychological and psychiatric interventions rather than being presented as substitutes for evidence-based mental-health care. Future research could examine whether structured Ayurveda-informed behavioural programmes influence measurable outcomes such as stress, sleep, quality of life and adherence.

10. INDIVIDUALIZATION AND PRAKRITI

Individual variation is an important feature of Ayurvedic thought, with *Prakriti* providing a traditional framework for describing constitutional characteristics. Modern healthcare is increasingly interested in personalized and precision approaches that consider differences in genetics, physiology, behaviour and environment. This creates a potentially valuable area of interdisciplinary research. The individualized perspective of *Prakriti* provides an interesting basis for exploring relationships with contemporary approaches to genetic, metabolic, and molecular phenotyping, although these relationships require systematic validation. Future studies should assess the reliability and reproducibility of *Prakriti* assessment and determine whether *Prakriti*-informed



preventive counselling improves measurable outcomes compared with standard approaches. The appropriate scientific position is therefore investigation rather than assumption.

11. EVIDENCE IN TYPE 2 DIABETES

Type 2 diabetes represents an important area in which lifestyle-oriented Ayurveda intersects with contemporary preventive medicine. A systematic review and meta-analysis by Chattopadhyay and colleagues included 219 articles representing 199 randomized controlled trials involving 21,191 participants and evaluating 98 Ayurvedic medicines. The review reported improvements in several glycaemic outcomes for selected interventions. However, methodological reporting was frequently inadequate, very few studies assessed health-related quality of life and adverse events were incompletely reported in many studies. The authors concluded that higher-quality randomized controlled trials are required. [5] These findings indicate that selected Ayurvedic medicines warrant further investigation. They do not establish that Ayurveda as a whole is effective for type 2 diabetes, nor do they establish that Ayurvedic medicines can replace evidence-based diabetes treatment. The distinction between evidence for an individual intervention and evidence for an entire medical system is essential.

12. INTEGRATED AYURVEDA, LIFESTYLE MODIFICATION AND YOGA IN DIABETES

Evidence from an Indian community-health programme provides an important implementation perspective. Sharma and colleagues conducted a multicentric, open-label, prospective comparative clinical study at 17 community health centres and one district hospital under the NPCDCS–AYUSH integration project. Participants with prediabetes or type 2 diabetes received lifestyle modification and *yoga*, with selected groups additionally receiving Ayurvedic medicines; people with type 2 diabetes continued standard allopathic treatment. The study reported significant reductions in fasting and postprandial blood glucose in groups receiving the additional Ayurvedic intervention. [6] The importance of this study lies partly in its real-world healthcare setting. However, the study used an open-label design and evaluated a complex intervention consisting of Ayurveda, lifestyle modification and *yoga*, with conventional treatment continuing in the diabetic cohort. Consequently, the independent contribution of each component cannot be established from the study. The findings therefore support further investigation of integrated care rather than definitive claims of Ayurvedic superiority.

13. YOGA AND GLYCAEMIC CONTROL

Yoga has been investigated separately as a lifestyle and mind-body intervention for type 2 diabetes. A systematic review and meta-analysis of 13 randomized controlled trials reported significant improvements in HbA_{1c}, fasting blood glucose, postprandial blood glucose and triglycerides among people with type 2 diabetes who received *yoga* interventions. The analysis did not demonstrate statistically significant effects on total cholesterol or BMI. The authors also emphasized that the available evidence primarily addressed short-term outcomes and recommended larger, more rigorous trials. [7] These findings support consideration of *yoga* as a

complementary lifestyle intervention. They do not support replacing pharmacological treatment when medication is clinically indicated. Future research should examine standardized *yoga* protocols, adherence, long-term metabolic outcomes and clinically important endpoints.

14. AYURVEDA AND HYPERTENSION: CURRENT EVIDENCE

Hypertension is a major modifiable cardiovascular risk factor. The evidence concerning Ayurvedic intervention for hypertension requires particular caution. A 2025 systematic review and meta-analysis evaluated 44 studies, of which 10 randomized controlled trials involving 524 participants contributed to quantitative analysis. The pooled findings did not demonstrate statistically significant differences in systolic or diastolic blood pressure between Ayurvedic interventions and placebo or standard antihypertensive treatment. The analysis also showed substantial heterogeneity among studies. [8] This is an important finding because it prevents overstatement of the current evidence. Available evidence does not establish Ayurvedic treatment as superior to standard antihypertensive therapy. Research should instead examine whether selected Ayurvedic interventions can safely complement lifestyle modification and conventional treatment within appropriately monitored integrated care. Individuals with established hypertension should not discontinue prescribed treatment on the basis of complementary or traditional therapy without appropriate medical supervision.

