Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Anti-obesity Effects of Sphaeranthus indicus Linn : Systematic Review of Clinical and Animal Studies

Sumedh Joshi
sumedhjoshi10395@gmail.com

All India Institute of Ayurveda
Vaibhav Kakde
Shri Ayurveda Mahavidyalaya
Aishwarya Joglekar
All India Institute of Ayurveda

Systematic Review

Keywords: Anti-obesity, Ayurveda, Mundi, Sphaeranthus indicus, Systematic review

Posted Date: December 31st, 2025

DOI: https://doi.org/10.21203/rs.3.rs-8409559/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License. Read Full License

Additional Declarations: No competing interests reported.

Abstract

Obesity is a growing public health concern in India, with NFHS-5 (2021) reporting a prevalence of 24% in women and 23% in men, highlighting the need for safe and effective therapeutic options. *Sphaeranthus indicus* L. (Mundi), traditionally used for *Medoroga* (obesity), has shown potential anti-obesity properties in both preclinical and clinical research, yet its therapeutic efficacy has not been comprehensively evaluated. This systematic review examined evidence from randomized controlled trials (RCTs) and in vivo animal studies assessing the anti-obesity effects of *Sphaeranthus indicus* L. Following PRISMA 2020 guidelines, searches were conducted across CTRI, WHO ICTRP, ChiCTR, and UMIN-CTR. Eligible studies included RCTs and animal models evaluating body weight, anthropometric measures, and lipid profiles; studies involving comorbidities such as diabetes or PCOD were excluded. Two reviewers screened 599 records, assessed 41 full-text articles, and included 9 studies after rigorous selection. Risk of bias was assessed, and data were extracted using a standardized framework. Results indicate that *Sphaeranthus indicus* L., often combined with *Garcinia mangostana* L., produced significant reductions in body weight (2–5 kg over 8–12 weeks), BMI (1–2 kg/m²), body fat percentage, and improved lipid parameters and adiponectin levels, with minimal adverse events. Preclinical studies showed dose-dependent reductions in visceral fat and triglycerides. However, limitations included small sample sizes, heterogeneity in study design, and frequent use of polyherbal formulations, making it difficult to attribute effects solely to *Sphaeranthus indicus* L. Although current evidence is encouraging, well-designed, large-scale RCTs employing standardized mono-herbal preparations are needed to confirm efficacy and support clinical application.

Introduction

Obesity and overweight are characterized by excessive accumulation of body fat leading to adverse metabolic consequences. [1] In India, the prevalence of obesity among elderly persons was 21.5% [2] in 2023–2024. As per NFHS-5 24% of Indian women and 23% of Indian men are overweight or obese.[3] Obesity is assessed through anthropometric indices (BMI, body fat percentage) and laboratory markers (lipid profile, adiponectin). Due to the undesirable effects of conventional anti-obesity drugs such as aminorex (pulmonary hypertension), fenfluramine (cardiac valvopathy), dexfenfluramine (valvopathy), phenylpropanolamine (stroke), rimonabant (suicidal ideation and behavior), sibutramine (myocardial infarction and stroke), and the most recent drug, lorcaserin (cancer) [4],[5] alternative treatment approaches (including diet and lifestyle modifications) are being explored including herbal medicines, for achieving weight loss. Recent trends have suggested that the common population is more inclined towards adopting non-pharmacological measures like diet, lifestyle modification and herbal medicine (including *Ayurveda* and traditional Chinese medicine). [6]

Sphaeranthus indicus L. (*Mundi*), a plant widely described in *Ayurvedic* texts, has been indicated in *Medaroga* (~ Obesity) [7]. Preclinical studies suggest its potential anti-obesity, hypolipidemic and hepatoprotective effects [8],[9] while emerging clinical trials offer initial but scattered evidence. Randomised controlled trials (RCTs) performed on *Sphaeranthus indicus* L. (majority in combination with *Garcinia mangostana* L.) have stated positive effects on weight control and other anthropological parameters, and the use of the herb is well tolerated as well. [10] Despite these promising preclinical findings, the clinical evidence remains fragmented and lacks systematic synthesis. Hence, this review consolidates all available data from RCTs and animal studies to evaluate the anti-obesity potential of *Sphaeranthus indicus* L. A systematic review is therefore essential to critically evaluate and consolidate existing data on the anti-obesity effects of *Sphaeranthus indicus* L. to support future clinical application and research. The present review thus aimed to systematically assess the anti-obesity effects of the Ayurvedic herb *Mundi* (*Sphaeranthus indicus* L.) in preclinical and clinical contexts. This study may help to generate evidence for the Anti-obesity activity of *Sphaeranthus indicus* L., being assessed using a robust systematic approach, as controlled clinical trials are included as well. This review can help in establishing the safety and effectiveness of *Sphaeranthus indicus* L. in management of obesity.

Methodology

Typessof study included

RCT, Animal studies (in vivo)

Attempt to identify other potentially eligible studies or ancillary publications by searching the reference lists of retrieved included studies, systematic reviews, meta-analyses, and health technology assessment reports.

For human RCT's, Placebo-controlled trials as well as standard controlled were screened and selected for further process. The studies involving the comorbidities like Diabetes Mellitus Type 2 and PCOD were excluded. Primary outcome measures of the intervention were reduction in body weight (change in absolute body weight in kg), anthropological parameters (effect on BMI, change in body weight percentage or body-fat content), effect on laboratory parameters etc.

