

## Original Research Article

# Impact of short term yoga on anthropometric measures, body composition and serum lipid profile in overweight and obese adults: a pilot study

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## ABSTRACT

**Background:** Excess bodyweight is the sixth most important risk factor contributing to the overall burden of disease worldwide. Overweight and obesity have been called a global epidemic by the World Health Organization. The epidemic reflects progressive decreases in physical activity, together with substantial dietary changes with passive over-consumption of energy despite the neurobiological processes controlling food intake. This pilot study was undertaken to find out the impact of yoga practice in overweight and obese individuals.

**Methods:** total of 32 subjects with BMI,  $\geq 23$  to  $\leq 40$  were selected for the study for a single group pre-post trial. The subjects had undergone yogic intervention for one hour in the morning for 10 days. The changes in anthropometric measures, body composition and serum lipid profile were assessed before and after 10 days of yoga therapy.

**Results:** The data obtained was verified for normal distribution and analysed using paired t-test with SPSS (version 20.0) package. Significant decrease in body weight, BMI, triglycerides and total cholesterol in obese subjects and a significant decrease in body weight, BMI and triglycerides of overweight subjects was observed.

**Conclusions:** The study demonstrates the efficacy of yogic practices on anthropometric measures and lipid profile subjects with overweight and obesity.

**Keywords:** Body mass index, Obesity, Overweight, Yoga

## INTRODUCTION

Obesity and overweight are chronic medical conditions associated with an excessive fat accumulation in the body that may impair health and increases the risk of morbidity from several pathologies, including hypertension, dyslipidemia, type 2 diabetes, coronary heart disease, stroke, non-alcoholic fatty liver disease, osteoarthritis, sleep apnea, and endometrial, breast, prostate, and colon cancers.<sup>1</sup> It is a metabolic disorder affecting the people

throughout the world and commonly caused by a combination of excessive food energy intake, lack of physical activity, genetic susceptibility, and other psychological problems.<sup>2</sup> Overweight and obesity have been called a global epidemic by the World Health Organization. Recent WHO Global estimates for overweight and obese had shown that in 2016, more than 1.9 billion adults aged 18 years and older were overweight. Of these over 650 million adults were obese.<sup>3</sup> The prevalence of adolescent and adult obesity is

increasing at an alarming rate. Studies have demonstrated that almost 30 to 65% of urban Indian population are overweight or obese or have abdominal obesity.<sup>4</sup>

Body mass index (BMI) is considered as an indicator and diagnostic criteria of overweight and obesity. It is calculated by dividing the weight in kilograms with the square of height calculated in meters.<sup>5</sup> Considering the fact that Asians have a higher percentage of body fat than Caucasian people of the same age, sex and BMI, BMI categories for Asian populations have been revised as per the suggestions by the World Health Organization (WHO) which defines overweight as  $BMI \leq 23.0$  to  $\geq 24.9 \text{ kg/m}^2$  and obesity as a  $BMI \geq 25 \text{ kg/m}^2$ .<sup>6</sup>

Obesity is associated with alterations in lipid metabolism, insulin resistance, and the metabolic syndrome, particularly with abdominal obesity. The hallmark of dyslipidemia in overweight and obesity is elevated fasting and postprandial TG in combination with the predominance of small dense LDL and low HDL-cholesterol.<sup>7</sup> Approximately 60-70% of obese patients are dyslipidemic while 50-60% of overweight patients are dyslipidemic.<sup>8</sup>

Yoga is an ancient Indian way of life, which includes practice of specific techniques such as yoga asanas (postures), breathing practices (pranayamas), and meditation to attain the highest level of consciousness.<sup>9</sup> Regular practice of yoga not only gives sufficient amount of exercise needed by the body but also helps in bringing normalcy, balance, and stability through effortless discipline. Yoga is one of the good ways for slow and steady weight reduction because it offers gentle and subtle mind management techniques. It also reduces the perceived stress, anxiety and depression which are the major reasons for overeating.<sup>10</sup>

Hence, this pilot study was undertaken to find the impact of short-term yoga practice on anthropometric measures, body composition and serum lipid profile in overweight and obese adults.

