

Comparative Clinical Evaluation of *Guduchyadi Yog* and *Suryanamaskar* in the Management of *Sthaulya* (Childhood Obesity): A Triple-arm Open-label Study

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Abstract

Introduction: In *Ayurveda*, *Sthaulya* is understood as a metabolic disorder with unique diagnostic and therapeutic principles. This condition, often paralleled with modern concepts of overweight and obesity, involves the abnormal or excessive accumulation of body fat. Numerous *Ayurvedic* texts describe *Sthaulya*, highlighting its multifaceted nature. This study clinically investigates the effectiveness of *Guduchyadi Yog* and *Surya Namaskar* in managing childhood obesity. **Methodology:** This triple-arm and open-label study enrolled 60 children diagnosed with *Sthaulya*. Participants were recruited from both outpatient and inpatient departments of the *Kaumarbhritya* Department at Dr. S. R. Rajasthan Ayurved University, Jodhpur, and surrounding primary schools. They were randomly allocated into three groups of 20 subjects each. Group A received *Guduchyadi Yog*, Group B practiced *Surya Namaskar*, and Group C received a combination of *Guduchyadi Yog* and *Surya Namaskar*. *Guduchyadi Yog* dosage was determined using Young's formula, adjusted for each patient's age. The intervention period for all groups was 45 days. **Results and Discussion:** Statistical analysis revealed that Group C, which received the combined therapy of *Guduchyadi Yog* and *Surya Namaskar*, demonstrated significantly superior outcomes in both subjective and objective parameters of *Sthaulya* compared to Group A (*Guduchyadi Yog* alone) and Group B (*Surya Namaskar* alone). This suggests a synergistic effect of the combined intervention in managing childhood obesity. **Conclusion:** This study demonstrates that the integrated approach of *Guduchyadi Yog* alongside *Surya Namaskar* offers a more effective therapeutic strategy for managing childhood obesity (*Sthaulya*) than either intervention used in isolation.

Keywords: Ayurvedic management, childhood obesity, *Guduchyadi Yog*, lifestyle intervention, *Medo Dhatu*, *Sthaulya*, *Surya Namaskar*, triple-arm clinical trial

INTRODUCTION

Childhood obesity has become a significant global public health concern, particularly in urban populations. Contributing factors include sedentary lifestyles, increased consumption of energy-dense and nutrient-poor foods, irregular dietary habits, and decreased physical activity.^[1,2] In India, the shift from traditional to urbanized living patterns has led to a rising prevalence of childhood obesity, further driven by accessibility to processed foods and lack of exercise opportunities.^[3] Obesity is characterized by excessive fat accumulation that adversely affects health, increasing the risk of metabolic disorders such as type 2 diabetes, insulin resistance, hypertension, dyslipidemia, cardiovascular disease, obstructive sleep apnea, and some

forms of cancer.^[4,5] The etiology of obesity is multifactorial, involving genetic predisposition, environmental influences, socioeconomic factors, and behavioral choices such as frequent consumption of high-calorie foods and physical inactivity.^[6]

According to the WHO data, global obesity rates have nearly tripled since 1975. In 2022, approximately 37 million children under the age of 5 years were overweight, with nearly half of them residing in Asia.^[7] Among adolescents aged 5–19 years,

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the prevalence of obesity increased from 2% in 1990 to 8% in 2022, affecting both genders equally.^[8] In India, the prevalence of obesity among school-aged children ranges from 5.7% to 8.8%, with higher rates reported in urban adolescents (21.4% in boys and 18.5% in girls aged 13–18).^[9,10]

In *Ayurveda*, childhood obesity aligns with the concept of *Sthaulya*, which is considered a SantarpanotthaVyadhi—a disorder arising from over-nourishment. It is marked by the accumulation of *Meda* (fat) and *Mamsa* (muscle), leading to flabbiness in the hips, abdomen, and breasts.^[11] *Acharya Charaka* classifies *Atisthauhya* (extreme obesity) among the eight undesirable conditions due to its physical and metabolic consequences. These include decreased lifespan (*Ayuhrasa*), reduced enthusiasm (*Javoparodha*), fatigue, bad body odor (*Dourgandhya*), excessive sweating (*Swedabadha*), and increased hunger and thirst (*KshutPipasadhikya*).^[12] *Ayurvedic* management of *Sthaulya* involves dietary regulation, *Vyayam* (exercise), *Yoga*, and the use of *Rukshana* (drying) therapies to balance metabolic function. Classical formulations and lifestyle modifications are emphasized for long-term control.^[13] Among these, *Guduchyadi Yog* and *Surya Namaskar* (Sun Salutation) are notable interventions due to their *Kapha-Medohara* (fat-reducing) and metabolism-enhancing properties.^[14]

While modern treatments like calorie restriction, pharmacotherapy (e.g. Orlistat), and bariatric surgery are effective to varying degrees, they are often limited by side effects, cost, or long-term sustainability.^[15,16] The success rate of lifestyle modifications alone remains low, ranging from 2% to 20% for sustained weight loss.^[17] Therefore, exploring integrative and traditional approaches such as *Ayurveda* is both timely and necessary.

Given the rising incidence of childhood obesity and its long-term complications, clinical evaluation of *Ayurvedic* therapies is essential. This study investigates the efficacy of *Guduchyadi Yog* and *Surya Namaskar* in managing *Sthaulya* in children, aiming to provide a safe, effective, and affordable solution.

Aims and objectives

- To evaluate the efficacy of *Guduchyadi Yog* in the management of *Sthaulya* (childhood obesity)
- To assess the efficacy of *Surya Namaskar* in the management of *Sthaulya* (childhood obesity)
- To compare the therapeutic effectiveness of *Guduchyadi Yog*, *Surya Namaskar*, and their combination in the management of *Sthaulya* (childhood obesity).

METHODOLOGY

Ethical approval and trial registration

The study was approved by the Institutional Ethics Committee of the Post Graduate Institute of Ayurved, Dr. S. R. Rajasthan Ayurved University, Jodhpur (Approval No. DSRRAU/PGIA/IEC/21-22/501, dated January 31, 2023), and conducted in accordance with the Declaration of Helsinki, ICMR, and ICH-GCP guidelines. It was prospectively registered with

the Clinical Trials Registry-India (CTRI/2023/07/055513) in July 2023.

Study design

This was an open-label, randomized, and three-arm prospective interventional clinical trial. The study aimed to assess the therapeutic efficacy of *Ayurvedic* and *yogic* interventions in the management of childhood obesity (*Sthaulya*).

Sample size and randomization

A total of 60 children diagnosed with *Sthaulya* were enrolled in the study. Participants were randomly allocated into three equal groups ($n = 20$ each) using a simple random sampling technique.

Intervention duration and follow-up

The treatment duration was 45 days. Patients were monitored and followed up every 15th day throughout the study period to assess the clinical outcomes and ensure adherence to the intervention protocol.

Diagnostic criteria

Inclusion criteria

- Children aged 8–16 years presenting with clinical signs and symptoms of *Sthaulya* (childhood obesity) as described in both *Ayurvedic* texts and modern literature
- Children of both sexes
- Cases of obesity primarily due to sedentary lifestyle and unhealthy dietary habits
- Children with a familial predisposition to obesity.

Exclusion criteria

- Children already receiving treatment for obesity or other related disorders
- Obesity secondary to endocrine disorders such as Cushing's syndrome, hypothyroidism, or Prader-Willi syndrome.

Discontinuation criteria

- Occurrence of any acute illness requiring emergency medical care
- Withdrawal of consent by parents, guardians, or the child.

Adverse drug reaction monitoring

A structured monitoring protocol was implemented to assess potential adverse drug reactions (ADRs) related to *Guduchyadi Yog*. However, no adverse effects were reported during the entire study period.