Duplicate articles, multiple reports and companion documents of the same article or study were also excluded from the analysis. The duplicates were removed at every stage of study. Conference Abstracts were excluded, previous systematic reviews on the anti-obesity potential of *Mundi* were excluded as well. Only the full text articles published in English language were considered in the present study. No minimal duration of treatment or follow up was determined while selecting the studies. However, the details were noted down.

Databases searched (with time frame of year 2000 to 2025) included Google Scholar, Pubmed, EMBASE, Cochrane Central Register of Clinical trials through EBSCO, CINAHL (cumulative index to Nursing and allied health literature), EMBASE (Excerpta Medica dataBASE) and clinical trial registry databases (Clinical trial registry of India, WHO International Trials Clinical Registry Platform, Chinese Clinical Trial Registry (ChiCTR), Japanese- UMIN Clinical Trials Registry (UMIN-CTR)) were considered as well. Clinical Trial Registry of India (accessed at https://ctri.nic.in/clinicaltrials.gov) showed eight studies on *Sphaeranthus indicus* L. but none on obesity, WHO international Trials clinical registry showed no studies involving *Sphaeranthus indicus* L. and Obesity (accessed at

https://trialsearch.who.int/Default.aspx) No studies were found at Chinese Clinical Trial Registry (ChiCTR) (https://www.chictr.org.cn/searchprojEN.html) as well as Japanese- UMIN Clinical Trials Registry (UMIN-CTR) (https://www.umin.ac.jp/ctr/).

The articles and every record retrieved in the literature searches of databases meeting the inclusion criteria were further independently screened the abstract, title, or both by two review authors (AJ, SJ) of. We obtained the full text of all potentially relevant records. We resolved any disagreements through discussion or by recourse to a third review author (VK). The reason for exclusion of the studies was also stated. For studies which fulfilled our inclusion criteria, the three review authors (AJ, SJ, VK) independently extracted key information on participants, interventions, and comparators. 599 articles were checked for suitability for inclusion at title and abstract level, while 41 studies were assessed in full text. The details of the studies and reasons for their non-inclusion are presented in the excel sheet, as attached in the supplementary data. The information extracted are described based on the template for intervention description and replication. Cochrane Risk of Bias Tool (RoB 2) was used to assess any risk of bias associated with studies involved along with CONSORT 2025 statement. Points including selection bias (sequence generation and allocation sequence concealment), outcome related, blinding related. After the review, 9 articles were included for the final assessment.

Table 1
Selection criteria for research articles related to human trials on *Sphaeranthus indicus* and obesity

Criteria for selection of studies for full text and abstract for human trials	Key element
Individuals diagnosed with Obesity or overweight or intending weight loss/ effect on weight	Population
Sphaeranthus indicus L. OR *Mundi* OR *GORAKHMUNDI* OR *Gorakhmundi*	Intervention/Exposure
Reduction in weight, BMI, anthropometric parameters (girth circumference), adiponectin, HS-CRP	Outcome
Anti-obesity agents, Hypoglycemic agents, Placebo, no treatment, non-pharmacological interventions like exercise, diet and lifestyle modification, combination of *Sphaeranthus indicus* L. with drugs or non-pharmacological treatment	Comparator

Table 2
Critical appraisal criteria for selected articles based on Cochrane Risk of Bias Tool (RoB 2), CONSORT 2025 Guidelines The Cochrane Risk of Bias (RoB 2) assessment method was used to evaluate how reliable and well designed the included studies were. This tool carefully looks at aspects such as attrition, allocation, missing outcomes and type of blinding. A lower score suggests a greater chance of bias, indicating methodological flaws, while a higher score reflects better study reliability and validity.

Criteria Appraisal Criteria	Addressed bias	Applied scale (Lower the score more is the bias)
Attrition bias	Attrition bias	1–10
Allocation sequence generation	Allocation sequence generation	1–10
Missing outcomes - Weight, Lipid Profile	Mention of Outcomes like body weight lipid profile serum adiponectin	1–10
Based on the type of blinding - Single Blind Double Blind	blinding if necessary	1–10

