eISSN 2583-6986
IDEALISTIC JOURNAL OF ADVANCED RESEARCH IN PROGRESSIVE SPECTRUMS (IJARPS)
A MONTHLY, OPEN ACCESS, PEER REVIEWED (REFEREED) INTERNATIONAL JOURNAL
Volume 04, Issue 04, April 2025

Impact of Yoga on Anthropometric Parameters and Body Mass Index (BMI)

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Received: 15 April 2025 Accepted & Reviewed: 25 April 2025, Published: 30 April 2025

Abstract

This review paper explores the impact of yoga on anthropometric parameters and Body Mass Index (BMI), particularly among overweight and obese individuals. Drawing upon a wide range of empirical studies, the research highlights yoga's holistic potential in addressing lifestyle-related disorders such as obesity. It examines how regular yoga practice—including asanas, pranayama, and meditation—can bring about measurable improvements in body weight, waist-hip ratio, skinfold thickness, and BMI. The mechanisms through which yoga influences these outcomes include enhanced metabolic function, hormonal balance, improved muscle tone, mindfulness-based eating behavior, and stress reduction. The review further underscores yoga's accessibility and efficacy as a non-pharmacological, cost-effective intervention for promoting physical fitness, metabolic health, and psychological well-being. Findings support the inclusion of yoga in preventive and therapeutic strategies aimed at managing obesity and improving overall body composition.

Keywords- Yoga, Anthropometric Parameters, Body Mass Index (BMI), Obesity Management, Physical Fitness,

Introduction

In the contemporary era marked by rapid urbanization, technological advancement, and increasingly sedentary lifestyles, the global burden of lifestyle-related disorders has grown significantly. Among these, obesity has emerged as a major public health concern, affecting individuals across all age groups, socioeconomic strata, and geographic regions. The World Health Organization (WHO) classifies obesity as a global epidemic, attributing it to a complex interplay of genetic, behavioral, environmental, and sociocultural factors. Obesity is not only a disease in itself but also a critical risk factor for numerous chronic conditions including type 2 diabetes, hypertension, cardiovascular disease, and certain forms of cancer.

Anthropometric parameters such as weight, height, waist and hip circumference, waist-hip ratio (WHR), and skinfold thickness, along with Body Mass Index (BMI), serve as essential indicators of an individual's nutritional and health status. These measures are widely used to assess body composition, monitor physical development, and evaluate the effectiveness of lifestyle interventions. Among them, BMI is the most commonly employed tool to classify individuals as underweight, normal, overweight, or obese based on a simple height-to-weight ratio. However, while BMI offers a useful population-level screening metric, it does not distinguish between muscle mass and fat mass, nor does it provide insight into fat distribution—factors increasingly recognized for their importance in health risk stratification.

With the rising prevalence of obesity and the limitations associated with conventional interventions—such as pharmacological treatments and bariatric surgery—there is a growing interest in non-invasive, holistic, and sustainable alternatives. One such alternative gaining widespread recognition is **yoga**, an ancient Indian discipline that integrates physical postures (*asanas*), controlled breathing (*pranayama*), and meditation (*dhyana*) to promote overall well-being. Unlike high-impact exercise routines, yoga provides a low-intensity,

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adaptable form of physical activity that is accessible across diverse age groups and fitness levels. Its unique combination of physical movement, mental discipline, and spiritual awareness offers a multifaceted approach to health promotion and disease prevention.

Research has increasingly demonstrated that regular yoga practice can positively influence key anthropometric variables and BMI. Studies have reported reductions in body weight, waist circumference, body fat percentage, and overall improvements in physical fitness and quality of life following structured yoga interventions. The underlying mechanisms include enhanced metabolic efficiency, improved endocrine regulation, reduced stress and cortisol levels, mindful eating behavior, and hormonal balance—each contributing to healthier body composition and weight control.

This review-based study aims to explore and synthesize the existing scientific literature on the impact of yoga on anthropometric parameters and BMI. By critically analyzing empirical research findings, this paper seeks to offer a comprehensive understanding of how yoga can serve as a preventive and therapeutic strategy in the management of obesity and related health disorders. The study is particularly relevant for healthcare professionals, physical educationists, and public health policymakers who are seeking evidence-based, integrative approaches to address the obesity epidemic through sustainable and culturally grounded interventions.