Source of patients and grouping

A total of sixty children diagnosed with *Sthaulya* (childhood obesity) were recruited from the Outpatient and Inpatient Departments of the *Kaumarbhritya* at *Sanjeevani* at Sanjeevani Ayurveda Hospital, affiliated with Dr. S. R. Rajasthan Ayurved University, Jodhpur. Additional participants were identified through screening camps conducted in Jodhpur and nearby regions. Prior to enrolment, written informed ascent was obtained from the parents or guardians of all participants. The selected patients were randomly allocated into three groups:

Group A, Group B, and Group C. All participants received standard dietary guidance, including specific recommendations and restrictions, regardless of their group allocation. Grouping and posology was shown in Table 1.

Trial drug

For this study, *Guduchyadi Yog*, a classical formulation mentioned in the *Yogaratanakara* under *Medoroga Adhikara*, was selected. The formulation comprises five herbal ingredients known for their *Lekhana* (scraping) and *Medohara* (anti-obesity) properties.

Collection and authentication of raw materials

All the plant materials were procured from certified and authenticated local suppliers in Jodhpur. The identity and authenticity of each raw drug were verified by the Department of *Dravyaguna*, Postgraduate Institute of Ayurveda, Dr. S. R. Rajasthan Ayurved University, Karwad, Jodhpur.

Method of preparation of *Guduchyadi Ghanavati*

The ingredients listed in Table 2 were taken in equal proportions and ground into a coarse powder (*Yavakut*) using a mechanical grinder. This powder was then soaked in water, eight times the weight of the ingredients, and allowed to macerate to prepare a decoction (*Kwatha*). The decoction was simmered on low heat until the volume was reduced to one-fourth. The mixture was then filtered through a clean muslin cloth. The filtrate was boiled again with continuous stirring until it thickened and all liquid content evaporated, yielding a semi-solid mass (*Ghana*). After cooling, *Triphala Churna* was added and thoroughly mixed to form a dough-like consistency. This mass was then rolled into tablets (*Vatis*) of uniform size. The final product was labelled appropriately with the date of manufacturing, batch number, and drug license number for standardization and traceability.

Dosage and administration

The dosage of *Guduchyadi Ghanavati* was calculated using Young's formula, with the adult dose considered as 12 g, as per the guidelines described in *Sharangadhara Samhita*.^[18] The formulation was administered twice daily with lukewarm water (*Ushna Jala*) as an *Anupan* for a duration of 45 days.

Follow-up and monitoring

Patients were evaluated on days 15, 30, and 45 during the treatment period, and a final follow-up was conducted on

day 90 postintervention. Each follow-up included a detailed assessment of subjective clinical parameters and any adverse effects. No ADRs or safety concerns were observed during or after the trial.

Surya Namaskar

Asana forms the foundational component of *Hatha Yoga*, with its primary objective being the stabilization of the body and mind. According to classical yogic texts, one should begin yoga practice with *Asanas*, gradually incorporating *Pranayama* (breath control) and *Mantras* (chants). A unique practice that combines these three elements is *Surya Namaskar* (Sun Salutation), a dynamic sequence of twelve postures that includes both forward and backward bending movements. This integrated practice promotes physical, mental, and spiritual well-being.^[19,20] *Surya Namaskar* is considered one of the most effective and accessible yogic techniques for managing obesity and maintaining overall health. It provides a comprehensive workout involving muscular engagement, cardiovascular activation, and mental focus. The sequence not only supports weight reduction but also improves hormonal balance, boosts metabolism, enhances flexibility, and increases mental clarity.^[21,22] A complete cycle of *Surya Namaskar* involves twelve distinct postures: *Pranamasana* (Prayer Pose), *Hasta Uttanasana* (Raised Arms Pose), *Padahasthasana* (Hand to Foot Pose), *Ashwa Sanchalanasana* (Equestrian Pose), *Parvatasana* (Mountain Pose), *Ashtanga Namaskara* (Salute with Eight Limbs), *Bhujangasana* (Cobra Pose), *Parvatasana* (repeated), *Ashwa Sanchalanasana* (repeated), *Padahasthasana* (repeated), *Hasta Uttanasana* (repeated), and *Pranamasana* (closing Prayer Pose).

Each posture is coordinated with specific breathing patterns and mindful awareness, making the practice both physical and meditative. Conventionally, *Sanskrit mantras* are chanted along with each posture. These mantras are believed to stimulate internal organs, balance the chakras, and enhance vibrational energy. There is also evidence that such phonetic vibrations can positively influence the autonomic nervous system, promoting relaxation and emotional stability.^[23] It is generally recommended to perform at least 10 cycles of *Surya Namaskar* twice daily to achieve optimum results. When

Table 1: Grouping and posology

Parameter	Group A	Group B	Group C
Intervention	<i>Guduchyadi Yog</i> + Diet	<i>Surya Namaskar</i> + Diet	<i>Guduchyadi Yog</i> + <i>Surya Namaskar</i> + Diet
Number of patients	20	20	20
Study type	Open-label	Open-label	Open-label
Trial duration (days)	45	45	45
Dose	As per Young's formula	–	As per Young's formula
Frequency	Twice daily	Once daily	<i>Guduchyadi Yog</i> – Twice daily <i>Surya Namaskar</i> – Once daily
Anupan (vehicle)	<i>Ushna Jala</i> (lukewarm water)	–	<i>Ushna Jala</i> (lukewarm water)
Route	Oral	–	Oral
Randomization	Simple random sampling	Simple random sampling	Simple random sampling

Table 2: Ingredients of *Guduchyadi Yog*

Ingredient	Botanical name (Latin name)	Part used	Proportion
<i>Haritaki</i>	<i>Terminalia chebula</i>	Dried fruit	1 part
<i>Bibhitaki</i>	<i>Terminalia bellirica</i>	Dried fruit	1 part
<i>Amalaki</i>	<i>Phyllanthus emblica</i> (syn. <i>Emblica officinalis</i>)	Dried fruit	1 part
<i>Musta</i>	<i>Cyperus rotundus</i>	Dried rhizome	1 part
<i>Guduchi</i>	<i>Tinospora cordifolia</i>	Dried stem	1 part

Table 3: Grading of subjective symptoms

Symptom	Severity description	Grade
<i>Trishna</i> (thirst)	Thirst after 6–8 h; relieved by water	G0
	Thirst after 8–10 h; relieved by water	G1
	Thirst after 10–12 h; relieved by water	G2
	Thirst after more than 12 h; relieved by water	G3
<i>Anga Gaurava</i> (body heaviness)	No sensation of heaviness	G0
	Heaviness felt occasionally	G1
	Heaviness felt most of the time	G2
	Persistent heaviness throughout the day	G3
<i>Alasya/Utsaha Hani</i> (lethargy lack of enthusiasm)	Performs tasks on time with energy	G0
	Performs tasks with delay	G1
	Performs tasks with poor efficiency	G2
	Avoids tasks entirely	G3
<i>Gatrasada</i> (fatigue)	No fatigue experienced	G0
	Fatigue after moderate physical activity	G1
	Fatigue after mild activity	G2
	Fatigue during routine daily activities	G3
<i>Atiksudha</i> (excessive hunger)	Absence of hunger	G0
	Mild hunger felt occasionally	G1
	Normal hunger	G2
	Intense or frequent hunger	G3

practiced regularly, *Surya Namaskar* serves as a complete physical, mental, and spiritual regimen. It is especially effective in preventing and managing lifestyle-related disorders, such as childhood obesity, due to its simplicity, holistic benefits, and nonpharmacological nature.^[24]

Assessment criteria

The effectiveness of the therapeutic intervention was evaluated based on both subjective and objective parameters.