Table 3
Summary of selected articles for systemic review

Author	Title Of the Article	Intervention Herb	Study Type	Control	Blinding	Sample Size	Randomization Sampling Technique	Time Duration	Follow Up	Ou
Kudiganti et. al.	Efficacy and tolerability of Meratrim for weight management: a randomized, double-blind, placebo-controlled study in healthy overweight human subjects [11]	*Sphaeranthus indicus* L. extract	Clinical Trial	Placebo controlled	double-blind	60 (57 completed)	Computer generated block randomization design	16 weeks (4 months)	None (Total duration 16 weeks)	Bo (5. p < (1. kg 0.((9. cm siz 5.1 0.(LD 6.2 mg 0.(tri 43 mg 0.(ch 20 mg
SM Kang, G Go	A herbal blend of *Sphaeranthus indicus* L. and *Garcinia mangostana* L. reduces adiposity in high-fat diet-induced obese mice[10]	*Sphaeranthus indicus* L. and *Garcinia mangostana* L.	Animal Study	NA	NA	60	Randomly assigned into six groups (n = 10)	20 weeks	NA	Bo co inc fat ma tis mi (Bl me du ab As an (A an (A Tri Ch
Srivastava et. al.	A novel anti-inflammatory natural product from *Sphaeranthus indicus* L. inhibits expression of VCAM1 and ICAM1, and slows atherosclerosis progression [12]	*Sphaeranthus indicus* L.	Animal Study	NA	NA	50	Animals were then randomly grouped into 3 groups of 10 animals	8 weeks	NA	To tri LD glu AL are
Rajendra et.al.	A blend of *Sphaeranthus indicus* L. flower head and *Terminalia chebula* Retz. fruit extracts reduces fatty liver and improves liver function in non-alcoholic, overweight adults[13]	*Sphaeranthus indicus* L. flower head and *Terminalia chebula* Retz. fruit extracts	Clinical Trial	placebo-controlled clinical trial	double-blind	90	Block randomization	84 DAYS	Follow ups at day 28, day 56 and day 84	liv lip ox ma se Sh He (Sl Ga sy sc
M Chopda, N Mahajan, B Talele	Antihyperlipidemic activity of methanolic extract of flowers of *Sphaeranthus indicus* L. [14]	Methanolic extract of flowers of *Sphaeranthus indicus* L.	Animal Study	NA	NA	18	Not mentioned	7 days	NA	Ch tri de lip lov lip ve lip (V

Author	Title Of the Article	Intervention Herb	Study Type	Control	Blinding	Sample Size	Randomization Sampling Technique	Time Duration	Follow Up	Ou
JS Stern, J Peerson, AT Mishra, ...	Efficacy and tolerability of an herbal formulation for weight management[15]	*Sphaeranthus indicus* L. and *Garcinia mangostana* L.	Clinical Trial	placebo-controlled	double-blind	100 (95 completed the trial)	not mentioned	8 weeks	14, 28, 56 days	BM an cir Se lip ad lev
JS Stern, J Peerson, AT Mishra, MV Sadasiva Rao,	Efficacy and tolerability of a novel herbal formulation for weight management [16]	*Sphaeranthus indicus* L. and *Garcinia mangostana* L.	Clinical Trial	placebo controlled	double-blind	60	not mentioned	8 weeks	14, 28, 56 days	Se ad lev we wa cir ch an lev
D Bagchi, FC Lau, T Golakoti, AV Krishnaraju	Efficacy and Tolerability of Merastin-a Novel Herbal Formulation for Weight Management: A Randomized Double Blind Placebo Controlled Clinical Study[17]	Extracts of *Sphaeranthus indicus* L. and *Garcinia mangostana* L.	Clinical Trial	placebo controlled	double-blind	60 obese individuals	Simple randomization	8 weeks	Every week	Blo ch trig glu LD ad Pla Ac Inh lev
Salter et. al.	A botanical extract blend of *Mangifera indica* and *Sphaeranthus indicus* combined with resistance exercise training improves muscle strength and endurance over exercise alone in young men: a randomized, blinded, placebo-controlled trial. [18]	*Sphaeranthus indicus* L. flower head and *Mangifera indica* L. bark extracts	Clinical Trial	placebo controlled	Double blind	40	Block randomization	56 days	14, 28, 56 day	Se trig Se ch we arı cir (M co us en ab (D

Table 4
Risk of Bias assessment table

Risk of bias				
	Attrition bias (1–10)	Allocation sequence generation (1–10)	Missing outcomes (1–10)	Single Blind Double Blind (1–10)
V Kudiganti 2016	9	10	1	7
SM Kang 2023	1	1	1	1
RAK Srivastava 2015	10	7	10	1
VKP Rajendra 2022	10	1	10	9
M Chopda	10	1	10	8
Stern Peerson 2013	4	1	10	10
JS Stern 2013	10	1	10	10
D Bagchi 2011	10	1	10	10
Rokkam 2023	10	1	10	10

Discussion

This systematic review aggregates findings from randomized controlled trials (RCTs) and animal studies to assess the potential of *Sphaeranthus indicus* L. (*Mundi*), a traditional Ayurvedic herb used for treating obesity (*Medaroga*). After a comprehensive search through multiple databases, a total of 599 studies were identified. Following the application of additional filters, 9 studies with accessible full texts were systematically evaluated. These studies encompassed both human trials and experimental research aimed at establishing the anti-obesity effects of the herb.

Analysis of the selected animal studies indicates encouraging evidence supporting the anti-obesity, lipid-lowering, and hepatoprotective properties of *Sphaeranthus indicus* L. (either alone or in combination with other herbs) in preclinical models. These studies were conducted using various models of diet-induced obesity, hyperlipidemia, and atherosclerosis in rodents to analyze both the effectiveness and the mechanisms of action of the herbal treatments. A herbal combination of *Sphaeranthus indicus* L. and *Garcinia mangostana* L. was administered to high-fat diet-induced obese mice over a 20-week period. This treatment led to significant reductions in adiposity measures, such as enhanced lean mass and bone mineral density as evaluated using DEXA. Additionally, improvements in biochemical markers like liver enzymes and lipid profiles were noted, indicating systemic metabolic benefits and possible liver-protective effects. These results are consistent with human trials, which also exhibited reductions in anthropometric and lipid measurements, enhancing translational relevance.

