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## **Effectiveness of 12 weeks yoga practices on body composition parameters among healthy male college students**

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**Abstract**---Background: The stressful situation may result in obesity, which is linked to a variety of diseases. Aims: The current study sought to determine whether yoga has an effect on body composition reduction. Methods: The current study included 95 (n = 95) healthy male volunteers aged 18-24 years, with 35 (n = 35) volunteers excluded. The remaining 60 volunteers (n = 60) were divided into two groups at random: (a) Yoga Group (n = 30) and (b) Control Group (n = 30). The yoga group received 60 minutes of yoga training per day, six days per week for 12 weeks, while the control group received no yoga training. Body composition parameters were assessed in both groups at baseline, before yoga training (0 week), and after the training (12 weeks). Results: Significant reduction ( $P < 0.001$ ) in the percentage of body fat; levels were noted in the yoga group after 12 weeks when compared to baseline data (0 week). However, there was no significant difference in height, weight, body mass index, body surface area and lean body mass among the yoga group after 12 weeks when compared to baseline data. These changes might be due to yoga training. Conclusions: Regular yoga practice reduces body fat.

Yoga practices may be helpful to reduce the chance of occurrence of various diseases and helps to maintain normal healthy lifestyle.

**Keywords**---yoga practices, body composition parameters, healthy male, college students.

## **Introduction**

Stress has been defined as "the body's nonspecific response to any noxious stimuli." Sustained stress can have a variety of pathophysiological effects on the body.<sup>[1,2]</sup> Persistently stressful conditions can result in an excess of free radicals and an oxidative burden.<sup>[3]</sup> Disruptions in the normal redox state of tissues can cause toxic effects by producing peroxides and free radicals, which damage all cell components, including proteins, lipids, and DNA.<sup>[4]</sup> Many diseases in humans are caused by oxidative stress, including sickle cell disease, atherosclerosis, Parkinson's disease, Alzheimer's disease, heart failure, myocardial infarction, schizophrenia, Bipolar disorder, fragile X syndrome, and chronic fatigue syndrome.<sup>[5]</sup> Natural antioxidants are available to scavenge free radicals and prevent oxidative damage to biological membranes. Enzymatic antioxidants are one type of antioxidant (intracellular), Superoxide dismutase (SOD), glutathione (GSH) peroxidase, and catalase are examples of antioxidant enzymes (CAT).<sup>[6]</sup> In addition to enzymatic antioxidants, are the major natural antioxidants, the majority of which are obtained from natural sources through dietary intake and include vitamins A, C, E, and carotenoids.<sup>[7]</sup> Abnormally high levels of peroxidation, combined with a decline in antioxidant defence mechanisms, can cause damage to cellular organelles, resulting in the oxidative stress formation<sup>[8]</sup> Stress has been linked to the depletion of several free radical detoxifying enzymes, including GSH peroxidase, CAT, and SOD.<sup>[9,10]</sup> Environmental factors and workload place stress on young workers, which can lead to oxidative stress. Stressful conditions, as well as changes in physiological factors, can lead to a variety of diseases. As a result, the number of working days is reduced, productivity is increased, and the amount spent on medication these impose a significant burden on employers and the country as a whole. Yoga has several subtypes and incorporates physical postures (asanas), controlled breathing (pranayama), deep relaxation, and meditation. It originated in ancient India. Yoga practise on a regular basis improves fitness and coordination of the brain and muscular activities.<sup>[11]</sup> Several studies on the effect of yoga on cardiorespiratory fitness<sup>[12]</sup> and oxidant antioxidant defence mechanism have been conducted in the Indian context.<sup>[13-15]</sup> However, there is little information on the effect of yoga on the body composition mechanism of the Tamil population of Tamilnadu, India. Based on the foregoing, the current study was designed to investigate the effects of yoga on body composition status in healthy adult males college students.