Subjective criteria

The subjective evaluation focused on classical symptoms of *Sthaulya* (obesity) as described in the Ayurvedic texts. These symptoms were assessed and graded according to their severity to monitor changes during the intervention. The key symptoms included *Atiksudha* (excessive hunger), *Gatrasada* (fatigue), *Atipipasa* (excessive thirst), *Alasya/Utsaha Hani/Javoparodha* (lethargy or loss of enthusiasm), and *Anga Gaurava* (sense of heaviness in the body). Each symptom was scored using a four-point grading scale (G0–G3), with G0 indicating absence of the symptom and G3 reflecting the most severe presentation as shown in Table 3.

Table 4: Classification of body mass index (kg/m²) in Children and Adolescents^[25] (Based on centers for disease control body mass index-for-age percentiles)

Weight status category	Percentile range
Underweight	<5 th percentile
Normal or healthy weight	5 th percentile to <85 th percentile
Overweight	85 th to <95 th percentile
Obese	95 th percentile or greater

Table 5: Demographic and clinical profile of the study participants

Parameter	Most frequent observation	Percentage
Age	10–12 years	31.67
Sex	Male	58.33
Religion	Hindu	83.33
Habitat	Urban	63.33
Socioeconomic status	Upper class	33.33
Diet	Vegetarian	73.33
<i>Sharirik Prakriti</i>	<i>Vata-Kapha</i>	38.33
<i>Manasik Prakriti</i>	<i>Rajasika-Tamasika</i>	60.00
<i>Vikriti Bala</i>	<i>Madhyam</i>	86.67
<i>Samhanana</i>	<i>Madhyam</i>	86.67
<i>Satmya</i>	<i>Madhyam</i>	60.00
<i>Satva</i>	<i>Madhyam</i>	66.67
<i>Ahar Shakti</i>	<i>Pravara</i> (high)	63.33
<i>Jaran Shakti</i>	<i>Pravara</i> (high)	51.67
<i>Vyayam Shakti</i>	<i>Avara</i> (low)	66.67
<i>Desha</i> (geographic region)	<i>Jangala</i> (arid)	91.67
<i>Agni</i> (digestive fire)	<i>Teekshna</i> (sharp)	60.00
<i>Kostha</i> (bowel habit)	<i>Madhyam</i>	66.67
<i>Nidra</i> (sleep)	8–10 h per day	43.33
Quality of diet	Predominantly Junk Food	50.00
Duration of disease	Around 3 years	45.00

Objective criteria

The objective assessment included anthropometric and biochemical investigations. The following parameters were compared before and after the intervention:

- Body mass index (BMI): Calculated using the standard formula (weight in kg/height in m²) to categorize weight status as shown in Table 4.
- Anthropometric Measurements:
 1. Body Weight – Measured using a standardized weighing scale
 2. Waist-Hip Ratio (WHR) – Determined using a flexible measuring tape to assess fat distribution
 3. Skinfold Thickness – Measured using a calibrated skinfold caliper at specific sites including biceps, triceps, suprailiac, and subscapular regions to estimate subcutaneous fat.
- Biochemical parameters:
 1. Serum lipid profile – Blood samples were collected to analyze the lipid levels including total cholesterol, triglycerides, high-density lipoprotein (HDL),

and low-density lipoprotein (LDL), which are the essential indicators of metabolic health and obesity risk.

Statistical analysis

The statistical analysis for the study was conducted using GraphPad InStat 3.0 software (GraphPad Software, Inc., San Diego, California, USA). For intra-group comparisons, the Wilcoxon matched-pairs signed-rank test was applied to nonparametric data, while the paired *t*-test was utilized for the parametric data to assess pre- and posttreatment effects within the same group. For inter-group comparisons, analysis of variance was employed to evaluate the differences across the three groups for both parametric and nonparametric variables. $P < 0.05$ was considered statistically significant.

RESULTS

Demographic characteristics of the study participants were presented in Table 5, whereas the results of the clinical evaluation were summarized in Tables 6-11.

DISCUSSION

A total of 976 individuals were screened for *Sthaulya* (obesity). Out of these, 910 patients were excluded as they did not meet the diagnostic criteria or did not present with classical symptoms of *Sthaulya*. Subsequently, 66 patients who fulfilled the inclusion criteria were enrolled for the clinical trial. During the course of the study, four patients discontinued the intervention voluntarily, and two patients were lost to follow-up. Ultimately, a total of 60 patients successfully completed the trial and were included in the final analysis.

Demographic discussion

Age

Among the 60 registered patients in this clinical study, the majority (40%) were in the age group of 10–12 years, followed by 31.67% in the 15–16 years group, 20% in the 13–14 years group, and 13.33% in the 8–9 years group. This pattern suggests that school-going children, due to their sedentary lifestyle, limited physical activity, and increased consumption of energy-dense foods such as junk food, chocolates, and sugary beverages, are more susceptible to *Sthaulya*. *Ayurveda* classifies this phase as *Madhyama Avastha*, a developmental stage where *Dhatu Paripurnata* (tissue maturation) is actively taking place, making children more vulnerable to imbalances when lifestyle and diet are not properly managed.^[26]

Sex

The study revealed that 58.33% of the patients were male, while 41.67% were female. This trend aligns with national data indicating a higher prevalence of overweight and obesity among boys compared to girls.^[27] A study in Udupi, South India, reported an overweight prevalence of 11% in boys and 10.6% in girls.^[28] In contrast, a central Indian study from Wardha showed nearly equal prevalence (boys 4.4%, girls 4.3%).^[29] However, it has also been observed that by the age

of 15, girls tend to surpass boys in obesity rates, possibly due to earlier onset of pubertal changes and metabolic shifts. Girls typically require less caloric intake compared to boys, contributing to differential energy balance.^[30]

Religion

The study population predominantly comprised Hindus (83.33%), followed by Muslims (16.67%). This distribution is reflective of the demographic profile of Jodhpur and its adjoining areas, from where the participants were recruited.

Socio-economic status

Patients from upper (33.33%) and upper-middle (31.67%) socio-economic classes formed the majority. Middle-class (25%) and lower-middle-class (10%) participants were fewer. The higher prevalence in affluent classes may be attributed to increased consumption of calorie-rich convenience foods and reduced physical activity. Similar findings were reported by Goyal *et al.* and Kotian *et al.*, indicating a higher incidence of obesity in children from affluent urban families.^[28,31]

Habitat

A larger portion of participants (63.33%) belonged to the urban settings, while 36.67% were from rural areas. Urban children are more inclined to sedentary routines, frequent consumption of fast foods, and less outdoor physical activity, all of which contribute to the development of *Sthaulya*.

Diet

Vegetarian diets were more common (73.33%) than mixed diets (26.67%). This may reflect the dietary customs of the local Hindu population. While some studies suggest that vegetarianism may reduce obesity risk, the type of diet may have less influence on disease manifestation when proper adherence to *Ahara Vidhi Visheshayatana* is maintained.^[32]

Sharirik Prakriti

Most patients exhibited *Kapha Vata Prakriti* (38.33%), followed by *Kapha Pitta* (21.67%), *Pitta Kapha* (16.67%), *Vata Kapha* (10%), *Pitta Vata* (6.67%), and *Vata Pitta* (5%). Since *Kapha* is the dominant *Dosha* associated with *Meda Dhatu*, its prevalence aligns with *Sthaulya*'s pathophysiology. *Kapha*'s *Guru*, *Snigdha*, and *Sthira* attributes promote fat accumulation, supporting the classical view of *Sthaulya* as a *Sleshma Nanatmaja Vyadhi*.