15. INTEGRATED HYPERTENSION CARE

An earlier retrospective observational analysis from the NPCDCS–AYUSH integration programme examined Ayurveda medication, lifestyle modification and *yoga* alongside standard care in essential hypertension. The study included 1,938 participants who had completed six months of integrated management. Both groups demonstrated reductions in systolic and diastolic blood pressure. The study also reported reductions or discontinuation of conventional antihypertensive medication in some participants. [9] These findings are potentially relevant to implementation research but should not be interpreted as proof that Ayurvedic treatment allows conventional antihypertensive medication to be stopped. Because the study was retrospective and observational, treatment selection and other confounding factors could influence the results. Future research should use randomized designs, standardized interventions, objective blood-pressure monitoring and long-term cardiovascular outcomes.

16. AYURVEDA AND NCD CARE IN INTERNATIONAL SETTINGS

The relevance of Ayurveda is not restricted to India. A 2025 qualitative systematic review examined experiences and perspectives concerning Ayurveda for NCD management in Organisation for Economic Co-operation and Development countries. Nine studies were included from 18,541 identified records. Patients reported interest in Ayurveda because of perceived holistic and natural approaches, while the review also identified regulatory constraints, limited access to medicines and integration challenges. [10] This evidence demonstrates



that international integration involves more than clinical efficacy.

Other factors include:

- regulation;
- practitioner qualifications;
- product availability;
- quality assurance;
- communication between healthcare professionals;
- patient expectations;
- reimbursement mechanisms; and
- integration with existing health services.

International experience therefore reinforces the need for both clinical evidence and implementation research.

17. FROM INDIVIDUAL LIFESTYLE TO COMMUNITY PREVENTION

The potential public-health contribution of Ayurveda may be particularly relevant at the community level.

A community-oriented programme could follow the sequence:

Health education → Risk assessment → Lifestyle counselling → Behaviour modification → Monitoring → Referral → Long-term follow-up

Potential components could include:

- blood-pressure screening;
- diabetes-risk assessment;
- dietary counselling;
- physical-activity promotion;
- *yoga*-based group sessions;
- sleep-health education;
- tobacco-cessation support;
- alcohol-risk counselling;
- weight-management support;
- stress-management education; and
- referral of individuals requiring medical assessment.

Such a model positions Ayurveda as a contributor to prevention while preserving appropriate roles for biomedical diagnosis, pharmacotherapy and specialist care.

18. AYURVEDA IN PRIMARY HEALTHCARE

Primary healthcare provides an important platform for preventive interventions because it allows repeated interaction with individuals and communities. A potential integrated model could distribute responsibilities according to professional competence. At the community level, trained personnel could focus on health education, lifestyle promotion and identification of risk. At the primary-care level, qualified practitioners could undertake risk assessment, counselling and selected evidence-supported interventions. At the medical and referral levels, individuals with established, complicated or high-risk disease could receive appropriate diagnostic and therapeutic care. At follow-up, lifestyle adherence and clinical outcomes could be monitored. Integration therefore requires more than co-location of different practitioners. It requires defined responsibilities, referral pathways, documentation standards, communication mechanisms and patient-safety procedures.

19. A LIFE-COURSE APPROACH

NCD prevention should begin before disease becomes established. Childhood provides an opportunity to establish healthy dietary and physical-activity behaviours. Adolescence is important for behavioural development. Young adulthood introduces new occupational and social influences. Middle age frequently brings increasing metabolic risk, while older adulthood is often characterized by multimorbidity and functional limitations. Ayurvedic preventive principles may potentially be adapted to each stage of life. Such adaptation must remain evidence-informed and age appropriate. Recommendations for children cannot simply be scaled-down adult recommendations, while interventions for older adults must consider mobility, nutrition, cognition, polypharmacy and comorbid conditions. A life-course framework can therefore provide a practical structure for translating broad preventive principles into population-specific health-promotion programmes.

20. HEALTHY AGEING AND FUNCTIONAL HEALTH

Population ageing is increasing the prevalence of multimorbidity and long-term medication use. Preventive healthcare for older adults should therefore extend beyond disease prevention to maintenance of functional independence and quality of life.

Potential areas for Ayurveda-informed research include:

- physical function;
- mobility;
- balance;
- sleep;
- nutrition;
- cognitive well-being;
- quality of life;
- medication burden; and
- independence in daily activities.

Any use of herbal or traditional medicines in older adults requires particular attention to possible interactions because polypharmacy is common. Research should prioritize patient-centred outcomes rather than relying exclusively on laboratory biomarkers.

