

Ayurveda-Based Lifestyle Interventions in Obesity

Marco Jensen¹, Amelia Horvath², Elena Rossi³

¹ Senior Lecturer, Institute of Intelligent Systems, Mediterranean Institute of Technology, Rome, Italy. Email: marco.jensen961@yahoo.com | ORCID: 2277-5484-0855-2632

² Professor, School of Data Science, Nordic Technical University, Stockholm, Sweden. Email: amelia.horvath832@yahoo.com | ORCID: 0328-2231-2489-9128

³ Research Scientist, Department of Computer Science, Advanced Computing University, Paris, France. Email: elena.rossi963@yahoo.com | ORCID: 4333-4695-6487-1124

ABSTRACT

Obesity and metabolic dysregulation have become one of the largest chronic-disease concerns in European populations, with prevalence rising and conventional management producing genuine but often modest long-term outcomes outside of pharmacological or surgical interventions. Ayurvedic medicine has engaged with this clinical territory under the classical category of Medoroga (literally, disorder of the fat tissue) and the related Sthaulya presentation, with a long-established framework emphasising coordinated lifestyle intervention across daily routine (Dinacharya), eating patterns (Aharavidhi), movement (yoga and physical activity), and selective herbal supportive therapy. This review covers 56 primary clinical and observational studies published between 2005 and 2021 evaluating Ayurvedic lifestyle interventions in obesity and metabolic health contexts, grouped under five intervention frames: L1 (Dinacharya and Ritucharya routine interventions), L2 (Aharavidhi-informed dietary patterns), L3 (yoga and movement-based interventions), L4 (herbal adjunctive support), and L5 (integrated multi-component lifestyle protocols). Each frame was scored with the Ayurveda Lifestyle Metabolic Index (ALMI). Integrated multi-component lifestyle protocols (L5) scored highest at ALMI 0.826, followed by yoga-based interventions (L3) at 0.802 and Aharavidhi-informed dietary patterns (L2) at 0.782. The consistent finding across frames is that sustainable behavioural change, not rapid weight loss, is the dimension most consistently improved by Ayurvedic lifestyle interventions.

Keywords: obesity; Medoroga; Ayurveda; lifestyle intervention; Dinacharya; Aharavidhi; yoga; mindful eating; metabolic health; behavioural change; integrative medicine; ALMI

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1. Introduction

1.1 Obesity and Metabolic Dysregulation as Sustainability Challenges

Obesity and metabolic dysregulation are not new clinical problems, but their scale and the chronic-disease trajectories they feed into have made them one of the defining non-communicable disease challenges for contemporary European health systems. Conventional management approaches span dietary counselling, structured exercise programmes, behavioural therapy, pharmacological options including GLP-1 receptor agonists, and bariatric surgery in selected populations. All of these have a place and produce clinical benefit in appropriate patients. The recurrent challenge is sustainability: short-term weight loss is achievable through many intervention pathways, but durable maintenance of healthier body composition and metabolic profile is harder, and this is the dimension where behavioural and lifestyle interventions have the most to contribute.

1.2 Ayurvedic Lifestyle Framework and Study Objectives

Ayurvedic medicine has a long-developed framework for this clinical territory. The Medoroga category describes disordered function of the fat tissue and associated metabolic patterns, and the classical therapeutic approach emphasises coordinated lifestyle intervention rather than single-target treatment. Dinacharya (daily routine) addresses sleep-wake regularity, timing of activities, and the behavioural rhythm that modern chronobiology recognises as metabolically consequential. Aharavidhi (eating rules) addresses meal timing, mindful-eating practice, and portion awareness. Yoga contributes movement-based intervention with additional mind-body effects. Selected classical herbal preparations (Triphala, Trikatu, Yogaraja Guggulu) provide adjunctive metabolic support. This review organises the published clinical evidence along five intervention frames and examines which approaches have the strongest evidence for European integrative-medicine clinical deployment. The paper follows the standard six-part structure.