Manasika Prakriti

A significant number of patients (30%) showed *Rajasika Tamasika* or *Tamasika Rajasika* traits. Other combinations included *Satvika Tamasika* (15%), *Satvika Rajasika* (11.67%), and minor proportions of *Rajasika Satvika* and *Tamasika Satvika* (5% each). Individuals with *Tamasika* traits often indulge in overeating and exhibit reduced physical and mental activity, increasing their susceptibility to *Sthaulya*.

Vikriti Bala

Most patients (86.67%) had *Madhyama Vikriti Bala*, while 13.33% showed *Avara Bala*, indicating moderate disease resistance.

Samhanana

The majority (86.67%) exhibited *Madhyama Samhanana*, while 8.33% had *Avara* and 5% had *Pravara*. Although obese individuals may appear physically well-formed, their *Dhatu Sarata* is often weak, particularly in *Meda Dhatu*, supporting the *Ayurvedic* concept of *Abaddha Meda*.

Satva and Satmya

Most patients demonstrated *Madhyama Satva* (66.67%), followed by *Pravara* (31.67%) and *Avara* (1.67%). Similarly, *Madhyama Satmya* was seen in 60%, *Pravara* in 35%, and *Avara* in 5%. These mental and habitual tendencies influence diet choices and compliance with lifestyle modifications, directly impacting weight gain.

Abhyavaharana Shakti and Jarana Shakti

Regarding digestive capacity, 63.33% of participants had *Pravara Abhyavaharana Shakti*, 31.67% had *Madhyama*, and 5% had *Avara*. For *Jarana Shakti*, 51.67% were classified as *Pravara*, 40% as *Madhyama*, and 8.33% as *Avara*. Enhanced appetite combined with poor digestion leads to the formation of *Ama*, contributing to *Sthaulya*.

Vyayama Shakti

A significant proportion (66.67%) exhibited *Alpa Vyayama Shakti*, indicating low physical endurance. Only 5% had *Pravara* and 28.33% had *Madhyama Vyayama Shakti*. This deficiency in physical capacity may arise due to *Dhatukshaya* or impaired *Agni*, both of which are implicated in the pathogenesis of *Sthaulya*.

Desha

Most patients (91.67%) were from *Jangala Desha* and only 8.33% from *Anupa Desha*. This mirrors the population distribution in Jodhpur, a predominantly arid zone.

Agni

Of the participants, 60% had *Samagni*, while 21.67% had *Vishamagni*, 13.33% had *Tikshnagni*, and 5% had *Mandagni*. *Tikshnagni* often leads to excessive appetite, causing overconsumption, while *Vishamagni* leads to irregular digestion – both promoting fat accumulation.

Kostha

The majority (66.67%) had *Madhyama Kostha*, with 18.33% having *Krura* and 15% *Mridu Kostha*. This observation is consistent with a predominance of *Kapha Vata* Prakriti, which disrupts regular bowel habits and digestion.

Nidra

Regarding sleep patterns, 43.33% of patients slept 8–10 h per day, 41.67% slept 10–12 h, and 15% slept 6–8 h. *Ayurveda* emphasizes balanced *Nidra* as a key factor in health; excessive sleep increases *Snigdha Guna* and aggravates *Kapha*, promoting *Meda* accumulation and contributing to *Sthaulya*.^[33]

Quality of diet

Half the patients (50%) reported frequent consumption of junk food, 36.67% consumed fortified marketed foods, and

13.33% primarily ate home-cooked meals. Highly processed foods rich in fats and sugars have been strongly associated with obesity.

Duration of disease

Most patients (55%) had a chronicity of 3 years, 35% for 4 years, and 10% had disease duration of either 2 or 5 years. The slow, progressive nature of obesity as a *Santarpanjanya Vyadhi* aligns with the WHO's view of obesity as a chronic lifestyle disorder.

Discussion on results

Effect of therapy on Atipipasa (excessive thirst)

In the present study, a statistically significant improvement was observed in all three groups with respect to *Atipipasa* (excessive thirst), as the *P* values for Groups A, B, and C were all <0.0001 [Table 6]. The percentage improvements were 50% in Group A, 63.89% in Group B, and 68% in Group C. Intergroup comparison using the Kruskal–Wallis's test revealed a statistically significant difference (*P* = 0.014) [Table 7], with Group C showing the highest percentage improvement. From an *Ayurvedic* perspective, *Charaka* mentions that excessive thirst in obese individuals is due to *Tikshna Agni*, which arises from the presence of excess *Vata* in the *Koshtha*, caused by *Margavarodha* (obstruction) by *Meda* (adipose tissue).^[34] *Guduchyadi Yoga*, with its predominance of *Katu Rasa*, *Ushna Virya*, and *Tikshna Guna*, helps eliminate this obstruction. As a result, *Agni* becomes balanced and the symptom of *Atipipasa* is alleviated through improved digestion and metabolic function.

Effect of therapy on Anga Gaurava (heaviness in the body)

All three groups showed statistically significant improvements in *Anga Gaurava*, with *P* < 0.0001 [Table 6]. The response was the highest in Group C (65.85%), followed by Group B (54.55%) and Group A (51.85%). The Kruskal–Wallis test revealed a significant intergroup difference (*P* = 0.016) [Table 7], again indicating superior efficacy in Group C. *Ayurveda* attributes *Anga Gaurava* to *Kapha* and *Meda Dushti*, both rich in *Prithvi* and *Jala Mahabhuta*, leading to an increase in *Guru*, *Snigdha*, and *Sheeta Guna* – qualities that contribute to heaviness.^[35] The trial formulation, with its *Laghu*, *Ruksha Guna*, and *Ushna Virya*, functions as an *ĀmaPācaka* and *Srotoshodhaka*, aiding in the clearance of metabolic toxins and blockages, thereby reducing *Anga Gaurava*.

Effect of therapy on Aalasya/Javoparodha (lethargy/lack of initiative)

Significant changes were observed in all groups with *P* < 0.0001 [Table 6]. Group C again demonstrated the highest improvement (72.09%), followed by Group B (61.11%) and Group A (54.55%). However, the intergroup difference was not statistically significant (*P* = 0.525) [Table 7]. *Aalasya* is often associated with *Kapha Vriddhi*, resulting in both physical and mental inertia. *Guduchyadi Yoga* contains herbs such as *Guduchi* (*Tinospora cordifolia*), which possess *Medhya*, *Rasayana*, and *Kapha-Vata Shamana* properties, enhancing energy and mental clarity.^[36] By improving *Agni* and eliminating *Ama*, the formulation reduces fatigue and promotes motivation, vitality, and responsiveness to physical tasks.

Table 6: Effect on subjective parameters in *Sthaulya* patients – Group A, B, and C