In a similar vein, Srivastava et al. showed that a natural compound derived from *Sphaeranthus indicus* L. has strong anti-inflammatory and anti-atherosclerotic properties. The treated animals demonstrated significant decreases in lipid profiles and blood glucose levels, as well as a reduction in aortic lesion areas. Moreover, the suppression of VCAM-1 and ICAM-1 expression implies that *Sphaeranthus indicus* L. may offer vascular protective benefits by influencing inflammatory pathways that are involved in endothelial dysfunction and plaque development.

Research by Chopda et al. investigated the antihyperlipidemic properties of methanolic extracts from *Sphaeranthus indicus* L. flowers over a brief 7-day period. Despite the small sample size and the limited duration of the study, the results support the lipid-lowering capabilities of S. indicus, justifying the need for further long-term research.

Throughout all animal studies, the consistent improvement in lipid profiles, normalization of liver enzymes, and metabolic balance imply a multi-targeted mechanism of action for *Sphaeranthus indicus* L. These effects are likely mediated through the regulation of hepatic lipid metabolism, antioxidant defense systems, and anti-inflammatory pathways. Nonetheless, certain limitations are apparent. Many studies did not thoroughly investigate dose-response relationships, and long-term safety evaluations are absent. Furthermore, standardization of extracts and the identification of active phytoconstituents are areas that need further focus to guarantee reproducibility and clinical relevance.

Regarding the human clinical trials, the results indicate that *Sphaeranthus indicus* L., often administered in conjunction with *Garcinia mangostana* L., leads to significant reductions in body weight (2–5 kg over 8–12 weeks), body mass index (BMI; 1–2 kg/m²), and body fat percentage while enhancing lipid profiles and adiponectin levels with minimal side effects [11]. These outcomes are in line with data from the National Family Health Survey (NFHS-5,21), which reported a 24% obesity prevalence among Indian women and 23% among men, highlighting the urgent need for safe and effective interventions [19]. The review's thorough methodology, which follows PRISMA guidelines and applies a risk-of-bias assessment tool, enhances its reliability; however, the limited number of high-quality RCTs (41 full-text articles reviewed from 599 screened) and the lack of obesity-specific trials in registries like the Clinical Trials Registry of India (CTRI) point to the early stage of clinical research on *Sphaeranthus indicus* L. [20] The dependence on combination therapies and diverse study designs makes it challenging to attribute specific effects, highlighting the need for additional research to confirm S. indicus as an independent anti-obesity agent. Assessing *Sphaeranthus indicus* L. as both a sole and supplementary treatment provides unique insights. While there are several review articles discussing various clinical functions of *Sphaeranthus indicus* L., no systematic review has been conducted on its anti-obesity effects in human trials and experimental studies. Preclinical research, mainly involving rodent models made obese by high-fat diets, shows that extracts of *Sphaeranthus indicus* L. can lead to reductions in body weight, visceral fat, and serum lipid levels (including triglycerides and LDL cholesterol) in a dose-dependent manner, indicating inherent anti-obesity properties. [21] In contrast, clinical randomized controlled trials (RCTs) mainly evaluated *Sphaeranthus indicus* L. in combination with *Garcinia mangostana* L., noting significant decreases in anthropometric measurements and enhancements in lipid profiles. The combined effects of xanthones from *Garcinia mangostana* L., which are known to reduce fat absorption and improve lipid metabolism, likely enhance the observed results, but obscure the specific impacts of *Sphaeranthus indicus* L. [22] This complicating factor, alongside the absence of trials focusing solely on *Sphaeranthus indicus* L., restricts the assessment of its independent effectiveness. Upcoming RCTs should emphasize single-herb formulations to clarify its therapeutic potential, especially considering the positive safety profile noted, which stands in contrast to standard anti-obesity medications like sibutramine (linked to myocardial infarction) and lorcaserin (associated with cancer risk). [23]. The influence of *Sphaeranthus indicus* L. on biological markers offers further insights into its mechanisms for combating obesity. Clinical studies reported increased levels of serum adiponectin, a vital factor in regulating insulin sensitivity and lipid metabolism, alongside decreases in inflammatory markers such as C-reactive protein (CRP) and interleukin-6 (IL-6). Animal experiments further showed reduced hepatic lipid accumulation, lower serum triglycerides (by 20–30% in some cases), and heightened activity of antioxidant enzymes like superoxide dismutase and catalase. These results imply that *Sphaeranthus indicus* L. may alleviate metabolic dysfunction and oxidative stress related to obesity, potentially by influencing adipogenesis and lipid breakdown. Nonetheless, the inconsistent assessment of biomarkers across studies—some concentrating solely on lipid profiles while others considered adipokines or inflammatory markers—complicates direct comparison. The review excluded studies involving comorbidities such as type 2 diabetes mellitus and polycystic ovary syndrome (PCOD) to maintain a focused analysis, but this may have missed potential secondary benefits in more complex metabolic populations. Future studies should utilize standardized biomarker panels, incorporating adiponectin, leptin, and oxidative stress markers, to develop a thorough metabolic profile. Methodological differences considerably influence the reliability and applicability of the findings. Disparities in *Sphaeranthus indicus* L. formulations (like aqueous versus ethanolic extracts), dosages (ranging from 100 to 600 mg/day in clinical investigations), and treatment lengths (ranging from 4 to 12 weeks) introduce confounding factors that affect the consistency of outcomes. For instance, variations in extraction techniques may modify the bioavailability of essential phytoconstituents, such as sesquiterpenoids, which can impact therapeutic effectiveness. [24] The small participant numbers (generally 20 to 60 individuals per RCT) and lack of long-term follow-ups further diminish statistical power and insights into lasting effects. The review employed a stringent screening method with two independent reviewers (AJ, SJ) and a third (VK) to resolve discrepancies, helping to reduce selection bias, although excluding non-English studies and conference presentations may have created publication bias. The lack of registered trials on platforms like the WHO International Clinical Trials Registry or Chinese Clinical Trial Registry indicates a limited global interest, underscoring the need for standardized, large-scale RCTs to substantiate the effectiveness of *Sphaeranthus indicus* L.

