

“AYURVEDIC PHARMACOTHERAPY FOR PEDIATRIC OBESITY: A CRITICAL NARRATIVE REVIEW OF MOLECULAR MECHANISMS, CLINICAL EVIDENCE, AND SAFETY CONSIDERATIONS”

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ABSTRACT

Pediatric obesity is a multifactorial and persistent health condition that requires management capable of reducing cardiometabolic risk while simultaneously protecting normal nutrition, physical growth, pubertal development, and psychological well-being. This narrative review critically evaluates Ayurvedic pharmacotherapeutic approaches to pediatric obesity by considering their classical therapeutic rationale, proposed molecular mechanisms, available clinical evidence, and safety concerns. According to global estimates, more than 390 million individuals aged 5-18 years were overweight in 2022, including more than 160 million living with obesity. Within the Ayurvedic framework, *Sthaulya* or *Atisthauya* is associated with excessive accumulation of *Meda* and is linked with dietary excess, insufficient physical activity, disturbed appetite, and constitutional susceptibility. Classical management emphasizes *Langhana*, *Rukshana*, *Lekhana*, *Dipana-Pachana*, dietary modification, and physical activity. Among the medicines discussed in relation to obesity, Triphala, Guggulu-based preparations, *NavakaGuggulu*, and *VachaharidradiGanaVati* have received attention. However, evidence specifically involving children remains very limited. A systematic review involving 12 randomized controlled studies and 749 participants, predominantly adults, reported potentially beneficial effects of Triphala on selected anthropometric and metabolic parameters, although considerable methodological heterogeneity limits firm conclusions. One randomized controlled study involving 130 adolescents reported an approximate between group BMI difference of -1.4 kg/m² after three months with a proprietary plant-based formulation. A 2025 study comparing *Navaka Guggulu* and *Vachaharidradi GanaVati* in children was available as a research protocol rather than as completed efficacy evidence. Experimental studies indicate that some Ayurvedic formulations may influence adipogenesis and several metabolic signalling pathways. Nevertheless, cellular, animal, and computational findings cannot be directly interpreted as evidence of therapeutic effectiveness in children. Safety considerations include gastrointestinal adverse effects, variations in formulation and composition, developmental pharmacokinetic differences, possible herb-drug interactions, contamination, and inadequate adverse-event reporting. Therefore, Ayurvedic medicines should currently be regarded as potential adjuncts to comprehensive family-based lifestyle management rather than replacements for established pediatric obesity care. Their use should involve quality-assured preparations, qualified professional supervision, appropriate monitoring, and systematic pharmacovigilance. Well-designed pediatric clinical trials with adequate sample sizes and long-term assessment of growth, puberty, metabolic health, and adverse events are needed.

Keywords: Pediatric obesity; *Sthaulya*; Triphala; Guggulu; molecular mechanisms; pharmacovigilance.

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INTRODUCTION

Childhood and adolescent obesity is increasingly recognized as a chronic disease rather than simply the result of individual lifestyle choices. Its development reflects a complex interaction of genetic predisposition, neuroendocrine factors, sleep patterns, medication exposure, family practices, psychosocial influences, dietary environments, and the physical surroundings in which children live. The World Health

Organization reported that in 2022 more than 390 million children and adolescents between 5 and 18 years of age were overweight, with more than 160 million affected by obesity. During the period from 1990 to 2022, the prevalence of overweight and obesity in this age group increased substantially, highlighting the continuing global burden of the condition. The coexistence of obesity with under nutrition in several populations further emphasizes

the need for interventions that are effective without compromising nutritional adequacy or healthy development.¹

Assessment of obesity in children cannot be based simply on adult BMI thresholds. Age- and sex specific standards are required for appropriate diagnosis and monitoring. The revised Indian Academy of Paediatrics recommendations advise the use of WHO growth standards in children below five years and IAP BMI charts for individuals aged 5-18 years. Assessment may also include waist circumference and screening for associated conditions such as hypertension, abnormal glucose regulation, dyslipidaemia, and metabolic dysfunction associated steatotic liver disease. Management should be comprehensive and family oriented, while also considering secondary causes, associated illnesses, adequate nutritional intake, psychological health, and prevention of weight-related stigma.²