Understanding Anthropometric Parameters and BMI

Anthropometric measurements are scientific techniques used to assess the size, shape, and composition of the human body. These measurements are essential for evaluating an individual's growth, nutritional status, physical development, and risk of developing chronic health conditions. In both clinical and research settings, anthropometric parameters serve as reliable, non-invasive, and cost-effective tools for health assessment and monitoring changes over time.

Key Anthropometric Parameters

1. **Body Weight and Height:**

Body weight is the most basic measurement used to assess body mass. It is an important indicator when evaluating overall health and monitoring changes during interventions such as diet or exercise programs.

Height is measured to assess linear growth, especially important during childhood and adolescence. When combined with weight, it provides insight into proportional development and health status.

2. **Waist and Hip Circumference:**

Waist circumference measures the abdominal girth and is a key indicator of central (visceral) fat, which is strongly linked to metabolic diseases like diabetes and cardiovascular disorders.

Hip circumference is measured at the widest point around the buttocks. It provides information about lower-body fat distribution.

3. **Waist-Hip Ratio (WHR):**

WHR is the ratio of the circumference of the waist to that of the hips. It reflects fat distribution in the body. A higher WHR indicates greater abdominal fat accumulation, which is a known risk factor for heart disease, stroke, and type 2 diabetes.

WHO guidelines consider a WHR above 0.90 for males and 0.85 for females as indicative of increased health risk.

4. **Mid-Upper Arm Circumference (MUAC):**

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MUAC is commonly used in nutritional assessments, especially in children and older adults. It provides insights into muscle mass and fat stores in the upper arm and is a quick method for identifying undernutrition.

5. **Skinfold Thickness:**

Skinfold measurements are taken using calipers at various sites of the body such as the triceps, biceps, subscapular, and suprailiac areas. These measurements help estimate body fat percentage by assessing the thickness of subcutaneous fat layers.

When performed accurately, skinfold measurements can give a reliable estimation of total body fat.

Body Mass Index (BMI)

Body Mass Index (BMI) is a widely utilized method for classifying an individual's weight status relative to their height. The calculation is performed using the formula:

BMI = weight (kg) / height (m)^2

The World Health Organization (WHO) defines BMI categories as follows:

- **Underweight:** BMI less than 18.5
- **Normal weight:** BMI between 18.5 and 24.9
- **Overweight:** BMI between 25 and 29.9
- **Obese (Class I):** BMI between 30 and 34.9
- **Obese (Class II):** BMI between 35 and 39.9
- **Obese (Class III or Morbid Obesity):** BMI 40 and above

While BMI does not differentiate between adipose tissue and muscle mass, and may not accurately reflect body composition in athletes or individuals with elevated muscle mass, it remains a practical and effective screening tool for population-level health assessments.

Significance in Health and Physical Education

Anthropometric parameters and BMI are valuable for physical education professionals, trainers, and healthcare providers in developing personalized fitness plans, monitoring progress, and preventing lifestyle-related diseases. These indicators also help in identifying at-risk individuals who may benefit from interventions such as yoga, diet modification, or structured physical activity programs.

Mechanisms through which Yoga Impacts Anthropometric Parameters and BMI

Yoga, though traditionally associated with spiritual and mental well-being, has profound physiological effects on the human body. Scientific studies and clinical observations have shown that regular yoga practice leads to beneficial changes in anthropometric parameters and body mass index (BMI). The following mechanisms explain how yoga brings about these changes:

1. Caloric Burn and Muscle Toning

Although yoga is generally considered a low to moderate-intensity physical activity, it still contributes to **caloric expenditure** and **muscle strengthening**. Many dynamic forms of yoga such as **Vinyasa**, **Power Yoga**, and **Ashtanga Yoga** involve continuous movement that increases heart rate and energy expenditure. Even static postures in **Hatha Yoga** require the engagement of core and peripheral muscles, leading to **muscle toning and improved body posture**.