## METHODS

### Participants

A total of 32 subjects (group average age in years,  $30.3 \pm 2.8$ ) with BMI,  $\geq 23.0$  to  $\leq 40$  were recruited for the study for a single group pre-post trial that have enrolled in yoga camps. None of them had done yoga before. The selection criteria included BMI  $\geq 23$  to  $\leq 40 \text{ kg/m}^2$ , absence of a disease which could have contributed to obesity (e.g. hypothyroidism, polycystic ovarian syndrome) or overweight, and subjects without conditions which required treatment which could have resulted in weight gain (e.g. conditions which required treatment with steroids). The study design was explained to them and they gave their signed consent to participate. The study was approved by the ethics committee of the institution.

## Assessments

### Body mass index

The body mass index (BMI) was calculated as the body weight (kg), in light clothing and without shoes, divided by height (in metres) squared. Body weight was measured to 0.05kg using an electronic balance (GTEP Essae, Eeroka Ltd). Height was measured to the nearest 0.1cm (Anthropometric tape, Global medical devices, Maharashtra.).

### Waist circumference

The waist circumference was measured to the nearest 0.1 cm in a horizontal plane midway between the inferior costal margin and the iliac crest.

### Hip circumference

Hip circumference was measured around the pelvis at the point of maximal protrusion of the buttocks. The ratio of the waist circumference to the hip circumference was derived and is a ratio between the fat stored centrally inside the abdomen (waist circumference) and fat stored peripherally (hip circumference).

### Body composition

Body composition was measured by using Tanita TBF-410 Pro body composition analyzer.

### Biochemical measurements

For biochemical estimations, about 5 ml of venous blood was collected from all the participants before and after the yoga practice and the serum was used for the estimation of lipid profile using (ERBA Lipid Profile Reagents, TransAsia bio-medicals).

## Intervention

Participants of the study have undergone one hour of yoga practice session in the morning between 6 am to 7.30 am for 10 days as a residential retreat. Each one hour of yoga session included yoga postures, breathing techniques and meditation. Participants were provided a low calorie vegetarian diet that is individually planned and takes into account of the patient's obese or overweight status in order to create a deficit of energy up to 500 to 1000kcal/day. The details of the yoga intervention are given in Table 1.<sup>11</sup>

### Statistical Analysis

For the purpose of analysis, subjects recruited for the study were categorised into two groups. The subjects who had BMI  $\leq 23.0$  to  $\geq 24.9 \text{ kg/m}^2$  were categorised as overweight group and those who had BMI  $\geq 25 \text{ kg/m}^2$  as obese group. The data obtained was verified for normal

distribution and analysed using paired t-test with SPSS (Version 20.0) package.  $p < 0.05$  was considered the level of significance.

**Table 1: Details about the yoga program.**

Yoga practice	Rounds	Duration (Min)
Sukhasana (Easy posture)+ Prarthana mantra (Universal Prayer)	1	1
Standing series of asanas	Suryanamaskar	5
	Ardhachakrasana	1
	Trikonasana (Triangular pose)	1
Supine series of Asanas	Uttitapadasana	1
	Vipareetakarani	1
	Naukasana	1
	Pavanamuktasana	1
Prone series of Asanas	Bhujangasana	1
	Shalabhasana	1
	Dhanurasana	1
	Navasana	1
Instant relaxation Technique	1	2
Pranayama Series	Bhastrika (bellows breathing)	36-50 strokes
	Kapalabhati (High frequency yoga breathing)	250-300 strokes
	Anulom-vilom (nostril breathing)	20-25 rounds
	Right nostril breathing	20-25 rounds
Deep Relaxation technique	-	20
Total Duration	60 Minutes	

## RESULTS

The present study was conducted to assess the efficacy of yoga practice on anthropometry variables, body composition and serum lipid profile level in overweight and obese adults. The assessments were made at 1<sup>st</sup> day (Pre) and at the end of 10 days (post) of yoga intervention.