Symptoms	Group	Mean score		Median		SD		Wilcoxon W	P	Percentage relief	Significance
		BT	AT	BT	AT	BT	AT				
<i>Atipipasa/Trishna</i> (excessive thirst)	A	1.60	0.80	2.00	1.00	0.75	0.41	−3.771 ^b	0.000162	50.00	Significant
	B	1.80	0.65	2.00	0.00	0.83	0.81	−3.758 ^b	0.000171	63.89	
	C	1.25	0.40	1.00	1.00	0.64	0.73	−3.051 ^b	0.002282	68.00	
<i>Anga Gaurav</i> (heaviness)	A	1.35	0.65	1.00	1.00	0.75	0.59	−3.742 ^b	0.000183	51.85	Significant
	B	1.65	0.75	2.00	1.00	0.93	0.72	−3.819 ^b	0.000134	54.55	
	C	2.05	0.70	2.00	1.00	0.69	0.55	−4.234 ^b	0.000023	65.85	
<i>Aalasya/Javaparodha</i> (lethargy)	A	1.65	0.75	2.00	1.00	0.75	0.55	−3.819 ^b	0.000134	54.55	Significant
	B	1.80	0.70	2.00	1.00	0.70	0.66	−3.947 ^b	0.000079	61.11	
	C	2.15	0.60	2.00	1.00	0.75	0.88	−3.440 ^b	0.000581	72.09	
<i>Gatrasad</i> (fatigue)	A	2.50	1.65	3.00	1.50	0.61	0.75	−3.900 ^b	0.000096	34.00	Significant
	B	2.25	1.25	2.00	1.00	0.64	0.64	−4.472 ^b	0.000008	44.44	
	C	2.00	1.00	2.00	1.00	0.73	0.67	−3.900 ^b	0.000096	50.00	
<i>Atikshudha</i> (excessive hunger)	A	1.55	0.85	2.00	1.00	0.83	0.67	−3.500 ^b	0.000465	45.16	Significant
	B	1.90	0.70	2.00	0.50	0.91	0.80	−3.874 ^b	0.000107	63.16	
	C	2.00	0.60	2.00	1.00	0.65	0.73	−3.944 ^b	0.000080	70.00	

^bBased on Wilcoxon Matched-Pairs Signed Rank Test, $P < 0.05$ considered statistically significant. BT: Before treatment, AT: After treatment, SD: Standard deviation

Table 7: Intergroup comparison of subjective parameters in *Sthaulya* patients of Groups A, B, and C

Parameters	Group	n	Mean rank	Sum of rank	Kruskal–Wallis H	P
<i>Atipipasa/Trishna</i> (excessive thirst)	Group A	20	30.05	601.00	8.584	0.014
	Group B	20	23.55	471.00		
	Group C	20	37.90	758.00		
<i>Anga Gaurav</i> (heaviness)	Group A	20	24.75	495.00	8.281	0.016
	Group B	20	30.00	600.00		
	Group C	20	36.75	735.00		
<i>Aalasya/Javaparodha</i> (lethargy)	Group A	20	28.80	576.00	1.289	0.525
	Group B	20	29.10	582.00		
	Group C	20	33.60	672.00		
<i>Gatrasad</i> (fatigue)	Group A	20	29.00	580.00	6.113	0.035
	Group B	20	29.00	580.00		
	Group C	20	33.50	670.00		
<i>Atikshudha</i> (excessive hunger)	Group A	20	24.25	485.00	6.888	0.032
	Group B	20	30.75	615.00		
	Group C	20	36.50	730.00		

$P < 0.05$ indicates statistically significant differences among groups. n: Number of participants per group, H: Kruskal–Wallis test statistic

Effect of therapy on *Gatra Saada* (physical fatigue/ weakness)

The effect on *Gatra Saada* was statistically significant in all three groups ($P < 0.0001$) [Table 6], with Group C again exhibiting the highest improvement (50%), followed by Group B (44.44%) and Group A (34%). The Kruskal–Wallis test showed a significant intergroup difference ($P = 0.035$) [Table 7]. The reduction in *Gatra Saada* can be attributed to the *Rasayana*, *Agni-Deepana*, and *Ama-Pachana* actions of the herbs in *Guduchyadi Yoga*. *Haritaki* supports detoxification, regulates bowel movements, and strengthens the respiratory system.^[37] *Musta* aids in fat and carbohydrate digestion and supports hepatic and metabolic activity, contributing to the reduction of fatigue and physical debility.^[38]

Effect of therapy on *Atikshudha* (excessive hunger)

All three groups showed statistically significant changes in *Atikshudha* ($P < 0.0001$) [Table 6], with the greatest effect in Group C (70%), followed by Group B (63.16%) and Group A (45.16%). Intergroup analysis revealed a statistically significant difference ($P = 0.032$) [Table 7]. According to *Ayurveda*, excessive hunger can result from *Tikshna Jatharagni* due to *Ama* and *Kapha* imbalance. *Guduchyadi Yoga*, rich in *Dipana* and *Pachana* herbs with *Kashaya*, *Katu*, and *Tikta Rasa*, helps pacify *Kapha* and digest *Ama*, normalizing both *Jatharagni* and *Dhatvagni*.^[39] This action reduces abnormal appetite and supports balanced metabolism, especially in individuals with *Meda Vridhhi*.

Effect of therapy on weight

All the three groups demonstrated statistically significant reductions in weight, with $P < 0.05$ [Table 8]. Group A showed a mean reduction of 10.80%, Group B 13.25%, and Group C 16.95%. Intergroup comparison via the Kruskal–Wallis test yielded a $P = 0.001$, indicating significant differences across the groups [Table 9]. Group C achieved the highest percentage improvement. The effectiveness of *Guduchyadi Yoga* in weight reduction may be attributed to its *Katu Rasa*, *Tikta-Kashaya Rasa*, *Laghu*, *Ruksha*, *Ushna* and *Teekshna Guna*, along with *Ushna Virya* and *Katu Vipaka*, which possess *Kapha-Vata Shamana* and *Lekhana* (scraping) actions. These properties stimulate *Jatharagni* (digestive fire), aid in *Amapachana* (detoxification), promote the breakdown of *Meda Dhatu* (fat tissue), and prevent the accumulation of *Kapha*.^[40,41] This collectively results in significant weight reduction.

Effect of therapy on body mass index

Statistically significant improvement was seen in BMI in all groups ($P < 0.05$) [Table 8]. Group A showed a reduction of 13.44%, Group B 9.81%, and Group C 18.84%. Intergroup comparison yielded a significant $P = 0.001$ [Table 9], with Group C showing maximum benefit. BMI is directly

correlated with body weight and adipose tissue volume. *Katu Rasa* and *Laghu-Ruksha Guna* in *Guduchyadi Yoga* enhance *Lekhana Karma* by metabolizing and reducing *Meda* and *Mamsa Dhatu*. In addition, the *Ruksha* property absorbs excess *Kleda* (moisture), supporting fat reduction and thereby decreasing BMI.^[42]

Effect of therapy on waist circumference

All three groups exhibited statistically significant reductions in waist circumference ($P < 0.05$). Group A demonstrated a 6.45% reduction, Group B 8.63%, and Group C 10.71% [Table 8]. The Kruskal–Wallis test revealed a significant intergroup difference ($P = 0.001$) [Table 9]. This effect can be attributed to the *Lekhana*, *Agni-deepana*, and *Srotoshodhaka* actions of the herbal formulation. *Guduchyadi Yoga* assists in reducing abdominal fat by balancing *Kapha* and improving fat metabolism, leading to a decrease in central obesity.^[43]

Effect of therapy on hip circumference

Significant improvement was noted in hip circumference across all groups ($P < 0.05$). Group A showed a reduction of 2.02%, Group B 5.16%, and Group C 8.42% [Table 8]. The intergroup comparison showed a statistically significant difference ($P = 0.001$) [Table 9]. The reduction in hip

Table 8: Effect on objective parameters in *Sthaulya* patients of Groups A, B, and C