The anti-obesity properties of *Sphaeranthus indicus* L. are probably facilitated by its phytochemical components, such as sesquiterpenoids (for example, 7-hydroxyeudesmanolide), flavonoids, and phenolic compounds [25]. Preliminary studies indicate that these substances can inhibit the differentiation of adipocytes by downregulating peroxisome proliferator-activated receptor gamma (PPARγ) and CCAAT/enhancer-binding protein alpha (C/EBPα), while also enhancing fatty acid β-oxidation through the activation of AMP-activated protein kinase (AMPK) [26]. Flavonoids might also mitigate obesity-related inflammation by inhibiting nuclear factor-kappa B (NF-κB) signaling, whereas phenolic compounds improve antioxidant defenses, thereby protecting adipose tissue from oxidative damage. However, the specific molecular targets and dose-response relationships are still inadequately studied, and variations in phytochemical profiles due to differences in plant sources or extraction methods present challenges for standardization. Research on pharmacokinetics is essential to establish the bioavailability and metabolism of these compounds in humans, as well as to identify potential interactions with other drugs or herbs that could influence clinical safety and efficacy [27].

The prominence of preclinical research in comparison to clinical trials creates notable obstacles for the implementation of *Sphaeranthus indicus* L. in clinical settings. Animal studies, while important for understanding mechanisms, frequently utilize higher doses (like 200–400 mg/kg in rats) that may not be directly applicable to human physiology due to differences in metabolism and pharmacokinetics. The absence of standardized S. indicus extracts and the variability in bioavailability make it difficult to establish appropriate dosing protocols for clinical applications. Regulatory hurdles, including the requirement for extensive safety and efficacy data to comply with standards set by organizations like India's Central Drugs Standard Control Organization (CDSCO) and the US Food and Drug Administration (FDA), further impede clinical use [28]. Moreover, the cultural acceptance of Ayurvedic treatments in India may not be universally applicable without substantial clinical validation. The dependence on combination therapies within existing randomized controlled trials (RCTs) raises issues concerning possible synergistic or antagonistic effects, underscoring the need for trials that investigate *Sphaeranthus indicus* L. in isolation. Future investigations should concentrate on large-scale, double-blind RCTs utilizing standardized extracts, with prolonged follow-up periods (e.g., 6–12 months), as well as pharmacokinetic and pharmacodynamic studies to overcome these challenges and support the incorporation of *Sphaeranthus indicus* L. into evidence-based obesity management.

Conclusion

Sphaeranthus indicus L. shows promising anti-obesity potential, supported by preclinical and preliminary clinical evidence of weight reduction, improved anthropometric parameters, and favorable metabolic effects. Its rich phytochemical profile and minimal adverse effects position it as a viable alternative to conventional therapies, aligning with the growing demand for traditional and culturally resonant interventions. However, methodological heterogeneity, limited clinical data, and challenges in isolating its effects from combination therapies underscore the need for further research. Large-scale RCTs with standardized mono-herbal formulations, comprehensive biomarker assessments, and mechanistic studies are critical to establishing the efficacy, optimal dosage, and long-term safety, paving the way for its integration into integrative obesity management strategies.

Abbreviations

1. **ALT**: Alanine Aminotransferase
2. **AMPK**: AMP-Activated Protein Kinase
3. **AST**: Aspartate Aminotransferase
4. **BMD**: Bone Mineral Density
5. **BMI**: Body Mass Index
6. **C/EBPα**: CCAAT/Enhancer-Binding Protein alpha
7. **CDSCO**: Central Drugs Standard Control Organization
8. **ChiCTR**: Chinese Clinical Trial Registry
9. **CINAHL**: Cumulative Index to Nursing and Allied Health Literature
10. **CONSORT**: Consolidated Standards of Reporting Trials
11. **CRP**: C-Reactive Protein
12. **CTRI**: Clinical Trial Registry of India
13. **DEXA**: Dual-Energy X-ray Absorptiometry
14. **EMBASE**: Excerpta Medica dataBASE
15. **FDA**: Food and Drug Administration
16. **GIS**: Gastrointestinal Symptoms
17. **HDL**: High-Density Lipoprotein
18. **HDL-C**: High-Density Lipoprotein Cholesterol
19. **HS-CRP**: High-Sensitivity C-Reactive Protein
20. **ICAM-1**: Intercellular Adhesion Molecule-1 (Also VCAM1)
21. **IL-6**: Interleukin-6
22. **L.**: Linnaeus (Standard botanical nomenclature)
23. **LDL**: Low-Density Lipoprotein
24. **LDL-C**: Low-Density Lipoprotein Cholesterol