## **Methods**

### **Subject selection and experimental design**

For the current study, 95 (n = 95) healthy male volunteers between the ages of 18 and 24 were recruited at random from the Chengalpattu District in Tamil Nadu,

India. All volunteers were subjected to a medical examination by physicians. Thirty-five ( $n = 35$ ) volunteers were excluded from the study due to noncompliance with the inclusion criteria ( $n = 09$ ), refusal to participate ( $n = 08$ ), inability to perform yoga ( $n = 11$ ), and inability to follow the schedule ( $n = 07$ ). The remaining sixty ( $n = 60$ ) volunteers were divided into two groups at random: (a) Yoga Group (30) and (b) Control Group (30). The yoga group volunteers received yoga training, whereas the control group volunteers received no yoga training. Yoga instruction was provided by a qualified yoga instructor for 60 minutes per day, six days per week for a 12-week period, following a standard protocol. [16] Table 1 shows the yoga protocol in detail. Body composition parameters were estimated for each group. All parameters were recorded at baseline, before yoga training (0 week), and after the training (12 weeks). Table 1 shows the yoga training schedule in detail. The volunteers were informed about the study's purpose and potential complications, and written consents were obtained from them. Throughout the experiment, the volunteers were asked not to smoke or consume alcohol. Participants in the yoga group were instructed not to engage in any other physical activity for the duration of the study. The participants were instructed to continue eating their normal diet. The Institutional Ethical Committee approved the experimental protocol (Human Studies) (Ref No. SRMMCHRC/IEC/ 2021; date: 25.11.2021). The participant flow during the study is shown in Figure 1.

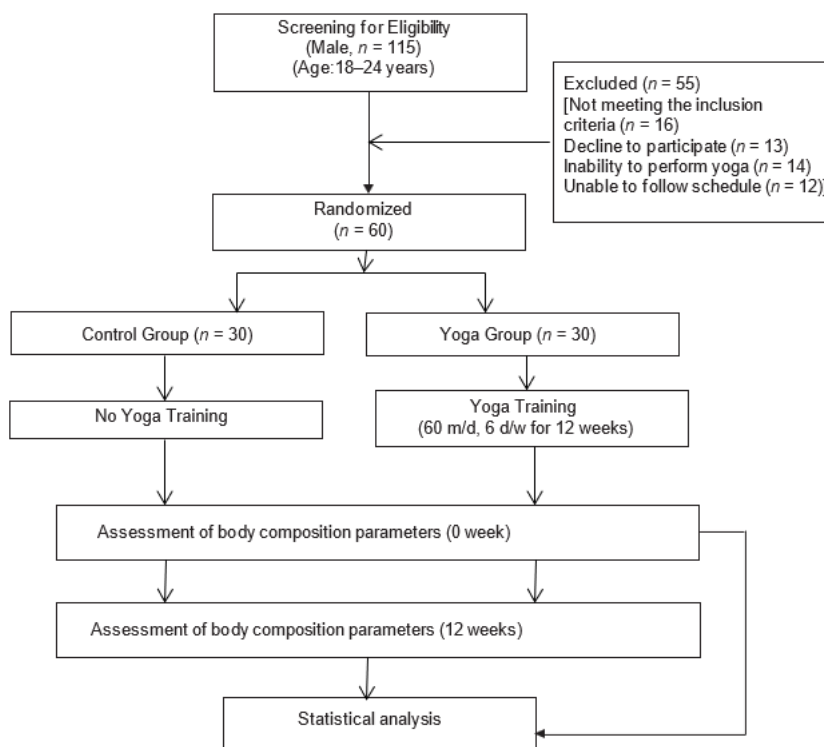


Figure 1. The flow chart of the experiment

## **Measurements**

### **Measurement of height (stature) and body mass**

The height was measured using a stadiometer (Seca 220, UK) with an accuracy of 0.5 cm. The participant stood erect, barefoot, with heels together and arms naturally hanging by the sides. The heels, buttocks, upper back, and sometimes, but not always, the back of the head were in contact with the vertical wall. During the measurement, the participant looked straight ahead and took a deep breath. The distance from the standing platform, to the highest position of the head (vertex), was measured with the help of stadiometer, which indicates the participants' height.<sup>[17]</sup> The height was measured in centimetres. The body mass index was determined using a standard electronic weighing machine (Seca Alpha 770, UK), having an accuracy recorded to the nearest 50 g. The participant stood straight in the centre of the weighing machine. The body mass index was measured in kilogrammes.<sup>[17]</sup>