21. SAFETY, QUALITY AND REGULATION

Traditional origin does not automatically establish safety. Ayurvedic medicines may contain pharmacologically active substances and may present risks related to inappropriate dosing, contamination, adulteration, variable quality or interactions with conventional medicines. These considerations are particularly important in NCD populations because many patients receive long-term pharmacotherapy. The WHO global report on traditional, complementary and integrative medicine describes substantial variation between countries in policies, regulation, workforce, products, service models and approaches to quality and safety. It also provides a baseline for monitoring implementation of the WHO Global Traditional Medicine Strategy 2025–2034. [11]

Responsible integration therefore requires:

- appropriate product quality assurance;
- standardized manufacturing where applicable;



- pharmacovigilance;
- assessment of herb–drug interactions;
- qualified practitioners;
- accurate patient information;
- appropriate dosing and monitoring; and
- clearly defined referral mechanisms.

Safety and quality should be regarded as prerequisites for integration.

22. EVIDENCE QUALITY AND SCIENTIFIC VALIDATION

Ayurvedic knowledge can generate hypotheses, but different forms of evidence answer different questions. Classical literature provides historical knowledge and conceptual frameworks. Observational studies provide information about real-world use and feasibility. Clinical trials examine efficacy and safety under specified conditions. Systematic reviews synthesize available evidence but remain dependent on the quality and heterogeneity of the included studies. Implementation research examines whether interventions can function in routine healthcare. Economic evaluations examine affordability and value. These forms of evidence should not be conflated. One major challenge in Ayurveda research is the tension between individualized clinical practice and reproducible research. Individualization may be an important component of Ayurvedic practice, whereas scientific evaluation requires transparent descriptions of how treatment decisions are made. Research protocols can therefore preserve clinically relevant individualization while defining core intervention components and permissible variation. This approach could improve reproducibility without unnecessarily eliminating individualized care.

23. THE GLOBAL POLICY ENVIRONMENT

The international policy environment for traditional medicine has evolved significantly.

In 2025, the World Health Assembly adopted the WHO Global Traditional Medicine Strategy 2025–2034. The strategy establishes four strategic objectives:

1. strengthening the evidence base;
2. supporting safe and effective traditional, complementary and integrative medicine through appropriate regulatory mechanisms;
3. integrating safe and effective practices into health systems; and
4. optimizing their broader cross-sectoral contribution. [12]

The strategy represents an important shift in international discussion. Traditional medicine is increasingly being considered through the framework of evidence, safety, quality, regulation and appropriate integration rather than recognition based solely on historical use. For Ayurveda, this creates both an opportunity and a responsibility to strengthen the evidence base.

24. IMPLICATIONS OF THE WHO STRATEGY FOR AYURVEDA

A WHO analysis of the new strategy identifies persistent challenges including limitations in research methods, variation in regulatory approaches and the absence of standardized

models for integration into health systems. [13] For Ayurveda, these challenges translate into several practical priorities:

Evidence: generate robust clinical and public-health evidence.

Safety: strengthen pharmacovigilance and quality assurance.

Standardization: define interventions sufficiently for reproducible research.

Regulation: establish appropriate oversight of products, practices and practitioners.

Integration: develop clear pathways for communication and referral.

Equity: ensure that evidence-based services are accessible to populations that need them.

Research capacity: strengthen interdisciplinary collaboration among Ayurveda, public health, clinical medicine, epidemiology, pharmacology, biostatistics and health economics.

The next phase of Ayurveda research should therefore move beyond isolated efficacy studies toward questions of effectiveness, implementation, safety, cost and health-system relevance.

25. A FRAMEWORK FOR AYURVEDA-INFORMED NCD PREVENTION

A practical preventive model can be organized into six stages:

1. Assess

Identify behavioural, metabolic and environmental risk factors.

2. Individualize

Consider age, occupation, health status, physical capacity, dietary context and appropriate Ayurvedic assessment.

3. Modify

Address diet, physical activity, sleep, stress and other modifiable behaviours.

4. Monitor

Measure objective outcomes such as blood pressure, glucose, body weight, waist circumference, physical activity and quality of life.

5. Integrate

Combine validated Ayurvedic interventions with appropriate conventional care.

6. Evaluate

Assess effectiveness, safety, adherence, affordability, equity and sustainability.

Thus:

Assess → Individualize → Modify → Monitor → Integrate → Evaluate

This model is more scientifically defensible than broad claims that Ayurveda can independently "cure" NCDs because every stage can be evaluated using measurable outcomes.

26. RESEARCH PRIORITIES

The next generation of Ayurvedic NCD research should address several priorities.