Parameters	Group	Mean		SD		SE		<i>t</i>	<i>P</i>	Percentage change	Result
		BT	AT	BT	AT	BT	AT				
Weight	A	54.15	48.30	4.11	4.22	0.92	0.94	3.050	0.0066	10.80	Significant
	B	53.20	46.15	4.19	4.12	0.94	0.92	3.414	0.0029	13.25	
	C	63.58	52.80	12.63	12.56	2.82	2.81	3.337	0.0035	16.95	
BMI	A	26.23	22.71	0.62	0.61	0.14	0.14	3.271	0.0040	13.44	Significant
	B	26.16	23.60	0.61	0.57	0.14	0.13	3.288	0.0039	9.81	
	C	28.16	22.86	2.93	2.83	0.65	0.63	3.701	0.0015	18.84	
Waist circumference	A	92.30	86.35	1.56	1.57	0.35	0.35	3.756	0.0013	6.45	Significant
	B	92.15	84.20	1.87	1.88	0.42	0.42	3.134	0.0055	8.63	
	C	92.00	82.15	1.59	1.53	0.36	0.34	3.479	0.0025	10.71	
Hip circumference	A	96.35	94.40	1.14	1.14	0.25	0.26	3.756	0.0013	2.02	Significant
	B	96.00	91.05	1.56	1.50	0.35	0.34	3.134	0.0055	5.16	
	C	94.45	86.50	2.09	2.14	0.47	0.48	3.512	0.0023	8.42	
WHR	A	0.96	0.92	0.02	0.02	0.00	0.00	3.701	0.0015	3.78	Significant
	B	0.96	0.94	0.03	0.03	0.01	0.01	3.852	0.0011	2.22	
	C	0.97	0.92	0.03	0.03	0.01	0.01	3.631	0.0018	5.82	
Supra iliac skin fold thickness	A	29.30	26.05	1.53	1.19	0.34	0.27	3.819	0.0012	11.09	Significant
	B	29.35	26.30	1.39	1.30	0.31	0.29	3.765	0.0013	10.39	
	C	29.70	24.25	1.59	1.52	0.36	0.34	3.768	0.0013	18.35	
Triceps skin fold thickness	A	21.35	19.38	1.42	1.48	0.32	0.33	3.756	0.0013	9.25	Significant
	B	21.85	19.80	1.81	1.91	0.41	0.43	2.299	0.0330	9.38	
	C	21.30	16.20	1.84	1.67	0.41	0.37	3.282	0.0039	23.94	
Biceps skin fold thickness	A	19.50	17.53	1.32	1.35	0.29	0.30	3.756	0.0013	10.13	Significant
	B	19.40	18.35	0.99	1.04	0.22	0.23	2.299	0.0330	5.41	
	C	19.65	16.10	1.14	1.03	0.25	0.23	3.693	0.0015	18.07	
Subscapular skin fold thickness	A	30.20	27.10	1.54	1.37	0.34	0.31	3.358	0.0033	10.26	Significant
	B	30.10	28.55	1.45	1.39	0.32	0.31	3.123	0.0056	5.15	
	C	30.30	26.05	1.49	1.36	0.33	0.30	3.641	0.0017	14.03	

Percentage change: Percentage reduction posttreatment, significant: $P < 0.05$. BT: Before treatment, AT: After treatment, SD: Standard deviation, SE: Standard error, BMI: Body mass index, WHR: Waist-hip ratio

Table 9: Intergroup comparison of objective parameters in *Sthaulya* patients of Groups A, B, and C

Parameter	Group	n	Mean difference	SD	SE	F	P
Weight (kg)	Group A	20	5.85	0.49	0.11	40.092	0.001
	Group B	20	7.05	0.22	0.05		
	Group C	20	10.78	0.55	0.12		
BMI (kg/m ²)	Group A	20	3.52	0.03	0.01	102.634	0.001
	Group B	20	2.57	0.04	0.01		
	Group C	20	5.31	0.41	0.09		
Waist circumference (cm)	Group A	20	5.95	0.00	0.00	26.418	0.001
	Group B	20	7.95	0.00	0.00		
	Group C	20	9.85	0.81	0.18		
Hip circumference (cm)	Group A	20	1.95	0.00	0.00	122.695	0.001
	Group B	20	4.95	0.00	0.00		
	Group C	20	7.95	0.39	0.09		
WHR	Group A	20	0.04	0.00	0.00	0.574	0.566
	Group B	20	0.02	0.00	0.00		
	Group C	20	0.06	0.01	0.00		
Suprailiac skinfold (mm)	Group A	20	3.25	0.44	0.10	4.563	0.015
	Group B	20	3.05	0.00	0.00		
	Group C	20	5.45	0.69	0.15		
Triceps skinfold (mm)	Group A	20	1.98	0.00	0.00	44.333	0.001
	Group B	20	2.05	0.00	0.00		
	Group C	20	5.50	0.89	0.20		
Biceps skinfold (mm)	Group A	20	1.98	0.00	0.00	122.695	0.001
	Group B	20	1.05	0.00	0.00		
	Group C	20	3.55	0.39	0.09		
Subscapular skinfold (mm)	Group A	20	3.10	0.55	0.12	17.016	0.001
	Group B	20	1.55	0.60	0.14		
	Group C	20	4.25	0.72	0.16		

F-value and P-value: Derived from Kruskal–Wallis test, Significance: $P < 0.05$ is considered statistically significant, n: Number of participants per group, Mean difference: Difference between pre- and post-treatment. BMI: Body mass index, WHR: Waist-hip ratio, SD: Standard deviation, SE: Standard error

circumference further supports the role of *Guduchyadi Yoga* in modulating fat deposition and facilitating the mobilization of stored adipose tissue, especially from peripheral regions, through its *Kapha-Meda-Hara* actions.^[44]

Effect of therapy on waist-hip ratio

Each group showed statistically significant changes in WHR ($P < 0.05$), with Group A improving by 3.78%, Group B by 2.22%, and Group C by 5.82% [Table 8]. However, the intergroup difference was not statistically significant ($P = 0.566$) [Table 9]. Despite the lack of intergroup significance, the changes suggest positive modulation of central adiposity. Herbs like *Nagarmotha* and *Madhu*, with *Lekhana* and *Medohara* actions, contribute to a reduction in abdominal fat, which is closely linked to metabolic health risks.^[45]

Effect of therapy on skinfold thickness (suprailiac)

Skinfold thickness at the suprailiac region showed significant reductions in all groups ($P < 0.05$). Group A had an 11.09% reduction, Group B 10.39%, and Group C 18.35% [Table 8]. The intergroup analysis revealed a statistically significant difference ($P = 0.015$) [Table 9]. This reduction indicates a mobilization of subcutaneous fat, particularly in the abdominal region. The *Ushna Virya* and *Tikta-Kashaya* Rasa of the trial

formulation enhance lipid metabolism and promote the burning of stubborn fat deposits.^[46]

Effect of therapy on skinfold thickness (triceps)

A significant reduction in triceps skinfold thickness was observed in all groups ($P < 0.05$). Group A showed a 9.25% decrease, Group B 9.38%, and Group C 23.94% [Table 8]. Intergroup difference was significant ($P = 0.001$) [Table 9]. The notable reduction in Group C points to effective fat mobilization from the upper extremities, likely due to systemic action of the formulation which improves *Agni* and reduces *Meda Sanchaya* (fat accumulation).^[47]

Effect of therapy on skinfold thickness (biceps)

All the groups recorded statistically significant reductions in biceps skinfold thickness ($P < 0.05$), with Group A at 10.13%, Group B at 5.41%, and Group C at 18.07% [Table 8]. The Kruskal–Wallis test confirmed a significant intergroup difference ($P = 0.001$) [Table 9]. This effect correlates with the systemic *Lekhana* and *Medohara* actions of the herbs, particularly in reducing peripheral subcutaneous fat.^[48]

Effect of therapy on skinfold thickness (subscapular)

Statistically significant reductions were also noted in subscapular skinfold thickness ($P < 0.05$). Group A

showed a 10.26% decrease, Group B 5.15%, and Group C 14.03% [Table 8]. Intergroup comparison indicated a significant difference ($P = 0.001$) [Table 9]. The formulation's *Ushna* and *Ruksha* properties enhance the breakdown of fat from deeper deposits. By opposing *Kapha-Meda Vriddhi*, *Guduchyadi Yoga* promotes metabolic activity and prevents fat accumulation in subcutaneous layers.^[49]

Effect of therapy on serum cholesterol

All the three groups demonstrated statistically significant reductions in serum cholesterol levels ($P < 0.05$) [Table 10]. Group A showed a 10.77% decrease, Group B 10.59%, and Group C 15.18%. The Kruskal–Wallis test revealed a significant intergroup difference ($P = 0.007$) [Table 11], with Group C showing the greatest reduction in serum cholesterol levels. The reduction in serum cholesterol may be attributed to the *Lekhana* (scraping) and *Shoshana* (absorption) properties of *Tikta* and *Kashaya Rasa* present in *Guduchyadi Yoga*. These rasas help eliminate excessive *Kapha* and *Meda* from the channels (*srotas*), thereby lowering lipid accumulation.^[50] In addition, *Laghu* and *Ruksha* properties facilitate the breakdown and clearance of lipids, enhancing lipid metabolism.