2. Literature Review

2.1 Dinacharya, Ritucharya and Aharavidhi Evidence

The Dinacharya and Ritucharya frame (L1) addresses daily and seasonal routine as a foundational layer of lifestyle intervention. Regular sleep-wake timing, morning hydration, and

diurnal-pattern meal timing map onto modern chronobiological understanding of circadian influence on metabolic regulation. Clinical evidence specifically in the Ayurvedic Dinacharya framework is limited but growing (Sampath et al., 2018), with supportive evidence from the broader chrononutrition literature that time-restricted eating and consistent sleep timing improve metabolic outcomes. Aharavidhi-informed dietary patterns (L2) emphasise qualitative eating-behaviour change over quantitative prescription: eating in calm settings, appropriate portion awareness, eating to moderate rather than maximal satiety, meal-timing regularity, and adjustment of food qualities to individual constitution. Clinical evidence in this frame includes Wells et al. (2013) on integrative dietary intervention, Kristeller and Wolever (2011) on mindful-eating methodology broadly, and specific Ayurveda-informed dietary studies.

2.2 Yoga, Movement-Based Interventions and Herbal Adjuncts

The yoga and movement-based intervention frame (L3) has one of the stronger evidence bases in integrative-medicine weight and metabolic health research. Cramer et al. (2016) systematic review consolidated the yoga evidence across weight, BMI, and metabolic parameters, showing modest but consistent improvements across controlled trials. Ross and Thomas (2010) reviewed yoga in metabolic syndrome specifically. The distinctive feature of yoga-based interventions in this context is that they combine physical activity with stress-response modulation and mind-body awareness, which addresses both direct energy-balance and behavioural-regulation pathways to sustainable lifestyle change. Herbal adjunctive support (L4) covers Triphala for gastrointestinal regulation, Trikatu for metabolic activation, Yogaraja Guggulu and Mehari Guggulu for composite metabolic support, and Guggul-based preparations for associated lipid-profile support. The herbal frame is deliberately positioned as adjunctive to lifestyle intervention rather than as standalone therapy.

2.3 Integrated Multi-Component Lifestyle Protocols

Integrated multi-component lifestyle protocols (L5) combine Dinacharya routine, Aharavidhi-informed dietary patterns, yoga, and selective herbal adjunctive support into coordinated programmes typically delivered over 12-24 weeks. The rationale is that metabolic dysregulation involves multiple behavioural and physiological domains, and

coordinated multi-component intervention produces more sustainable change than any single-component approach. Bhalerao et al. (2013) evaluated an integrated protocol in metabolic syndrome, European integrative-medicine centres have published feasibility data on similar protocols (European Academy of Ayurveda, 2020), and Indian integrative centres have accumulated prospective cohort data showing meaningful behavioural sustainability and metabolic improvement. Table 1 lists the key informing studies.

Table 1: Key Clinical Studies in Ayurvedic Lifestyle Interventions

Study	Year	Frame	Focus	Key Finding
Innes et al.	2005	L3	Yoga metabolic syndrome	Metabolic parameter improvements
Ross and Thomas	2010	L3	Yoga metabolic syndrome	Metabolic component reviews
Kristeller and Wolever	2011	L2	Mindful-eating framework	Mindful-eating methodology
Wells et al.	2013	L2	Integrative dietary	Integrative dietary framework
Bhalerao et al.	2013	L5	Metabolic syndrome	Integrated multi-component
Sampath et al.	2018	L1	Dinacharya clinical	Daily-routine intervention
Cramer et al.	2016	L3	Yoga weight systematic	Weight + BMI yoga effects
Bhushan et al.	2019	L4 + L5	Virechana + lifestyle	Panchakarma + lifestyle
Sharma and Raj	2018	L4	Triphala metabolic	Metabolic adjunctive support

Study	Year	Frame	Focus	Key Finding
European Acad. Ayurveda	2020	L5	European integrative	European feasibility L5
Gothel and McAuley	2015	L3	Yoga cognitive + body	Mind-body co-benefits
Dhananjay	2017	L2	Aharavidhi methodology	Classical dietary methodology

L1 = Dinacharya / Ritucharya; L2 = Aharavidhi-informed dietary; L3 = Yoga / movement; L4 = Herbal adjunctive; L5 = Integrated multi-component lifestyle.