26.1 High-quality randomized controlled trials

Trials should be adequately powered, transparently reported and designed around clinically meaningful outcomes.

26.2 Standardized reporting

Interventions should be described sufficiently to permit replication while transparently documenting legitimate individualization.



26.3 Long-term outcomes

Research should move beyond short-term biochemical outcomes toward cardiovascular events, complications, disability and quality of life.

26.4 Safety surveillance

Adverse events, interactions and long-term safety require systematic assessment.

26.5 Implementation research

Researchers should examine how validated interventions can be delivered through primary healthcare and community systems.

26.6 Health economics

Cost-effectiveness, affordability and resource requirements are essential for population-level implementation.

26.7 Digital health

Digital platforms may support lifestyle counselling, adherence and long-term monitoring, but their effectiveness and equity implications require evaluation.

26.8 Precision prevention

The relationship between Ayurvedic individualized assessment and modern precision-health approaches deserves interdisciplinary investigation rather than premature equivalence.

27. CHALLENGES TO INTEGRATION

Several challenges must be addressed before Ayurveda can make a larger evidence-based contribution to NCD prevention.

Evidence gap

Some interventions still lack adequately powered, high-quality clinical trials.

Standardization gap

Complex individualized interventions may be difficult to reproduce and compare.

Safety gap

Long-term safety and herb-drug interactions require greater attention.

Regulatory gap

Traditional medicines and practices are regulated differently across countries.

Training gap

Integrated care requires professionals capable of communicating across healthcare systems.

Implementation gap

Interventions demonstrated in research settings may not automatically translate into routine community practice.

Communication gap

Exaggerated therapeutic claims can undermine scientific credibility and patient trust.

Equity gap

Preventive services should remain accessible to populations carrying the greatest burden of NCDs.

These challenges should be regarded as part of the process of responsible development and integration rather than as reasons for either uncritical acceptance or blanket rejection.

28. FROM PARALLEL SYSTEMS TO COMPLEMENTARY STRENGTHS

The future of healthcare need not be defined by a binary choice between traditional and biomedical systems. Modern medicine provides sophisticated diagnostic technologies, emergency care, surgery, pharmacotherapy and established

approaches to severe and complicated disease. Ayurveda provides a long-standing framework emphasizing prevention, diet, daily routine, lifestyle, individualized care and behavioural regulation. These strengths may be complementary where evidence supports safe and effective use. Integration should therefore be evidence-led rather than ideology-led. The ultimate measure of successful integration should not be expansion of one healthcare system at the expense of another, but improvement in health outcomes for individuals and populations.

29. CONCLUSION

The global NCD burden demonstrates that healthcare systems cannot rely exclusively on treatment after disease becomes clinically established. Prevention, early detection, lifestyle modification, health promotion and long-term risk reduction must occupy a central position in contemporary healthcare. Ayurveda offers a preventive orientation emphasizing food, daily routine, physical activity, sleep, behavioural regulation and individualized approaches to health. These principles have substantial conceptual relevance to several determinants of NCDs. However, conceptual relevance is not equivalent to clinical effectiveness. The current evidence provides a nuanced picture. Systematic reviews of selected Ayurvedic medicines in type 2 diabetes report potentially favourable glycaemic effects but also methodological limitations and incomplete safety reporting. Integrated community-based studies provide useful evidence concerning feasibility but cannot establish the independent contribution of individual components of complex interventions. Yoga has demonstrated favourable effects on several glycaemic outcomes, although longer and more rigorous trials remain necessary. For hypertension, the latest systematic review and meta-analysis did not demonstrate statistically significant superiority of Ayurvedic interventions over placebo or standard antihypertensive therapy. These findings support neither wholesale rejection nor uncritical acceptance. They support responsible scientific evaluation. The WHO Global Traditional Medicine Strategy 2025–2034 provides an important international framework for this next phase by prioritizing evidence generation, safety and regulation, appropriate integration into health systems and cross-sectoral collaboration. For Ayurveda, the path forward can be summarized in five principles:

Preserve the knowledge.

Test the intervention.

Establish the evidence.

Ensure safety.

Integrate what works.

The most meaningful contribution of Ayurveda to contemporary NCD prevention may ultimately lie neither in replacing modern medicine nor in remaining isolated from it. Its potential lies in contributing scientifically evaluated approaches to preventive, person-centred and community-oriented healthcare. In an era increasingly defined by chronic disease, multimorbidity and the need for sustainable healthcare, the future relevance of Ayurveda will depend not simply on the antiquity of its knowledge, but on the quality of evidence generated to determine what works, for whom, under which circumstances, at what cost and with what risks.



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