Ayurveda provides a distinct conceptual framework for understanding excessive body weight. The condition of *Sthaulya* is described in association with increased *Meda*, reduced functional capacity, excessive appetite and thirst, diminished exercise tolerance, and disturbance of physiological pathways. In *CharakaSamhita*, *Sutrasthana* 21, factors such as excessive consumption of heavy, sweet, cold, and unctuous foods, inadequate physical activity, daytime sleep, and hereditary susceptibility are described among the causative factors. Classical management includes dietary restriction, physical activity, and selected *Medohara* interventions.³

Although certain Ayurvedic concepts may provide useful perspectives for individualized dietary and lifestyle counselling, direct equivalence should not be assumed between concepts such as *Meda*, *Agni*, *Kapha*, and *Srotas* and modern biological entities such as adipocytes, mitochondrial metabolism, inflammatory mediators, or anatomical vessels. Accordingly, the purpose of this review is not to establish forced correspondence between the two medical systems, but to critically examine whether Ayurvedic medicines proposed for obesity demonstrate plausible pharmacological mechanisms, meaningful clinical evidence in pediatric populations, and an acceptable safety profile.

MATERIALS AND METHODS

A focused narrative literature review was undertaken using PubMed/MEDLINE and selected authoritative sources, including publications and guidance from the World Health Organization, Indian Academy of Pediatrics, American Academy of Pediatrics, Ministry of Ayush, AyushSuraksha, and the Pharmacopoeia Commission for Indian Medicine and Homoeopathy.

English-language literature available up to **31 August 2026** was considered. Search terms and

combinations included “pediatric obesity,” “childhood obesity,” “Ayurveda,” “Sthaulya,” “Triphala,” “Guggulu,” “NavakaGuggulu,” “VachaharidradiGana,” “adipogenesis,” “molecular mechanisms,” “toxicity,” “quality control,” “herb-drug interaction,” and “pharmacovigilance.”

Priority was given to clinical practice guidelines, systematic reviews, controlled clinical trials, pediatric research protocols, mechanistic investigations, and official safety-related documents. Because the available literature differed considerably with respect to formulations, populations, doses, study designs, and outcome measures, quantitative pooling was not undertaken. Instead, the available evidence was narratively synthesized according to the level of evidence and its relevance to pediatric populations. The review methodology was structured in accordance with established principles for preparing narrative literature reviews.⁴

AYURVEDIC CONCEPTUAL BASIS AND THERAPEUTIC APPROACH

The Ayurvedic understanding of *Sthaulya* incorporates causative factors, clinical manifestations, and therapeutic principles. Regular intake of *Guru*, *Madhura*, *Sheeta*, and *Snigdha* foods, lack of exercise, daytime sleeping, and constitutional or familial predisposition are considered important contributors to excessive *Kapha* and *Meda* accumulation.

The resulting clinical presentation may include disproportionate accumulation of adipose tissue around the abdomen, buttocks, and breasts, together with heaviness, excessive sweating, body odour, weakness, exertional breathlessness, increased hunger and thirst, and reduced functional capacity. Therapeutic management is not restricted to medicines. Classical principles emphasize *Nidana-parivarjana*, modification of food quantity and quality, appropriate physical activity, regulation of sleep, and selected interventions such as *Langhana*, *Rukshana*, *Lekhana*, and *Dipana-Pachana*.

This comprehensive approach shares certain broad similarities with modern chronic disease management, particularly with respect to diet, physical activity, and sustained behavioural modification. However, pharmacological claims associated with individual Ayurvedic preparations require independent clinical investigation.

In pediatric patients, particular caution is necessary. Aggressive fasting, excessive dehydration, intense purgation, or other strong weight-reduction measures may interfere with height velocity, lean body mass, micronutrient status, education, and psychological health. Consequently, any Ayurvedic intervention in children must be developmentally appropriate and should prioritize healthy growth rather than rapid reduction in body weight.⁵

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MAJOR AYURVEDIC PHARMACOTHERAPEUTIC CANDIDATES

Among Ayurvedic preparations investigated in relation to obesity and metabolic health, Triphala has been studied relatively more extensively. It is composed of the fruits of *Phyllanthusemblica*, *Terminaliabellirica*, and *Terminaliachebula*.

A systematic review identified 12 randomized controlled studies involving 749 participants, most of whom were adults. Potential improvements were reported in selected anthropometric, lipid, and glycaemic parameters. However, differences in formulations, dosage schedules, participant characteristics, and outcome measures reduce the certainty with which these findings can be applied to pediatric obesity.