25. **MUAC**: Mid-Upper Arm Circumference
26. **NA**: Not Applicable / Not Mentioned (Inferred from Table 5)
27. **NF-κB**: Nuclear Factor-kappa B
28. **NFHS-5**: National Family Health Survey-5
29. **PAI-1**: Plasminogen Activator Inhibitor-1
30. **PCOD**: Polycystic Ovary Syndrome
31. **PPARγ**: Peroxisome Proliferator-Activated Receptor gamma
32. **PRISMA**: Preferred Reporting Items for Systematic Reviews and Meta-Analyses
33. **RCT(s)**: Randomized Controlled Trial(s)
34. **RoB 2**: Risk of Bias Tool 2
35. **SF-36**: 36-Item Short-Form Health Survey
36. **UMIN-CTR**: Japanese- UMIN Clinical Trials Registry
37. **VCAM-1**: Vascular Cell Adhesion Molecule-1 (Also VCAM1)
38. **VLDL**: Very Low-Density Lipoprotein
39. **WHO**: World Health Organization
40. **WHO ICTRP**: WHO International Trials Clinical Registry Platform

Declarations

Funding source- Not any

Conflict of interest- None declared

Funding source-

Not any

Author Contribution

S.J.: Conceptualization; Methodology; Investigation; Data curation; Formal analysis; Writing – original draft; Writing – review & editing.V.K.: Conceptualization; Methodology; Validation; Formal analysis; Supervision; Writing – review & editing.A.J.: Conceptualization; Methodology; Investigation; Data curation; Visualization; Writing – original draft; Writing – review & editing.

References

1. Fruh SM. Obesity: Risk factors, complications, and strategies for sustainable long-term weight management. J Am Assoc Nurse Pract. 2017;29(S1):S3–14. Available from: https://doi.org//10.1002/2327-6924.12510.
2. Daniel RA, Kalaivani M, Aggarwal P, Gupta SK. Prevalence of Overweight/Obesity among Elderly Persons in India: A Systematic Review and Meta-analysis. J Prim Care Spec. 2024;5(1):22–35. Available from: https://doi.org//10.4103/jopcs.jopcs_14_23
3. International Institute for Population Sciences (IIPS) and ICF. National Family Health Survey (NFHS-5), India, 2019–21: National Report. Mumbai: IIPS; 2021. Available from: https://dhsprogram.com/pubs/pdf/FR375/FR375.pdf
4. Coulter AA, Rebello CJ, Greenway FL. Centrally acting agents for obesity: past, present, and future. Drugs. 2018;78(11):1113–32. Available from: https://doi.org//10.1007/s40265-018-0946-y
5. Sharretts J, Galescu O, Gomatam S, Andraca-Carrera E, Hampp C, Yanoff L. Cancer risk associated with lorcaserin — the FDA's review of the CAMELLIA-TIMI 61 Trial. N Engl J Med. 2020;383(11):1000–2.Available from: https://doi.org//10.1056/NEJMp2003873
6. Park S, Keum D, Kim H. Efficacy and safety of anti-obesity herbal medicine focused on pattern identification: a systematic review and meta-analysis. Medicine (Baltimore). 2022;101(50):e32087. Available from: https://doi.org//10.1097/MD.0000000000032087
7. Anonymous. The Ayurvedic Pharmacopoeia of India. Part I. Vol. III. New Delhi: Department of ISM and H, Ministry of Health and Family Welfare, Government of India; 2001. p. 127–8.
8. Swetha K, Raju MG. Antidiabetic and hypolipidemic activity of methanolic extract of Sphaeranthus indicus in alloxan induced diabetic rats. Indo Am J Pharm. 2014;4:5218–25.
9. Tiwari BK, Khosa RL. Hepatoprotective and antioxidant effect of Sphaeranthus indicus against acetaminophen-induced hepatotoxicity in rats. J Pharm Sci Res. 2009;1(2):26–30.
10. Kang S, Kim H, Bang C, Park JH, Go G-w. The Herbal Blend of Sphaeranthus indicus and Garcinia mangostana Reduces Adiposity in High-Fat Diet Obese Mice. Foods. 2024;13(18):3013. Available from: https://doi.org/10.3390/foods13183013