### **Anthropometric and Body Composition Assessments**

Body height (cm) was measured using a stadiometer with standardized protocols. Bodyweight and composition were assessed using multi-frequency whole-body bioelectrical impedance analysis with an InBody 720 (Biospace Co., Ltd., Seoul, Korea). Subjects avoided exercising and caffeine, did not shower before testing, fasted overnight and arrived at the lab in the morning. They removed all metal objects from their bodies, and had to stand barefoot (standard mode) on an Inbody 720. Next, researchers gathered information about the subjects (age, sex, and height). The weight value was determined by the thumbs and four fingers of both hands touching the bottom electrode handle, and then the arms were dropped naturally. The torso was 15 degrees, facing forward, and the position was held until the end of taking the measurements (a total of 90 s). Speak or moving was not permitted during the measurements. Body mass index (BMI) was calculated as body mass divided by the square of the body height ( $\text{kg}\cdot\text{m}^{-2}$ ).

### **Training Intervention**

The yogic practices programs, comprising 60-min sessions weekly for 12 weeks, were conducted at the Yoga Centre of SRM IST (Fig. 1). Each session included 10-min warm-up, cool-down, and stretching periods. Under the guidance and supervision of yoga experts and faculty, subjects performed yogic practices. The yogic practiced were Jal Neti (nasal cleansing) once in a week; this is a process of cleaning the nasal passage with salt water and is essential in allowing free breathing. Shavashana (body awareness, 10-15 min) laying flat on back in the supine position. Bhujangasana (5 times in 3 min) lying flat on the stomach with the legs straight and the soles of the feet uppermost. Shashankasana (5 times in 3 min) sitting in Vajrasana then bending forward and placing the hand and foreheads rest on the floor in front of the knees. Ush trasana (5 times in 3 min) kneel and adjust the knees and feet so that they are separated by the same width as the hips. Hasthuthanasana (5 times in 3 min) inhale deeply and slowly raising the arms above the head bending the head slightly backward and look up at the hands. Naukasana (5 times in 3 min) spine straight sit and straight both legs up

both hand also up and catch on both legs thumb fingers. Trikonasana (5 times in 3 min) stand and both leg apart and straight, bend right side, right hand to touch right feet left hand straight upward. Parvatasana (5 times in 3 min) both hands up and stand. bent forward, palms touch the floor. Legs together. Vrikshasana (5 times in 3 min) the spine straight and stand right leg feet put on the left leg thigh strongly and stand one leg both hands up and namaskar mudra. Bhastrika Pranayama (5 times in 3 min) sit in any meditation pose, both hands up. Force fully exhale with hands down and normal inhale with hands up. Shiddhasana (changing the feet, 5 min) sitting with the legs straight in front of the body. Bending the right leg and placing the sole of the foot flat against the inner left thigh. Nadi Shodhan Pranayama (5 times in 6-7 min). OM Meditation (10 min) Sit in any meditative pose. Eyes should close. And mentally chant A-U-M with deep exhalation & deep inhalation. Total duration of these practices was 45-60 min/day, seven days in week till 12 weeks in the Department of yoga of the institute of SRMIST.

### Statistical analysis

The Shapiro-Wilk normality test was used to determine whether the data were normally distributed. The mean and standard deviation were used to express all of the data (SD). To determine the significant difference in intragroup and intergroup variables, an analysis of variance with repeated measures was performed, followed by multiple comparison (post hoc) tests. The significant level was chosen at 0.05 in each case. SSPSS 20 software for Windows [IBM, USA] was used for all statistical analyses.