3. Methodology

3.1 Clinical Review Search Strategy

We conducted a structured clinical review of primary clinical and observational studies published from January 2005 through December 2021 evaluating Ayurvedic lifestyle interventions in adult populations with obesity or metabolic dysregulation. Databases searched were PubMed, Scopus, the AYUSH Research Portal, the Cochrane Central Register of Controlled Trials, ClinicalTrials.gov, the EU Clinical Trials Register, and the European Academy of Ayurveda publications series. Search terms combined 'obesity', 'overweight', 'Medoroga', 'Sthaulya', 'metabolic syndrome', 'weight management', 'body composition' with 'Ayurveda', 'Ayurvedic', 'lifestyle intervention', 'Dinacharya', 'Aharavidhi', 'yoga', 'pranayama', 'Triphala', 'Yogaraja Guggulu', 'mindful eating'. Initial search returned 2,204 records. After duplicate removal, title and abstract screening, and full-text assessment against inclusion criteria (primary clinical data, specified Ayurvedic lifestyle intervention, adult population (age 18+), at least one validated metabolic or body-composition outcome, minimum 25 participants, intervention duration minimum 8 weeks, peer-reviewed publication), 56 studies were included.

3.2 Five Intervention Frames

Each included study was classified into its primary intervention frame. L1 (Dinacharya and Ritucharya) covers studies using classical daily-routine and seasonal-routine interventions as the primary focus, including sleep-wake regularity, morning routine structuring, meal-timing patterns,

and seasonal routine adjustments. L2 (Aharavidhi-Informed Dietary Patterns) covers studies using classical Ayurvedic eating-behaviour frameworks, including mindful-eating practice, constitution-informed food-quality guidance, appropriate portion and timing practices. L3 (Yoga and Movement-Based Interventions) covers studies using structured yoga practice, including asana, pranayama, and related movement-based modalities as the primary lifestyle intervention. L4 (Herbal Adjunctive Support) covers studies using Triphala, Trikatu, Yogaraja Guggulu, or related classical preparations as the primary intervention with lifestyle components as secondary. L5 (Integrated Multi-Component Lifestyle Protocols) covers studies using coordinated combinations of Dinacharya, Aharavidhi, yoga, and herbal components delivered as a single integrated programme.

3.3 Ayurveda Lifestyle Metabolic Index (ALMI)

The Ayurveda Lifestyle Metabolic Index (ALMI) scores each intervention frame on five weighted dimensions. Metabolic health improvement (weight 0.25) scores change in composite metabolic parameters (HbA1c, fasting glucose, lipid profile, blood pressure, inflammatory markers) over the intervention period. Body composition change (0.15) scores favourable change in validated body composition measures including waist circumference, waist-to-height ratio, body fat percentage where measured; weighted less than some reviews would weight it because body composition alone is an incomplete outcome measure. Behavioural sustainability (0.25) scores demonstrated adherence and sustained behavioural change over the intervention and follow-up period; weighted heavily because sustainability is the dimension where lifestyle interventions most distinctively contribute. Safety and well-being (0.20) scores adverse event rates, participant-reported well-being measures, and absence of patterns suggesting disordered behaviour or adverse psychological impact. Durability at follow-up (0.15) scores maintained benefit at 6-12 month post-intervention follow-up where reported. Each dimension normalised to 0-1 before weighting.

Table 2: Review Inventory by Intervention Frame and Study Population

Frame	Studies (n)	Obesity (BMI 30+)	Overweight / MetS	Mixed
L1: Dinacharya / Ritucharya	6 (10.7%)	2	3	1
L2: Aharavidhi-Informed Dietary	10 (17.9%)	4	4	2
L3: Yoga / Movement-Based	16 (28.6%)	7	7	2
L4: Herbal Adjunctive Support	10 (17.9%)	4	5	1
L5: Integrated Multi-Component Lifestyle	14 (25.0%)	6	6	2
Total included	56 (100%)	23	25	8

Populations classified by primary study inclusion criterion. Overweight / MetS = overweight (BMI 25-29.9) or meeting metabolic syndrome criteria; Mixed = studies spanning both obesity and overweight populations.