11. Kudiganti V, Kodur RR, Kodur SR, Halemane M, Deep DK. Efficacy and tolerability of Meratrim for weight management: a randomized, double-blind, placebo-controlled study in healthy overweight human subjects. *Lipids Health Dis.* 2016 Aug 24;15(1):136. Available from: https://doi.org/10.1186/s12944-016-0306-4
12. Srivastava RA, Mistry S, Sharma S. A novel anti-inflammatory natural product from Sphaeranthus indicus inhibits expression of VCAM1 and ICAM1, and slows atherosclerosis progression independent of lipid changes. *Nutr Metab (Lond).* 2015 Jun 5;12:20. Available frm: https://doi.org/10.1186/s12986-015-0018-1
13. Rajendra V. Kurapati1 S., Balineni K, Goginen A. blend of Sphaeranthus indicusflower head and Terminalia chebulafruit extracts reduces fatty liver and improves liver function in non-alcoholic, overweight adults. Functional Foods in Health and Disease. 2022; 12(7): 361-379. Available from: https://doi.org//10.31989/ffhd.v12i7.958
14. M Chopda, N Mahajan, BD Talele. Antihyperlipidemic activity of methanolic extract of flowers of Sphaeranthus indicus Linn. In rat. *International Journal of Applied Research* (Suppl.) in Recent Advances and Opportunities in Biological Sciences. Page No. 236 to 238. Available from: https://www.allresearchjournal.com/archives/2017/vol3issue3S/PartH/76-699.pdf
15. Stern JS, Peerson J, Mishra AT, Mathukumalli VS, Konda PR. Efficacy and tolerability of an herbal formulation for weight management. J Med Food. 2013 Jun;16(6):529-37. Available from: https://doi.org/10.1089/jmf.2012.0178
16. Stern JS, Peerson J, Mishra AT, Mathukumalli VSR, Konda PR. Efficacy and tolerability of a novel herbal formulation for weight management. Obesity (Silver Spring). 2013;21(5):921–7. Available from: https://doi.org//10.1002/oby.20211
17. Bagchi D, C Lau F, Golakoti T, Alluru V, Krishnaraju Sengupta K. Efficacy and Tolerability of Merastin - a Novel Herbal Formulation for Weight Management: A Randomized Double Blind Placebo Controlled Clinical Study. *ipids Health Dis***11**, 122 (2012). Available from: https://doi.org/10.1186/1476-511X-11-122
18. Rokkam MP, Gora O, Konda MR, Koushik A. A proprietary blend of *Sphaeranthus indicus* flower head and *Mangifera indica* bark extracts increases muscle strength and enhances endurance in young male volunteers: a randomized, double-blinded, placebo-controlled trial. Food Nutr Res. 2023 Jan 27;67. Available from: https://do.org//10.29219/fnr.v67.8972
19. International Institute for Population Sciences. National Family Health Survey (NFHS-5), 2019–21: India Report. Mumbai: IIPS; 2021. Available from: https://ruralindiaonline.org/en/library/resource/national-family-health-survey-nfhs-5-2019-21-india/
20. Christensen R, Kristensen PK, Bartels EM, Bliddal H, Astrup A. Efficacy and safety of the weight-loss drug rimonabant: a meta-analysis of randomised trials. Lancet. 2007;370(9600):1706–13. Available from: https://doi.org//10.1016/S0140-6736(07)61718-8
21. Pande VV, Dubey S. Antihyperlipidemic activity of Sphaeranthus indicus on atherogenic diet-induced hyperlipidemia in rats. Int J Green Pharm. 2009;3(2):159–61. Available from: https://doi.org//10.4103/0973-8258.54911
22. Udani J, Hardy M, Madsen DC. Blocking carbohydrate absorption and weight loss: A clinical trial using a proprietary fractionated white bean extract. Altern Med Rev. 2009;14(2):120–7. Available from: https://pubmed.ncbi.nlm.nih.gov/15005645/
23. James WP, Caterson ID, Coutinho W, Finer N, Van Gaal LF, Maggioni AP, et al. Effect of sibutramine on cardiovascular outcomes in overweight and obese subjects. N Engl J Med. 2010;363(10):905–17. Available from: https://doi.org//10.1056/NEJMoa1003114
24. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. BMJ. 2009;339:b2535. Available from: https://doi.org//10.1136/bmj.b2535
25. Joshi S, Megha, Bhide BV, Ghildiyal S, Nesari TM. Physico-chemical and Phytochemical Analysis of Sphaeranthus indicus Linn. (Whole Plant). Pharmacog Res. 2023;15(3):492-6. Available from: https://doi.org//10.5530/pres.15.3.051
26. Galani VJ, Patel BG, Rana DG. Sphaeranthus indicus Linn.: A phytopharmacological review. Int J Ayurveda Res. 2010;1(4):247–53. Available from: https://doi.org//10.4103/0974-7788.76790
27. Williamson EM. Synergy and other interactions in phytomedicines. Phytomedicine. 2001;8(5):401–9. Available from: https://doi.org//10.1078/0944-7113-00060
28. Patwardhan B, Vaidya AD. Natural products drug discovery: Accelerating the clinical candidate development using reverse pharmacology approaches. Indian J Exp Biol. 2010;48(3):220–7. Available from: https://pubmed.ncbi.nlm.nih.gov/21046974/