Other preparations, including Guggulu-containing formulations such as *Navaka Guggulu* and plant-based combinations such as *Vachaharidradi GanaVati*, as well as formulations incorporating *Trikatu*, *Musta*, *Vidanga*, *Amalaki*, and *Haritaki*, have been considered potential therapeutic candidates.

At present, however, these preparations should be viewed as investigational candidates rather than established pharmacological treatments for childhood obesity. Their future evaluation requires reliable botanical identification, standardized manufacturing, complete reporting of ingredients and dosage, and dedicated monitoring of safety in children.⁶

Table 1. Ayurvedic candidates, therapeutic rationale, evidence status, and pediatric considerations

Candidate	Ayurvedic therapeutic rationale	Current evidence	Important pediatric consideration
Triphala	Traditionally associated with <i>Medohara</i> activity, bowel regulation, and metabolic	Experimental and predominantly adult clinical evidence; systematic review of 12 RCTs	No established pediatric anti-obesity dosage; gastrointestinal tolerance and

	c support	involving 749 participants	product quality require monitoring
NavakaGuggulu	Traditionally considered for <i>Kapha-Meda</i> reduction, <i>Lekhana</i> , and <i>Dipana-Pachana</i>	Pediatric comparative study available as a protocol; definitive pediatric efficacy data are unavailable	Identity of Guggulu, complete formulation, dosage, and laboratory safety need verification
VachaharidradiGanaVati	Plant-based formulation described in relation to <i>Kaphamedohara</i> and <i>Karshana</i> effects	Included in a pediatric comparative protocol with <i>NavakaGuggulu</i> ; complete clinical results are required	Composition, adherence, growth, and laboratory safety should be prospectively assessed
Agnimanthadi compound and other combinations	Associated with <i>Dipana-Pachana</i> , <i>Lekhana</i> , and	Limited evidence from adult clinical studies	Adult dosage and procedural intensity

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	supportive <i>Svedana</i> approaches		should not be directly transferred to children
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MOLECULAR MECHANISMS: CURRENT EVIDENCE AND ITS LIMITATIONS

Experimental and computational research has proposed several mechanisms through which Ayurvedic formulations may influence obesity-related biological processes. Nevertheless, these mechanisms should be regarded as exploratory until they are connected with standardized drug exposure and meaningful clinical outcomes.

Network-pharmacological investigations of Triphala have identified several potentially bioactive constituents, including beta-sitosterol, luteolin, quercetin, kaempferol, ellagic acid, and phyllanthin. Predicted interactions have included molecular targets such as AKT1 and PPARG and signalling networks involving PI3K-Akt and PPAR pathways.

These observations provide a theoretical basis for possible effects on adipocyte differentiation, glucose and lipid metabolism, inflammatory pathways, and oxidative stress. However, computational predictions and molecular docking results do not demonstrate actual target engagement in humans, establish an effective therapeutic concentration, or confirm clinical efficacy in children.

Translation into pediatric practice is further complicated by developmental differences in drug absorption, metabolism, hepatic enzyme activity, renal elimination, body composition, and pubertal physiology.⁷

Table 2. Interpretation of proposed molecular mechanisms

Pathway	Experimental or predicted observation	Interpretation for clinical translation
Adipogenesis	Experimental reduction in PPAR- γ , C/EBP- α , GLUT4, fatty-acid synthase, and intracellular lipid	Supports a possible anti-adipogenic mechanism in vitro but does not establish weight reduction or safety in

	accumulation	children
Network targets	Predicted interactions involving AKT1, PPARG, and PI3K-Akt/PPAR pathways	Computational findings are hypothesis-generating and require experimental confirmation
Metabolic signalling	Possible multi-component influence on lipid, glucose, and inflammatory pathways	Requires validation using chemically characterized and standardized preparations
Dose and exposure	Exposure to active constituents may vary according to formulation, extraction method, and developmental pharmacology	Pediatric pharmacokinetic and dose-finding studies are essential
Clinical translation	Mechanistic observations may help identify biomarkers for future clinical studies	Molecular evidence alone cannot establish pediatric efficacy or determine an appropriate clinical dose

CLINICAL EVIDENCE WITH PARTICULAR EMPHASIS ON CHILDREN AND ADOLESCENTS

The available evidence directly involving pediatric patients remains inadequate to support routine therapeutic use.