Following 10 days of yoga practice positive changes in anthropometric measurements were found in the present in study participants. There was a significant ( $p < 0.01$ ) decrease in body weight, BMI, and non significant decrease in waist circumference, hip circumference, and waist hip ratio was observed in overweight subjects. Body weight was reduced by  $4.2 \pm 0.7$ kg, BMI was reduced by  $1.59 \pm 0.27$ , and waist circumference was reduced by  $2.7 \pm 1.3$ cm.

In obese subjects also significant ( $p < 0.01$ ) decrease in body weight, BMI, and non significant decrease in waist circumference, hip circumference, and waist hip ratio was observed. Body weight was reduced by  $4.8 \pm 0.9$ kg, BMI was reduced by  $1.76 \pm 0.34$ , and waist circumference was reduced by  $2.5 \pm 1.2$ cm.

Positive changes were also observed in fat mass of the overweight and obese subjects. There was a non significant decrease in fat mass, lean body mass and body water was observed. The fat mass was decreased by  $1.5 \pm 0.27$ Kg in overweight and  $1.6 \pm 1.0$ kg in obese subjects.

**Table 2: Variables assessed at the beginning (baseline) and end (post) of the yoga intervention.**

Variables	Overweight (n=14)		Obese (n=18)	
	Baseline	Post test	Baseline	Post test
Body weight (Kg)	64.0 $\pm$ 4.7	59.8 $\pm$ 4.7**	88.3 $\pm$ 14.1	83.5 $\pm$ 14.2**
BMI (Kg/m <sup>2</sup> )	24.0 $\pm$ 0.5	22.4 $\pm$ 0.6**	32.0 $\pm$ 3.6	30.3 $\pm$ 3.7**
Waist circumference(cm)	90.6 $\pm$ 5.5	87.9 $\pm$ 6.1	100.0 $\pm$ 10.9	97.5 $\pm$ 10.9
Hip circumference(cm)	106.5 $\pm$ 4.9	104.2 $\pm$ 4.7	109.8 $\pm$ 8.2	107.1 $\pm$ 8.1
Waist/Hip ratio	0.85 $\pm$ 0.02	0.84 $\pm$ 0.02	0.91 $\pm$ 0.04	0.90 $\pm$ 0.04
Fat mass (Kg)	16.9 $\pm$ 4.1	15.4 $\pm$ 3.9	28.2 $\pm$ 6.9	26.6 $\pm$ 6.7
Lean body mass (Kg)	47.1 $\pm$ 5.2	46.4 $\pm$ 4.9	60.0 $\pm$ 8.3	59.2 $\pm$ 8.5
Body water (Kg)	40.2 $\pm$ 3.9	38.2 $\pm$ 3.9	39.6 $\pm$ 7.5	37.4 $\pm$ 7.3
Triglycerides(mg/dL)	137.7 $\pm$ 58.2	108.1 $\pm$ 47.0**	182.2 $\pm$ 42.9	154.7 $\pm$ 33.4**
Total Cholesterol(mg/dL)	191.9 $\pm$ 29.3	181.0 $\pm$ 17.1	230.7 $\pm$ 43.4	217.3 $\pm$ 28.1**
VLDL (mg/dL)	19.7 $\pm$ 4.4	18.2 $\pm$ 5.6	27.2 $\pm$ 6.4	25.1 $\pm$ 5.3
LDL (mg/dL)	136.9 $\pm$ 29.1	128.2 $\pm$ 18.0	165.9 $\pm$ 36.5	157.0 $\pm$ 24.0*
HDL (mg/dL)	35.3 $\pm$ 5.9	34.7 $\pm$ 6.2	37.6 $\pm$ 5.4	36.9 $\pm$ 4.9

All values are Mean  $\pm$  Standard deviation. Statistical test used: Paired Student's 't' test for comparing baseline and Post assessment values; \*  $p < 0.05$ , \*\*  $p < 0.01$ ; BMI-Body Mass Index, VLDL-Very low density lipoprotein, LDL-Low density lipoprotein, HDL-High density lipoprotein