Figures

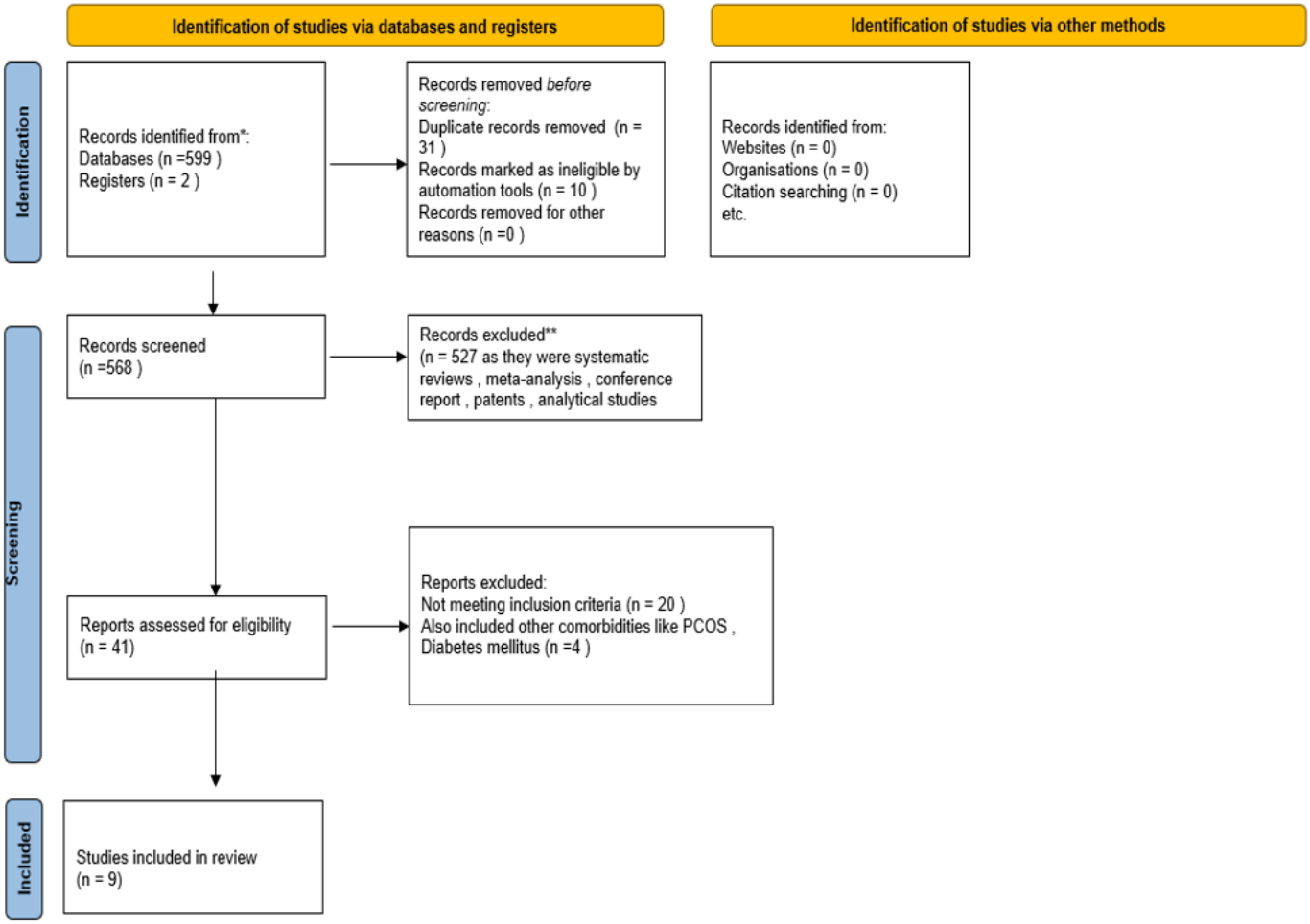

Figure 1

PRISMA Flow chart of the present systematic review

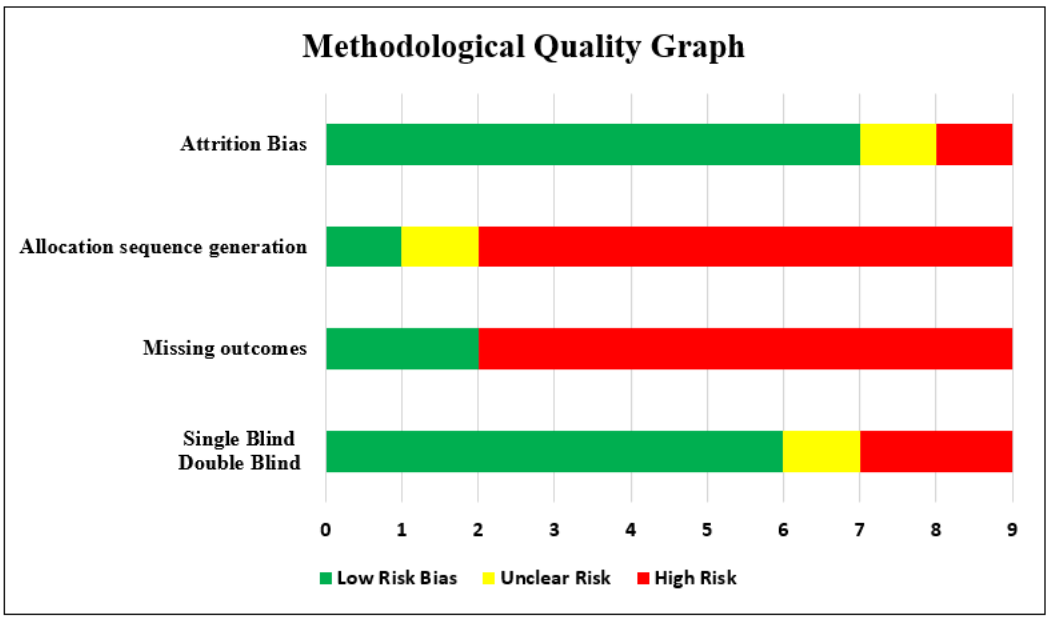

Figure 2

Methodological Quality Graph for the Risk of Bias in the selected articles