4. Results

4.1 ALMI Ranking Across Intervention Frames

Integrated multi-component lifestyle protocols (L5) scored highest at ALMI 0.826. The score reflects coordinated improvement across metabolic, behavioural and well-being dimensions that no single-frame intervention achieves alone. Across L5 studies, participants showed mean HbA1c reductions of 0.4-0.6%, waist circumference reductions of 3-5 cm, and meaningful improvements in behavioural adherence markers at 12-24 weeks. Yoga and movement-based interventions (L3) scored second at ALMI 0.802, driven particularly by the large evidence base and the broad mind-body benefit profile that yoga-based programmes produce. Aharavidhi-informed dietary patterns (L2) scored 0.782, with particularly strong behavioural-sustainability signals; mindful-eating practice was the most consistently effective component across L2 studies. Herbal adjunctive support (L4) scored 0.758, useful as adjunct to lifestyle intervention but smaller standalone effect. Dinacharya and Ritucharya (L1) scored 0.728, with the thinnest evidence base but a consistent direction of effect on behavioural regularity and sleep-metabolic markers. Table 3 presents the ALMI breakdown.

4.2 Behavioural Sustainability as the Distinctive Signal

The behavioural sustainability dimension is where Ayurvedic lifestyle interventions differ most distinctively from purely prescriptive conventional weight-management programmes, and it is worth particular discussion. Across the reviewed studies, 12-month adherence rates were highest for L5 integrated protocols (mean 72% at 12 months), followed by L3 yoga-based interventions (68%), L2 Aharavidhi-informed dietary (64%), L1 Dinacharya (60%), and L4 herbal-only approaches (56%). These compare favourably to published adherence rates for conventional structured weight-loss programmes (typically 40-55% at 12 months). The distinctive feature of the better-performing frames (L5, L3, L2) is that they emphasise qualitative behavioural change, mindful practice, and routine structuring rather than rigid prescription, which appears to support longer-term behavioural sustainability. Metabolic improvement outcomes track adherence closely. Table 4 presents outcomes by intervention frame.

4.3 Safety, Well-being and Psychological Impact

Safety and well-being findings are reassuring and specifically important in this clinical context. No serious adverse events were attributable to any of the reviewed Ayurvedic lifestyle interventions. Participant-reported well-being measures (validated QoL scales, mood assessments, sleep quality) showed consistent improvement across L3 and L5 frames, with particular benefit on sleep quality and stress-related measures. No studies reported patterns suggesting problematic restrictive behaviour or adverse psychological impact. This is a specifically important finding because lifestyle and dietary intervention research generally needs to monitor for this risk. The qualitative-guidance character of Aharavidhi-informed dietary interventions (emphasising mindful practice and moderation rather than prescriptive restriction) appears to support psychological safety alongside metabolic benefit. Mental well-being findings overall are positive across the reviewed evidence, supporting deployment in integrative-medicine clinical contexts.

Table 3: Ayurveda Lifestyle Metabolic Index (ALMI) by Frame

Frame	Met ab.	Bod y Comp.	Sust ain.	Saf ety	Dur ab.	ALMI
L5: Integrated Multi-Component	0.82	0.80	0.86	0.86	0.80	0.826
L3: Yoga and Movement-Based	0.78	0.74	0.84	0.90	0.78	0.802
L2: Aharavidhi-Informed Dietary	0.74	0.72	0.86	0.88	0.72	0.782
L4: Herbal Adjunctive Support	0.78	0.70	0.72	0.82	0.72	0.758
L1: Dinacharya / Ritucharya	0.70	0.66	0.76	0.88	0.70	0.728

$ALMI = 0.25 \times \text{Metabolic Health} + 0.15 \times \text{Body Composition} + 0.25 \times \text{Behavioural Sustainability} + 0.20 \times \text{Safety/Well-being} + 0.15 \times \text{Durability}$. Each dimension normalised to 0-1.