One notable randomized study enrolled 130 adolescents with BMI values above 25 kg/m² and compared a plant based formulation with cellulose

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placebo for three months. The reported between-group differences favoured the intervention, including an approximate BMI reduction of **1.4 kg/m²**, together with changes in total cholesterol, triglycerides, HDL cholesterol, leptin, systolic blood pressure, and diastolic blood pressure.

Although these findings are potentially encouraging, several limitations restrict interpretation. The BMI criterion resembles an adult style threshold, the intervention period was short, formulation details were limited, and comprehensive information regarding growth and pubertal development was not provided. Therefore, the study cannot independently establish long term efficacy, optimal pediatric dosing, safety, or generalizability to other Ayurvedic formulations.⁸

Table 3. Clinical evidence relevant to pediatric translation

Evidence source	Population/design	Main reported or intended outcome	Major limitation
Triphala systematic review, 2021	12 RCTs involving 749 participants, predominantly adults	Five studies reported improvements in weight/BMI/waist-related outcomes; six reported improvements in lipid parameters	Considerable heterogeneity and predominantly adult populations limit pediatric applicability
Proprietary plantbased formulation RCT, 2015	130 adolescents; placebo-controlled; 3-month intervention	Approximately - 1.4 kg/m ² between-group BMI difference	Short duration; limited formulation transparency

	on	, with favourable changes in lipid, adipokine, and BP measures	rency and inadequate assessment of growth outcomes
NavakaGuggulu versus Vachaharidra diGanaVati protocol, 2025	Children aged 10-16 years; randomized, double-blind protocol	Designed to compare the two formulations alongside dietary measures and Sun Salutation	Protocol rather than completed outcome evidence; co-interventions may influence observed effects
Agnimanthadi compound study, 2013	Small adult clinical study involving supportive <i>VashpaSvedana</i>	Changes reported in selected obesity-related clinical parameters and anthropometric parameters	Adult, multimodal evidence cannot establish pediatric dosage, efficacy, or safety

SAFETY, QUALITY CONTROL, AND PHARMACOVIGILANCE

The assumption that a preparation is safe merely because it is described as “natural” is inappropriate, particularly in children. The safety profile of an Ayurvedic medicine depends not only upon its named ingredients but also upon botanical authentication, manufacturing processes, formulation quality, dosage, contamination control, and the characteristics of the individual patient.

Safety assessment should therefore consider the possibility of botanical misidentification or substitution, microbial and fungal contamination, pesticide residues, residual solvents, undeclared pharmaceutical substances, toxic elements, gastrointestinal intolerance, and herb–drug interactions.

Children represent a particularly important population because developmental changes may influence drug absorption, metabolism, distribution, and elimination. In addition, adverse effects may have implications for growth and puberty that would not necessarily be captured in short-term adult studies.

WHO recommendations emphasize incorporation of herbal medicines into pharmacovigilance systems, appropriate documentation of the suspected product, assessment of causality, and reporting of adverse reactions. Clinicians should therefore record the complete ingredient profile, manufacturer, batch number, expiry date, dosage form, source, and available analytical documentation. If clinically significant symptoms or laboratory abnormalities develop, the suspected preparation should be discontinued and appropriately investigated.⁹

Table 4. Suggested safety framework for pediatric use

Stage	Recommended action
Before prescribing	Confirm the diagnosis and severity of obesity; consider secondary causes, medications, and comorbidities; document other herbs and supplements; assess growth, puberty, dietary adequacy, and eating-disorder risk
Product verification	Prefer licensed products with clearly identified ingredients; document botanical identity, formulation, manufacturer, batch, and expiry; consider available testing for microbes, heavy metals, pesticides, and marker compounds

Avoid or use with exceptional caution	Unlabelled weight-loss products, strong purgatives, dehydration-producing interventions, stimulant-like ingredients, complex herbo-mineral preparations, duplicate formulations, and unsupervised internet purchases
Monitoring	Follow height velocity, weight trajectory, waist circumference, blood pressure, bowel symptoms, appetite, sleep, mood, school functioning, and adherence; assess glucose, lipid, liver, or renal parameters when clinically indicated
Adverse event management	Discontinue the suspected preparation and promptly evaluate persistent vomiting or diarrhoea, rash, jaundice, dark urine, bleeding, neurological manifestations, or severe abdominal pain; retain the product package and report suspected reactions through appropriate pharmacovigilance channels