- Sustained muscle engagement during asanas builds **lean muscle mass**, which in turn boosts the **basal metabolic rate (BMR)**.

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- Increased muscle mass and toned musculature help in **fat oxidation**, thereby contributing to **reduction in overall body fat percentage**.
- Over time, these physical effects help lower **waist circumference**, **body weight**, and **BMI**.

2. Endocrine and Metabolic Regulation

Yoga has a direct influence on the body's **endocrine system**, which regulates hormonal secretions responsible for metabolism, energy balance, and fat storage. Through consistent practice:

- Yoga **improves insulin sensitivity**, which enhances glucose uptake by cells, preventing fat accumulation.
- It positively affects the **thyroid gland**, which regulates metabolism. Better thyroid function leads to more efficient calorie utilization and energy balance.
- Regular yoga practice increases **digestive efficiency** and enhances the function of the **liver and pancreas**, organs critical to metabolism and weight regulation.
- Metabolic regulation helps in **redistribution of fat**, reducing visceral fat (fat around internal organs), which is directly associated with health risks like cardiovascular disease and type 2 diabetes.

3. Mindful Eating and Stress Reduction

One of yoga's most powerful tools is its ability to cultivate **mindfulness**, which includes being aware of one's bodily needs, emotional triggers, and eating patterns.

- Yoga reduces levels of **cortisol**, a stress hormone linked to **increased appetite and abdominal obesity**. High cortisol levels can lead to cravings for high-calorie, sugary foods and encourage fat storage, especially in the abdominal region.
- Through practices like **pranayama (breathing exercises)** and **dhyana (meditation)**, yoga activates the **parasympathetic nervous system** (rest-and-digest mode), which calms the body and mind.
- Individuals who practice yoga regularly tend to become more conscious of what and how much they eat, leading to **healthier food choices** and **reduced binge eating**.
- This **behavioural shift** contributes significantly to long-term weight management and reduction in BMI.

4. Hormonal Balance and Appetite Regulation

Yoga helps balance key hormones involved in hunger and satiety, such as **ghrelin** (hunger hormone) and **leptin** (satiety hormone).

- Regular yoga practice has been associated with **decreased ghrelin levels** and **increased leptin sensitivity**, leading to **reduced food intake** and enhanced satiety.
- The practice also supports the **hypothalamic-pituitary-adrenal (HPA) axis**, which plays a central role in regulating stress responses and hormonal rhythms.
- Improved hormonal balance results in a **regulated appetite**, reduction in emotional or stress-induced eating, and better adherence to portion control.

Review of Literature

A growing body of literature supports the effectiveness of yoga as a non-pharmacological intervention for improving anthropometric parameters and managing BMI. This review highlights key research studies that

demonstrate the physiological and psychological benefits of yoga, particularly in relation to weight management, body composition, and metabolic health.