Ten days of yoga practice also had shown favourable changes in lipid profile of the study participants. There

was a significant ( $p < 0.01$ ) decrease in triglyceride level and non significant decrease in total cholesterol, LDL

cholesterol, VLDL cholesterol and increase in HDL cholesterol was observed in overweight subjects. Triglyceride was reduced by  $29.6 \pm 16.4$  mg/dL, total cholesterol by  $10.9 \pm 23.8$  mg/dL and LDL cholesterol by  $8.7 \pm 24.9$  mg/dL. In obese subjects also significant ( $p < 0.01$ ) decrease in triglyceride, total cholesterol and LDL cholesterol and non significant decrease in VLDL cholesterol and increase in HDL cholesterol was observed. Triglyceride was reduced by  $27.5 \pm 14.4$  mg/dL, total cholesterol by  $13.4 \pm 20.7$  mg/dL and LDL cholesterol by  $10.9 \pm 15.9$  mg/dL. These changes have been indicated in Table 2.

## DISCUSSION

The present pilot study was undertaken to assess the short-term impact of yoga practice on the selected variables in overweight and obese subjects. Results of the study reveals that there is significant ( $p < 0.01$ ) decrease in body weight, BMI, and triglycerides and significant decrease ( $p < 0.05$ ) in LDL-cholesterol in case of obese subjects. But in overweight subjects significant ( $p < 0.01$ ) decrease is seen only body weight and BMI.

Increased body weight due to excessive deposition of fat predominantly in the abdominal region is the major risk factor associated with overweight and obesity. Earlier studies have shown that it is associated with risk of many health problems, including diabetes, cardiovascular diseases, stroke, non-alcoholic fatty liver disease, osteoarthritis, sleep apnea, and endometrial, breast, prostate, and colon cancers (1). Present study results indicate significant reduction in bodyweight followed by yoga practice. The results are at par with the earlier studies, showing practice of yoga for different duration with changes in body weight.<sup>11,12</sup> According to national weight management guidelines it says reduction in body weight is very important in subjects with overweight or obesity because a modest weight loss of 5-10% of body weight leads to significant improvement in cardio-metabolic risk factors.<sup>13</sup> Recent systematic review analysed the effects of yoga on weight-related outcome, reported that yoga can be preliminarily considered as safe and effective intervention for weight reduction.<sup>14</sup>

Practice of yoga for 10 days has shown effective reduction in fat mass in both overweight and obese individuals. We can speculate practice of yoga for a longer duration being beneficial for further reduction in fat mass. Studies have shown yoga practice for two months and more with a significant reduction in the percentage of body fat in obesity.<sup>15,16</sup> Decrease in body fat is more advantageous compared to mere body weight because increase in fat percentage is the major risk factor for associated morbidity with obesity.<sup>17</sup> Recent study has shown waist circumference (WC) is the better indicator of overweight and obesity, since it is better associated with metabolic risk factors than BMI and Waist-hip ratio.<sup>18</sup> Present study results show decrease in WC

compared to the baseline values both in overweight and obese subjects.

Results of our study indicate significant improvement in lipid profile parameters viz., decrease in total cholesterol, LDL-cholesterol and triglycerides. But the HDL-cholesterol is slightly reduced in both overweight and obese adults. Several studies have confirmed that the yoga training significantly decreases TG, and LDL-cholesterol.<sup>19-21</sup> The decrease in lipid levels can be attributed to the changes gained in body weight. The improvement in lipid profile with practice of yoga could be due to increased hepatic lipase and lipoprotein lipase. This would increase the uptake of triglycerides by adipose tissue and affect the lipoprotein metabolism.<sup>22</sup> Another study has shown insignificant decrease in HDL-cholesterol followed by yoga intervention. In contrast with present study results, studies with long term yoga intervention have shown improvement in HDL-cholesterol.<sup>20,21</sup>

## CONCLUSION

The findings of the study suggest that yoga can be used as an effective life-style modality to reduce the body weight and to produce significant improvement in anthropometric measurements and lipid profile in subjects of overweight and obesity. The findings can be attributed to the practice of yoga which provides much needed physical exercise for overweight and obese subjects and thereby enhances the energy expenditure. Moreover, yoga also reduces the perceived stress, anxiety and depression which are the major reasons for overeating.

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