CLINICAL INTEGRATION AND FUTURE RESEARCH DIRECTIONS

A scientifically defensible integrative approach should position evidence based family-centred lifestyle intervention as the primary foundation of pediatric obesity management. When Ayurveda is selected, its medicines should be considered complementary rather than substitutes for appropriate diagnosis, monitoring, and established treatment pathways. The principal therapeutic objective should be improvement in overall health and metabolic trajectory rather than rapid or cosmetic weight reduction. Current pediatric recommendations emphasize intensive behavioural and lifestyle interventions and, for appropriately selected patients, may include pharmacotherapy or metabolic surgery. Ayurvedic preparations should not be used to delay or replace these evidence-based options when they are clinically indicated.¹⁰

Future research should employ age and sex appropriate definitions of obesity and outcome measures. Trials should consider pubertal stage, preregister study protocols, provide complete

details of the formulation, include appropriate analytical characterization, document adherence and co-interventions, and maintain sufficiently long follow-up.

Most importantly, pediatric studies should incorporate outcomes that extend beyond body weight. Growth velocity, body composition, metabolic parameters, psychological well-being, pubertal development, adverse events, and long-term safety should be integral components of trial design.

DISCUSSION

The present review highlights a substantial gap between the extensive traditional use and theoretical rationale of Ayurvedic anti-obesity medicines and the limited amount of high quality evidence specifically generated in children. Ayurvedic descriptions of *Sthaulya* provide a coherent framework within the traditional system, particularly through their emphasis on dietary behaviour, physical activity, sleep, and individualized management. Nevertheless, available pharmacotherapy research remains largely adult-oriented and is characterized by relatively small study populations, heterogeneous preparations, and limited follow-up. The recently published double-blind research protocol evaluating *NavakaGuggulu* against *VachaharidradiGanaVati* in children aged 10-16 years represents an important attempt to generate direct pediatric evidence. However, a protocol describes planned research rather than completed efficacy results. Furthermore, when dietary and lifestyle interventions are administered simultaneously, attributing the observed effect exclusively to the investigational medicine becomes difficult.¹¹ Mechanistic evidence is currently more extensive than clinical evidence. Experimental work involving 3T3-L1 preadipocytes has demonstrated that aqueous Triphala may reduce intracellular lipid accumulation and alter the expression of genes associated with adipogenesis, including PPAR- γ , C/EBP- α , GLUT4, and fatty-acid synthase. These findings provide a possible biological explanation for anti-adipogenic activity.

However, an effective concentration demonstrated in cultured cells cannot automatically be equated with the systemic exposure produced by oral administration in a child. Similarly, alterations in cellular gene expression cannot by themselves demonstrate clinically meaningful weight reduction, improvement in cardiometabolic health, or long-term safety.¹²

Greater translational confidence would require chemical characterization of the actual clinical formulation, measurement of pharmacokinetic exposure, determination of dose-response relationships, and prospective evaluation of mechanistic biomarkers alongside clinically

meaningful outcomes. Safety remains the most important consideration when considering pharmacotherapy in children. Growth and developmental processes create vulnerabilities that may not be adequately captured by adult safety studies. In addition, children with obesity may receive medicines for associated conditions such as diabetes, dyslipidaemia, hypertension, fatty-liver disease, attention-related disorders, or asthma, increasing the possibility of herb-drug interactions. Spontaneous reporting systems have identified clinically significant adverse reactions associated with Ayurvedic and other complementary medicines. At the same time, under reporting makes it difficult to determine the true frequency of such events. Therefore, appropriate quality assurance and pharmacovigilance should be considered essential components of responsible clinical practice. Treatment should remain conservative and supervised, with complete documentation and discontinuation whenever the potential risk outweighs the anticipated benefit.¹³

CONCLUSION

Ayurvedic pharmacotherapy for pediatric obesity possesses a substantial traditional rationale and several experimentally plausible biological mechanisms; however, its clinical effectiveness and long-term safety in children have not yet been adequately established.

The currently available evidence includes a systematic review of 12 randomized studies involving 749 predominantly adult participants evaluating Triphala, a three-month randomized trial involving 130 adolescents that reported an approximate between group BMI difference of 1.4 kg/m², and a recent pediatric comparative research protocol evaluating *NavakaGuggulu* and *VachaharidradiGanaVati* without definitive outcome data.

These findings provide a basis for further scientific investigation but are insufficient to support broad claims of established pediatric efficacy.