Effect of therapy on serum triglycerides

Significant reductions were observed in serum triglyceride levels across all groups ($P < 0.05$). Group A showed a 9.37% reduction, Group B 9.85%, and Group C 13.43% [Table 10]. The Kruskal–Wallis test confirmed a significant intergroup difference ($P = 0.008$) [Table 11], with Group C showing the most pronounced reduction. *Guduchyadi Yoga*'s *Ushna Virya* and *Agni-deepana* properties enhance metabolic activity, which supports the digestion and assimilation of fats. The formulation improves *Jatharagni* and *Dhatvagni*, aiding in the catabolism of triglycerides and preventing their excess accumulation.^[51]

Effect of therapy on high-density lipoprotein

The P values for all groups were < 0.05 , indicating statistically significant changes [Table 10]. Group A showed a 7.36% increase, Group B 13.33%, and Group C 15.21%. However, the intergroup difference was not statistically significant ($P = 0.560$) [Table 11]. Although HDL levels increased in all groups, the variation among them was not large enough to reach statistical significance. The rise in HDL could be attributed to improved liver function and lipid regulation as a result of the action of herbs such as *Guduchi* and *Haritaki*, which possess *Rasayana*, *Medohara*, and *Srotoshodhaka* qualities.^[36]

Effect of therapy on very low-density lipoprotein

Statistically significant reductions in very LDL (VLDL) were seen across all groups ($P < 0.05$), with Group A showing a 6.76% decrease, Group B 6.29%, and Group C 15.49% [Table 10]. The Kruskal–Wallis test revealed a significant intergroup difference ($P = 0.038$) [Table 11], with Group C demonstrating superior efficacy. The decrease in VLDL reflects the ability of the trial drug to regulate triglyceride metabolism, as VLDL is primarily composed of triglycerides. Herbs such as *Musta* and *Nagarmotha* support fat metabolism and hepatic detoxification, promoting lipid breakdown and clearance from circulation.^[52]

Effect of therapy on low-density lipoprotein

All groups showed statistically significant reductions in LDL ($P < 0.05$), with Group A showing a 3.68% decrease, Group B 6.25%, and Group C 10.61% [Table 10]. Intergroup comparison via Kruskal–Wallis test showed a significant difference ($P = 0.007$) [Table 11], with Group C again showing the most effective response. *Tikta* and *Kashaya* Rasas not only have *Lekhana* but also *Shoshana* properties that absorb excess lipids and reduce LDL levels. Additionally, *Laghu Guna* exerts *Langhana Karma*, which helps decrease overall body mass and indirectly affects lipid balance.^[53]

Table 10: Effect of Guduchyadi Yog on laboratory parameters in *Sthaulya* patients of Groups A, B, and C

Parameter	Group	Mean		SD		SE		t	P	Percentage change	Result
		BT	AT	BT	AT	BT	AT				
Serum cholesterol (mg/dL)	A	193.15	172.35	19.24	17.57	4.30	3.93	2.873	0.0097	10.77	Significant
	B	199.65	178.50	15.93	14.37	3.56	3.21	3.796	0.0012	10.59	
	C	206.55	175.20	9.75	8.70	2.18	1.95	3.712	0.0015	15.18	
Serum triglyceride (mg/dL)	A	100.90	91.45	19.49	17.50	4.36	3.91	2.500	0.0217	9.37	Significant
	B	109.60	98.80	18.31	16.60	4.10	3.71	3.010	0.0072	9.85	
	C	116.20	100.60	11.68	9.65	2.61	2.16	3.255	0.0042	13.43	
HDL (mg/dL)	A	55.00	59.05	15.40	14.94	3.44	3.34	2.130	0.0465	7.36	Significant
	B	51.00	57.80	16.87	16.25	3.77	3.63	3.488	0.0025	13.33	
	C	50.30	57.95	17.03	16.40	3.81	3.67	3.273	0.0040	15.21	
VLDL (mg/dL)	A	32.55	30.35	1.61	2.11	0.36	0.47	0.580	0.5688	6.76	Significant
	B	32.60	30.55	1.35	1.54	0.30	0.34	2.936	0.0085	6.29	
	C	32.60	27.55	1.35	1.54	0.30	0.34	3.956	0.0008	15.49	
LDL (mg/dL)	A	135.80	130.80	4.10	4.51	0.92	1.01	3.063	0.0064	3.68	Significant
	B	137.55	128.95	3.76	3.93	0.84	0.88	2.985	0.0076	6.25	
	C	137.55	122.95	3.76	3.93	0.84	0.88	2.985	0.0076	10.61	

Significance: Statistically significant ($P < 0.05$). BT: Before treatment, AT: After treatment, SD: Standard deviation, SE: Standard error, VLDL: Very LDL, LDL: Low-density lipoprotein, HDL: High-density lipoprotein

Table 11: Intergroup comparison of laboratory parameters among *Sthaulya* patients in groups A, B, and C

Parmeter	Group	n	Mean difference	SD	SE	F	P
Serum cholesterol (mg/dL)	Group A	20	20.80	5.21	1.16	2.768	0.007
	Group B	20	21.15	4.73	1.06		
	Group C	20	31.35	5.79	1.29		
Serum triglyceride (mg/dL)	Group A	20	9.45	3.56	0.80	2.667	0.008
	Group B	20	10.80	2.97	0.66		
	Group C	20	15.60	2.91	0.65		
HDL (mg/dL)	Group A	20	4.05	2.39	0.54	0.585	0.560
	Group B	20	6.80	2.31	0.52		
	Group C	20	7.65	2.25	0.50		
VLDL (mg/dL)	Group A	20	2.20	1.54	0.34	3.471	0.038
	Group B	20	2.05	0.94	0.21		
	Group C	20	5.05	0.94	0.21		
LDL (mg/dL)	Group A	20	5.00	2.92	0.65	2.767	0.007
	Group B	20	8.60	2.23	0.50		
	Group C	20	14.60	2.23	0.50		

F-value: Test statistics from Kruskal–Wallis test, P-value: Probability value indicating statistical significance, Significance: Considered statistically significant if $P < 0.05$. n: Number of participants in each group, SD: Standard deviation, SE: Standard error, VLDL: Very LDL, LDL: Low-density lipoprotein, HDL: High-density lipoprotein

Overall effect of therapy

The overall therapeutic efficacy was evaluated based on subjective and objective improvements [Table 12]. In Group A, 5% of patients showed significant improvement, 20% moderate, and 70% mild. In Group B, 10% showed significant improvement, 55% moderate, and 35% mild. Group C demonstrated the best outcomes: 15% showed significant improvement, 60% moderate, and only 25% mild improvement. The progressive increase in clinical benefit from Group A to Group C reinforces the efficacy of *Guduchyadi Yoga* in managing *Sthaulya* (obesity) and its associated metabolic disorders. This is likely due to its multi-dimensional action, including *Agni-deepana*, *Ama-pachana*, *Kapha-Meda-hara*, *Lekhana*, and *Srotoshodhana* effects.^[54]