- **Kumar et al. (2019)** conducted a 12-week intervention study on middle-aged women and reported significant reductions in BMI and waist circumference following regular yoga practice. These findings indicate that yoga can be a beneficial strategy in combating obesity in adult females.
- **Telles et al. (2018)** examined the effects of yoga practice on weight and waist-hip ratio (WHR) and found notable improvements in both. The study showed that yoga was effective in reducing body fat percentage and central obesity, which are critical risk factors for metabolic syndrome.
- **Ross and Thomas (2010)**, through a meta-analysis, concluded that yoga is equally or more effective than aerobic exercises in improving body composition and reducing BMI. Their review emphasized the added advantage of yoga in stress reduction and enhancing overall well-being.
- **Satyanarayana et al. (2021)** evaluated a structured yoga program's impact on overweight college students and found marked improvements in lean muscle mass and reductions in body fat percentage. Their findings support yoga's role in reshaping body composition and promoting physical fitness.
- **Asiah et al. (2023)** conducted a systematic review and meta-analysis to assess the impact of yoga on obesity-related outcomes. Their study validated yoga's role in improving anthropometry, quality of life, and lipid profile in obese individuals. The analysis advocated yoga as a cost-effective, holistic intervention with both preventive and therapeutic benefits.
- **Nongkhai et al. (2022)** explored the effects of online yoga programs during the COVID-19 pandemic and found significant reductions in body weight and waist circumference among overweight female students. Their findings point toward yoga's adaptability and its potential in digital and remote health promotion initiatives.
- **Karak, Jana, and Manna (2015)** focused on the physiological effects of yoga on college students and observed significant changes in body weight, BMI, and flexibility. This study supports the incorporation of yoga into the physical education curriculum for promoting youth fitness and health.
- **Suwannakul et al. (2024)** conducted a randomized controlled trial on overweight and obese female university students to evaluate the effects of Surya Namaskar yoga. The intervention led to reductions in stress, BMI, waist circumference, and improvements in overall physical fitness. This highlights the integrated physical-mental benefits of traditional yogic sequences.
- **Caldwell et al. (2022)** performed a systematic review focusing on yoga's influence on energy balance components in overweight or obese adults. Their review concluded that yoga promotes energy expenditure, improves eating behavior, and contributes to weight loss through stress reduction and mindful practices.
- **B. P. A. (2011)** studied the effects of yoga-pranayama on type 2 diabetic patients and found improvements in body composition, blood glucose levels, and waist-hip ratio. This suggests that yoga can be an effective complementary therapy for managing metabolic conditions.
- **Batrakoulis (2022)** provided a topical review of psychophysiological adaptations to yoga among overweight and obese individuals. The study documented significant improvements in stress management, cardiovascular fitness, flexibility, and body composition, reinforcing the role of yoga in holistic health.
- **Telles et al. (2014)** compared the effects of yoga and walking in overweight adults and found that yoga was more effective in reducing BMI and waist circumference. Their findings highlight yoga's dual role in physical and psychological health improvement.

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- **Yadav et al. (2016)** explored the impact of a short-term yoga-based lifestyle intervention on health-related quality of life in overweight and obese subjects. The results showed improved vitality, emotional well-being, and a reduction in BMI, indicating that even brief yoga programs can bring meaningful health benefits.
- **Yadav and Yadav (2021)** evaluated a 12-week yoga intervention on Indian adults with metabolic syndrome. The study reported reductions in the metabolic syndrome z-score, improvements in body composition, and enhanced quality of life. These findings underscore yoga's therapeutic value in managing complex health conditions.

Discussion

The growing prevalence of obesity and its associated comorbidities such as cardiovascular disease, type 2 diabetes, and metabolic syndrome has prompted researchers and healthcare practitioners to explore sustainable, non-pharmacological interventions. The findings of this review underscore the effectiveness of yoga as a holistic tool in addressing excess body weight and unfavorable anthropometric characteristics.

Across the literature, consistent patterns emergeyoga interventions—especially those integrating *asanas* (physical postures), *pranayama* (breath control), and *dhyana* (meditation)—contribute to statistically significant reductions in Body Mass Index (BMI), waist circumference, body fat percentage, and weight. Studies such as those by **Kumar et al. (2019)** and **Satyanarayana et al. (2021)** provide strong empirical support for yoga's positive effect on body composition. These changes are not only cosmetic but carry implications for long-term metabolic health and disease prevention.

The mechanisms underlying these improvements are multifactorial. Physiologically, yoga increases caloric expenditure through muscle engagement and improved basal metabolic rate. The findings also indicate enhanced insulin sensitivity, improved digestive efficiency, and hormonal regulation—particularly involving the thyroid and adrenal glands—which together promote better metabolic balance. This is consistent with research by **Caldwell et al. (2022)** and **B.P.A. (2011)** who demonstrated endocrine benefits and improved metabolic parameters through regular yoga practice.

In addition to its physiological impact, yoga promotes behavioral changes through increased mindfulness. By improving body awareness and reducing stress, yoga reduces the tendency toward emotional or stress-induced eating—a major factor contributing to central obesity. Studies by **Telles et al. (2014)** and **Yadav et al. (2016)** demonstrate that individuals practicing yoga report not only physical improvement but also enhanced mental well-being and emotional resilience, which further supports sustained lifestyle changes.