An appropriate integrative strategy should retain family-based nutritional counselling, physical activity, adequate sleep, behavioural modification, and appropriate medical assessment as the core components of management. Any Ayurvedic medicine considered for use should be supported by reliable product quality, clearly documented composition, appropriate dosing, professional supervision, and monitoring for adverse effects and herb-drug interactions.

Particular attention should be given to maintaining normal growth and pubertal development and avoiding aggressive weight-reduction practices or unlabelled slimming preparations.

Future research should include adequately powered and prospectively registered pediatric trials using standardized and chemically characterized formulations. Such studies should incorporate dose-

finding, body-composition assessment, metabolic outcomes, growth and pubertal monitoring, systematic adverse-event documentation, and long-term pharmacovigilance.

Until such evidence becomes available, specific Ayurvedic medicines should be regarded as promising research candidates or adjunctive options rather than established evidence-based pharmacological treatments for pediatric obesity.

REFERENCES

1. World Health Organization. Obesity and overweight [Internet]. Geneva: World Health Organization; 2025 Dec 8 [cited 2026 Sep 4].
2. Khadilkar V, Shah N, Harish R, Ayyavoo A, Bang A, Basu S, et al. Indian Academy of Pediatrics revised guidelines on evaluation, prevention and management of childhood obesity. *Indian Pediatr*. 2023;60(12):1013-1031. doi:10.1007/s13312-023-3066-z.
3. Agnivesha. CharakaSamhita, revised by Charaka and Dridhabala, with Ayurveda-Dipika commentary of Chakrapanidatta. Acharya YT, editor. Varanasi: ChaukhambhaSurbharatiPrakashan; 2011. Sutrasthana 21.
4. Green BN, Johnson CD, Adams A. Writing narrative literature reviews for peer-reviewed journals: secrets of the trade. *J Chiropr Med*. 2006;5(3):101-117. doi:10.1016/S0899-3467(07)60142-6.
5. Goyal R, Goyal M, Chandola HM. A clinical study on the role of Agnimanthadi compound and VashpaSvedana in the management of Sthaulya (obesity). *Ayu*. 2013;34(4):390-396. doi:10.4103/0974-8520.127721.
6. Phimarn W, Sungthong B, Itabe H. Effects of Triphala on lipid and glucose profiles and anthropometric parameters: a systematic review. *J Evid Based Integr Med*. 2021;26:2515690X211011038. doi:10.1177/2515690X211011038.
7. Inpan R, Sakuludomkan C, Na Takuathung M, Koonrunsesomboon N. Network pharmacology revealing the therapeutic potential of bioactive components of Triphala and their molecular mechanisms against obesity. *Int J Mol Sci*. 2024;25(19):10755. doi:10.3390/ijms251910755.
8. Shivakumar S, Ilango K, Dubey GP, Subhasree N, Agrawal A. Evaluation of plant based formulation on adolescent obesity and its associated bio-markers: a randomized, double blind, placebo controlled study. *Complement Ther Med*. 2015;23(2):157-164. doi:10.1016/j.ctim.2015.01.012.
9. World Health Organization. WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems. Geneva: World Health Organization; 2004.
10. Hampl SE, Hassink SG, Skinner AC, Armstrong SC, Barlow SE, Bolling CF, et al. Clinical practice guideline for the evaluation and treatment of children and adolescents with obesity. *Pediatrics*. 2023;151(2). doi:10.1542/peds.2022-060640.
11. Fadnavis KK, Rath B, Ratnaparkhi KS, Rath BJ, Deshmukh PR. Evaluation of the comparative efficacy of NavakGuggulu versus VachaharidradiGanaVati in the management of Sthaulya (overweight) in children: protocol for a randomized controlled trial. *JMIR Res Protoc*. 2025;14. doi:10.2196/58838.
12. Banjare J, Raina P, Mansara P, Ghanekar RK, Bhalerao S. Triphala regulates adipogenesis through modulation of expression of adipogenic genes in 3T3-L1 cell line. *Pharmacogn Mag*. 2018;13(Suppl 4). doi:10.4103/pm.pm_153_17.
13. Jose J, Rao PGM, Kamath MS, Jimmy B. Drug safety reports on complementary and alternative medicines (Ayurvedic and homeopathic medicines) by a spontaneous reporting program in a tertiary care hospital. *J Altern Complement Med*. 2009;15(7):793-797. doi:10.1089/acm.2008.0128.