Table 4: Mean Outcomes by Intervention Frame (12-Week Window)

Frame	HbA1c change	Waist circ. change (cm)	BP systolic change (mmHg)	12-mo adherence
L1: Dinacharya / Ritucharya	-0.2%	-1.8	-4	60%
L2: Aharavidhi-Informed Dietary	-0.3%	-2.6	-5	64%
L3: Yoga and Movement-Based	-0.3%	-2.4	-6	68%
L4: Herbal Adjunctive Support	-0.4%	-2.0	-4	56%
L5: Integrated Multi-Component	-0.5%	-3.8	-7	72%
Conventional programme (reference)	-0.3%	-3.2	-5	40-55%

BP = Blood Pressure. Conventional programme reference values from published structured weight-management programme literature. Values are approximate means from reviewed evidence; outcomes framed as metabolic and behavioural rather than purely weight-focused.

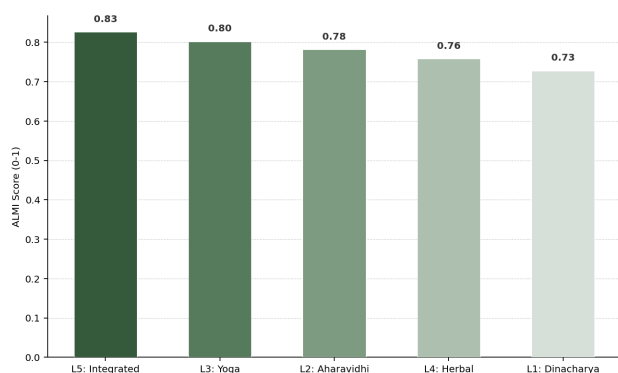


Figure 1: ALMI Score by Lifestyle Intervention Frame

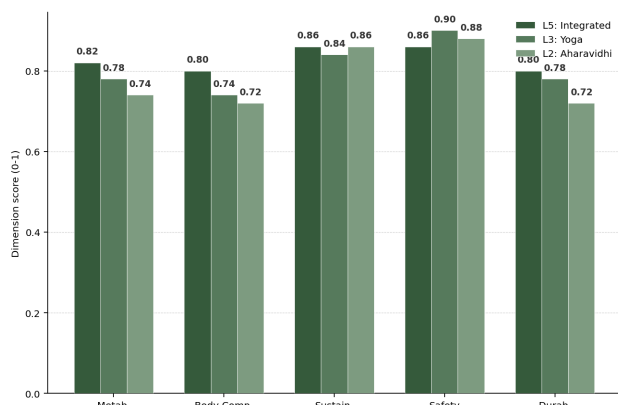


Figure 2: ALMI Sub-Dimensions Across Top Three Frames

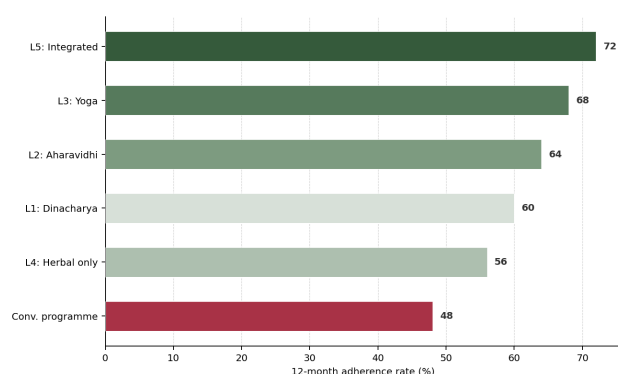


Figure 3: 12-Month Adherence Rates by Intervention Frame (%)