The unique advantage of yoga lies in its accessibility and adaptability. Unlike many exercise regimens that may not be suitable for older adults, sedentary individuals, or people with comorbid conditions, yoga offers a low-impact, inclusive form of physical activity. Moreover, the psychological benefits such as reduced anxiety and improved mood, as evidenced by **Batrakoulis (2022)**, further reinforce adherence and make yoga a more sustainable long-term intervention.

Another dimension brought forward by studies like **Suwannakul et al. (2024)** and **Nongkhai et al. (2022)** is yoga's adaptability to digital formats, enabling remote delivery. This expands its utility in reaching populations with limited access to fitness centers or those restricted by pandemics or mobility issues.

Despite the promising findings, it is important to note some limitations observed in the reviewed literature. Variability in the type of yoga, duration of intervention, and the demographic characteristics of participants make it challenging to generalize findings universally. Furthermore, many studies use small sample sizes and short durations, limiting insights into the long-term sustainability of these outcomes. Future research must

focus on larger-scale, longitudinal studies comparing yoga to other lifestyle interventions to establish its comparative efficacy more robustly.

Conclusion

This review establishes that yoga serves as a powerful, holistic approach to improving anthropometric health and managing Body Mass Index (BMI). Through its unique integration of physical movement, breath regulation, and mental focus, yoga addresses multiple dimensions of health simultaneously physical, metabolic, emotional, and behavioral. The evidence suggests that yoga is not only effective in reducing weight and body fat but also in enhancing metabolic efficiency and psychological resilience.

Unlike conventional exercise regimens, yoga promotes mindful living and stress reduction, which are essential for sustained lifestyle changes. The reviewed literature underscores its effectiveness not just as a physical activity, but as a comprehensive health intervention, especially valuable in combating the rising prevalence of obesity and lifestyle disorders in modern society.

Incorporating yoga into regular routines or public health strategies offers a promising, scalable, and sustainable solution for enhancing individual and community health. Future research should focus on long-term comparative studies and interventions across diverse populations to further validate its efficacy and optimize its application in health and wellness programs.

Recommendations for Future Research

While the current literature strongly supports the positive effects of yoga on anthropometric parameters and BMI, further research is essential to deepen and broaden the understanding of yoga's long-term benefits and mechanisms. The following recommendations are suggested for future studies:

1. **Longitudinal Studies**: There is a need for long-term studies that examine the sustained effects of regular yoga practice on body composition, metabolic health, and weight management across different age and gender groups.

2. **Comparative Analysis with Other Exercise Modalities**: Future research should compare yoga with other forms of physical activity, such as aerobic exercise, resistance training, and walking, to evaluate relative effectiveness in improving anthropometric and psychological parameters.

3. **Intervention-Based Studies in Diverse Populations**: More intervention-based studies are required across various population segments, including children, elderly, individuals with chronic diseases, and socioeconomically disadvantaged groups to determine the generalizability and adaptability of yoga practices.

4. **Impact of Specific Yoga Styles**: Future investigations should focus on the comparative effectiveness of different styles of yoga (e.g., Hatha, Ashtanga, Vinyasa, Iyengar, Surya Namaskar) to identify which forms offer the greatest health benefits for specific demographic groups.

5. **Technological Integration**: Given the rise in virtual health programs, studies should evaluate the efficacy and user engagement of online or app-based yoga interventions, particularly for individuals with limited mobility or access to in-person sessions.

6. **Behavioral and Psychological Mechanisms**: There is scope for deeper exploration into how yoga influences behavioral patterns such as eating habits, stress coping mechanisms, body image perception, and lifestyle choices that contribute to improved anthropometric outcomes.

7. **Biochemical and Hormonal Correlates**: Further research should explore the biochemical and hormonal changes (e.g., cortisol, insulin, leptin, ghrelin) associated with yoga interventions, providing a more detailed understanding of internal physiological shifts.

8. **Integration into Public Health Policy**: Research on the feasibility and effectiveness of incorporating yoga-based modules into school curricula, workplace wellness programs, and community health initiatives could support its wider implementation as a preventive health strategy.

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eISSN 2583-6986
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