Probable mode of action of *Guduchyadi Vati*

In *Ayurvedic* therapeutics, the synergistic effect of all ingredients within a compound formulation is often more therapeutically significant than the effect of individual components alone. In the pathogenesis of *Sthaulya* (obesity), the involvement of *Kapha* and *Vata* doshas is prominent, coupled with *Medodhatvagnimandya* (impaired fat tissue metabolism) and *Srotorodha* (obstruction of bodily channels). Hence, formulations possessing *Vataghna*, *Kaphaghna*, *Deepana*, *Pachana*, and *Srotoshodhaka* properties are recommended for managing *Sthaulya*.^[55] The trial formulation, *Guduchyadi Yoga*, predominantly comprises herbs with *Laghu* (light), *Ruksha* (dry), and *Tikshna* (sharp) qualities, alongside *Katu* (pungent), *Tikta* (bitter), and *Kashaya* (astringent) *rasa*, with *Ushna* (hot) *Virya* (potency). These pharmacodynamic features are essential for reducing *Kapha* dosha and enhancing *Agni* (digestive/metabolic fire). The ingredients *Guduchi*, *Musta*, and *Triphala* – exhibit dominance in *Katu* and *Kashaya rasa* and *Ushna virya*, helping to pacify both *Kapha* and *Vata* doshas. *Triphala*, being *Tridoshaghna*, further supports the metabolism and elimination of excessive *Medo Dhatu* (adipose tissue).^[56]

The etiopathogenesis of *Sthaulya* begins with the excessive intake of *Kapha*-increasing foods, sedentary lifestyle, and psychological stressors that impair *Jatharagni*, leading to the formation of *Ama* (toxins) and *Annarasa* (improperly digested food). This cascade weakens *Medodhatvagni*, resulting in the accumulation of *Meda* and manifesting as obesity. The trial drug breaks this pathogenic cycle at multiple levels: *Dosha*, *Dushya*, *Agni*, and *Srotas*, aligning with the holistic principles of *Ayurveda*.^[57]

Analysis based on *Rasa* (taste)

The formulation is rich in *Tikta*, *Kashaya*, and *Katu* *rasas*. *Tikta rasa*, dominated by *Akasha* and *Vayu Mahabhutas*, has *Lekhana* (scraping) and *Shoshana* (drying) actions and opposes *Kapha*, which is the primary dosha in *Sthaulya*. Both *Tikta* and *Katu rasa* have *Ama Pachana* properties and help in restoring *Agni* at the *Dhatu* level, while simultaneously eliminating *Kleda* (excess moisture) and *Meda*.^[58] *Kashaya rasa*, known for its *Shoshak* property, also aids in reducing *Kapha* and *Kleda*. *Katu rasa*, predominantly *Agni Mahabhuta*, imparts *Lekhana*, *Shoshana*, *Kledanashaka*, *Medonashaka*, and *Kaphashamaka* properties through its *Laghu*, *Ushna*, and *Ruksha* *gunas*.^[59]

Analysis based on *Guna* (qualities)

The majority of herbs in *Guduchyadi Yoga* have *Laghu* and *Ruksha* properties. *Laghu guna* imparts lightness and facilitates *Langhana* (reducing therapy), enhancing absorption and assisting in *Srotoshodhana*. *Ruksha guna*, dominated by *Agni* and *Vayu Mahabhutas*, induces dryness and counters the inherent *Snigdha* (unctuous) property of *Kapha*. These qualities help dismantle the *Samprapti* of *Sthaulya* by absorbing excess *Kleda* and supporting tissue metabolism.^[60]

Analysis based on *Virya* (potency)

The predominant *Ushna Virya* of the formulation contributes to *Deepana*, *Pachana*, *Svedana* (sweating),

Table 12: Overall effect of therapy among *Sthaulya* patients in Groups A, B, and C

Overall effect	Group A, n (%)	Group B, n (%)	Group C, n (%)
Marked improvement	1 (5.00)	2 (10.00)	3 (15.00)
Moderate improvement	4 (20.00)	11 (55.00)	12 (60.00)
Mild improvement	14 (70.00)	7 (35.00)	5 (25.00)
No improvement	1 (5.00)	0	0
Total	20 (100.00)	20 (100.00)	20 (100.00)

Dravikara (liquefaction), and *Bhedana* (purgative) actions. It pacifies *Kapha* and *Vata* doshas while stimulating *Pitta*, thereby enhancing digestion and metabolic activity. Conversely, *Sheeta Virya*, found in minimal proportions, calms *Pitta*, alleviates burning sensations, and provides soothing effects, but is less relevant in the context of *Sthaulya* management.^[61]

Analysis based on *Vipaka* (postdigestive effect)

The majority of herbs in *Guduchyadi Yoga* possess *Katu Vipaka*. This postdigestive effect promotes proper enzymatic activity, improves metabolism, reduces nutrient malabsorption, and supports sensory perception. *Katu Vipaka* also exerts *Lekhana* action, important in scrapping out excess *Meda* and *Kapha*. *Madhura Vipaka*, though less prominent, reduces *Pitta* and thirst (*Trishna*).^[62]

Doshaghna and *Tridosha balance*

The formulation is primarily *Tridoshaghna*, although it is especially efficacious in pacifying *Kapha*. The disease *Sthaulya* involves vitiation of all three doshas – specifically *Kledaka Kapha*, *Pachaka Pitta*, and *Samana* and *Vyana Vayu* – which collectively contribute to the *Samprapti*. *Guduchyadi Yoga* not only corrects the doshic imbalance but also enhances *Agni* and clears *Srotorodha*. These actions collectively improve lipid metabolism, reduce adiposity, optimize cholesterol levels, and aid in effective weight management.^[63]

Probable mode of action of *Surya Namaskar*

Surya Namaskar is a series of yogic postures integrated with synchronized breathing that acts as a dynamic, isotonic exercise. It enhances the metabolic rate and aids in calorie expenditure without causing fatigue. The coordinated forward and backward bends with rhythmic breath create alternating pressures in thoraco-abdominal regions, stimulating various *viceroreceptors*, leading to balanced physiological responses.^[64]

This structured sequence improves circulation, enhances lymphatic drainage, and promotes the mobilization of stored fat. As the number of cycle increases, the exercise becomes more intense, thus improving cardiovascular endurance and muscular tone. Despite minimal perspiration, practitioners often report heightened energy levels and mental clarity. Studies have shown that even low-intensity practices such as *Kapalabhati* and *Om chanting* elicit significant psychophysiological responses, supporting the hypothesis that *Surya Namaskar*, through moderate but consistent activity, fosters physical and mental well-being.^[65,66]

CONCLUSION

The present clinical study demonstrated that the participants in Group C, who received the trial drug *Guduchyadi Yoga* along with the practice of *Surya Namaskar*, exhibited the most significant reduction in the cardinal symptoms of *Sthaulya* compared to Groups A and B. The synergistic combination of *Ayurvedic* medication and structured yogic exercise enhanced metabolic rate, promoted fat mobilization, and improved physical and psychological well-being. Notably, no adverse effects were observed throughout the intervention period, underscoring the safety and tolerability of the combined therapy. The findings suggest that *Guduchyadi Yoga*, when integrated with *Surya Namaskar*, offers a safe, effective, and sustainable strategy for managing pediatric obesity. This integrative regimen, grounded in *Ayurvedic* principles and supported by lifestyle and behavioral modification, can serve as a valuable alternative or complementary approach in the holistic treatment of childhood obesity.

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Conflicts of interest

There are no conflicts of interest.

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