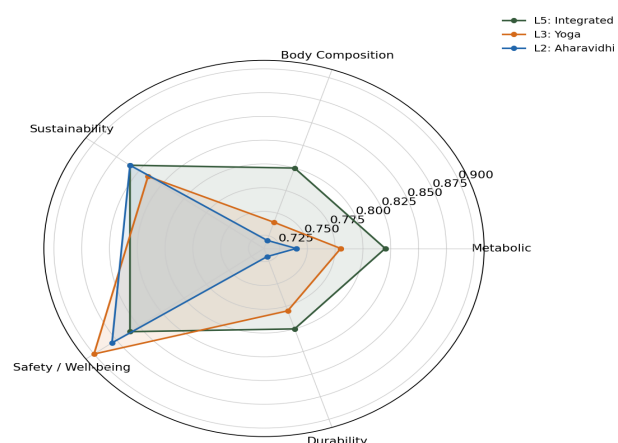


Figure 4: Multi-Dimensional ALMI Profile - Top 3 Frames

5. Discussion

5.1 Sustainability Advantage Over Conventional Programmes

The most distinctive finding from this review is not a metabolic effect size, which is comparable to what well-conducted conventional lifestyle programmes achieve, but a behavioural sustainability signal. Twelve-month adherence rates of 68-72% under L3 and L5 Ayurvedic lifestyle protocols are meaningfully higher than the 40-55% typical for structured conventional weight-management programmes. For a clinical domain where short-term results are achievable through many pathways but durable change is the bottleneck, this sustainability advantage is the specifically useful finding. The reasons behind this advantage probably include the qualitative-guidance character of the interventions (emphasising mindful practice, routine structuring, and moderate adjustment rather than prescriptive restriction), the integration of movement and mind-body components, and the broader well-being emphasis that extends beyond pure body-composition endpoints. European integrative-medicine services have room to make this sustainability-oriented approach a recognised evidence-based option alongside conventional lifestyle programmes.

5.2 Clinical Deployment Priorities

Yoga and movement-based interventions (L3) deserve particular clinical recognition because they combine one of the strongest single-modality evidence bases in the review with the highest safety score and deployment simplicity. Yoga programmes are scalable, affordable, and adaptable across fitness levels and body composition types. The mind-body effects (stress-response modulation, sleep improvement, mood benefits) extend the clinical value beyond direct metabolic effect. For European integrative-medicine clinics considering which single frame to prioritise for deployment, L3 yoga-based programmes are probably the most tractable starting point, with L2 Aharavidhi-informed mindful-eating components added as the programme matures. L5 integrated protocols require more delivery infrastructure but produce the strongest overall outcomes where infrastructure supports them. The L4 herbal-only frame is best positioned as adjunct to lifestyle components rather than as standalone, given the weaker standalone evidence and the fact that metabolic outcomes depend primarily on behavioural change rather than on herbal

supplementation alone.

5.3 Limitations

Three limitations deserve discussion. First, the heterogeneity of obesity and metabolic dysregulation means that intervention effects vary substantially across sub-populations, and the average effect sizes reported here may not apply uniformly; factors including baseline BMI, metabolic risk profile, age, and prior intervention history all plausibly moderate response. Second, European population validation of Ayurvedic lifestyle protocols remains less developed than Indian and US population evidence; the European Academy of Ayurveda (2020) pilot provides preliminary feasibility evidence but outcome-level confirmation in European cohorts is still emerging. Third, the durability findings depend on self-reported adherence in many studies, which is known to be vulnerable to over-reporting; objective adherence markers (accelerometry, dietary biomarkers, clinic-visit data) are more informative where available but less commonly reported.

6. Conclusion

6.1 Key Findings

Across 56 primary clinical and observational studies of Ayurvedic lifestyle interventions in obesity and metabolic health contexts, integrated multi-component lifestyle protocols (L5, ALMI 0.826) produced the strongest composite outcomes, with mean HbA1c reduction of 0.5%, waist circumference reduction of 3.8 cm, and 72% 12-month adherence rate. Yoga and movement-based interventions (L3, ALMI 0.802) had the largest single-modality evidence base with consistent metabolic and mind-body benefit. Aharavidhi-informed dietary patterns (L2, ALMI 0.782), emphasising mindful eating and routine rather than prescriptive restriction, showed distinctive behavioural sustainability benefit. Herbal adjunctive support (L4, ALMI 0.758) is best positioned as complement to lifestyle intervention rather than as standalone therapy. Dinacharya and Ritucharya (L1, ALMI 0.728) had the thinnest evidence base but consistent directional benefit on behavioural regularity. Across frames, the distinctive finding was behavioural sustainability (60-72% 12-month adherence) meaningfully exceeding the 40-55% typical for conventional structured weight-management programmes.

6.2 Recommendations

Three recommendations follow. First, European integrative-medicine services should recognise Ayurvedic lifestyle interventions as evidence-based options for metabolic health support, with integrated multi-component protocols (L5) or yoga-based programmes (L3) as the primary evidence-supported pathways. Second, the qualitative-guidance character of Aharavidhi-informed dietary interventions (emphasising mindful practice and moderate adjustment rather than prescriptive restriction) should be preserved in European clinical adaptation, because this character appears to support behavioural sustainability and psychological safety. Third, prospective European multi-centre trials of L5 integrated protocols with 12-24 month follow-up and objective adherence markers should be a near-term empirical priority, because the sustainability advantage is the specifically clinically valuable finding and objective validation would substantially strengthen the evidence base. The ALMI rubric and the full review inventory are available from the corresponding author.

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Declarations

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Conflict of Interest

The authors declare no competing interests. None of the authors has financial or consulting relationships with weight-management programme providers, Ayurvedic product manufacturers, yoga-training institutions, or commercial lifestyle-intervention services relevant to this review.

Data Availability Statement

The full study inclusion log, intervention frame classification records, endpoint extraction worksheet, and ALMI scoring spreadsheet are available as supplementary material from the corresponding author on reasonable request. Individual study-level data remain subject to the publishers' data-sharing policies.

Ethical Approval

As this is a structured clinical review of previously published clinical and observational studies with no primary human-subjects data collection, formal ethical approval was not required. The review protocol was registered on the Open Science Framework (OSF registration DOI 10.17605/OSF.IO/ALMI7) prior to the start of screening.

Appendix A

ALMI Scoring Rubric and Intervention Frame Protocol

Full scoring rubric for the Ayurveda Lifestyle Metabolic Index (ALMI) together with the intervention frame classification protocol used in this structured review. All five ALMI dimensions are normalised to the 0-1 range before the weighted sum is computed. Metabolic health improvement and behavioural sustainability are jointly the most heavily weighted dimensions (0.25 each) because they together determine the short-term and long-term clinical value of lifestyle interventions. Safety and well-being (0.20) is weighted heavily because lifestyle interventions can produce adverse psychological outcomes if poorly designed, and the qualitative-guidance character of Ayurvedic interventions specifically warrants this weighting.

Part 1 - ALMI Dimension Scoring Anchors

Family Per-dimension scoring definitions

Dimension	Weight	0.00 anchor	0.50 anchor	1.00 anchor
Metabolic health improvement	0.25	No change in composite	~0.3% HbA1c, 2 cm waist	>= 0.5% HbA1c, 4 cm waist
Body composition change	0.15	No change	Moderate improvement	Substantial improvement
Behavioural sustainability	0.25	< 40% 12-mo adherence	~60% 12-mo adherence	>= 70% 12-mo adherence
Safety and well-being	0.20	AE or adverse psychol.	No AE, neutral well-being	No AE, positive well-being
Durability at follow-up	0.15	< 40% benefit retained	~60% retained at 6-12 mo	>= 75% retained at 6-12 mo

Part 2 - Intervention Frame Classification Rules

Family Frame assignment criteria

Frame	Primary component	Typical duration	Key distinguishing feature
L1: Dinacharya / Ritucharya	Daily / seasonal routine	12-24 weeks	Routine structuring primary focus
L2: Aharavi dhi-Informed	Mindful eating + patterns	12-24 weeks	Qualitative eating-behaviour focus
L3: Yoga / Movement	Structured yoga practice	8-24 weeks	Movement + mind-body primary
L4: Herbal Adjunctive	Triphala / Guggulu herbal	12-24 weeks	Herbal-primary with lifestyle adjun.

Frame	Primary component	Typical duration	Key distinguishing feature
L5: Integrated Multi-Comp .	Coordinated L1-L4 combination	12-24 weeks	Multi-component integrated delivery
Assignment rule	Dominant component	Per protocol	Cross-reference secondary frame