### Results

#### Effect of yoga on body composition variables

When comparing the yoga group to the baseline data, the body composition variables revealed a significant reduction (P 0.001) in the percentage of body fat as well as total fat mass after 12 weeks. When compared to baseline data, there was no significant difference in height, body mass, BMI, BSA, or LBM among the yoga group after 12 weeks (0 week). Furthermore, at the end of 12 weeks, the yoga group had significantly (P 0.001) lower body mass, BMI, and body fat than the control group [Tables 2 and 3].

Table 2: Height and weight parameters of yoga and control group participants

Parameters	Groups			
	Yoga group		Control group	
	0 week	12 weeks	0 week	12 weeks
Height (cm)	171.1±6.8	171.1	169.3±4.1	169.3 (NS)±4.1
Body mass (kg)	60.1 <sup>###</sup> ±5.	(NS)±6.8	64.4±4.0	64.8 (NS)±5.1
BMI (kg/m <sup>2</sup> )	4	58.7 <sup>###</sup> ±6.2	22.5±1.2	22.8 (NS)±1.6
	20.5 <sup>###</sup> ±1.7	20.1 <sup>###</sup> ±1.2		
BSA (m <sup>2</sup> )	1.7	1.7	1.7±0.1	1.7 (NS)±0.1

(NS)±0.1

(NS)±0.1

(when compared to control group:  $###P<0.001$ ) All the data were expressed as mean  $\pm$  SD. ANOVA with repeated measures followed by multiple comparison (*post hoc*) tests were performed. NS=Not significant, BMI=Body mass index, BSA=Body surface area, ANOVA=Analysis of variance, SD=Standard deviation

Table 3: Body composition characteristics of yoga and control group participants

Parameters	Groups		
	Yoga group		Control group
	0 week	12 weeks	
Fat (%)	14.1 $###\pm$ 1.7 14.7 (NS) $\pm$ 2.3	10.4 $***###\pm$ 1.5 <u>12 weeks</u>	15.8 $\pm$ 2.6
Fat mass (kg)	7.9 $###\pm$ 1.2 9.2 (NS) $\pm$ 1.4	6.4 $***###\pm$ 1.2 <u>12 weeks</u>	9.6 $\pm$ 1.6
LBM (kg)	53.4 (NS) $\pm$ 5.0 55.9 $\pm$ 4.3	51.7 (NS) $\pm$ 4.6	54.8 $\pm$ 3.9

(when compared to baseline data:  $***P<0.001$  ) (when compared to control group:  $###P<0.001$ ,  $##P<0.01$ ), All the data were expressed as mean  $\pm$  SD. ANOVA with repeated measures followed by multiple comparison (*post hoc*) tests were performed. NS=Not significant, LBM=Lean body mass, ANOVA=Analysis of variance, SD=Standard deviation

## Discussion

Yoga can help you maintain good health and physical fitness. After 12 weeks of yoga training, a significant reduction in body fat was observed in the current study. The reduction in body fat could be attributed to the volunteers engaging in a high level of yogic exercise over a period of time, resulting in a lower body fat percentage. Yoga, which includes a variety of physical activities, posture changes, and repeated contractions and relaxations of the abdominal muscles, may be the cause of weight loss. Many authors made similar observations regarding body fat reduction after yoga training.[25,26] Zorofi et al. conducted another study.[27] This could be due to improper training load optimization and/or a short duration of yoga training. Obesity, cardiovascular disease, diabetes, and a variety of other complications can all be exacerbated by an increase in body fat.[25,26,28] Regular yoga practices may help to reduce body fat, which is necessary for living a diseasefree lifestyle. This study indicates that even a brief practice of yogic lifestyle can significantly reduce body composition and help in promoting healthy life.

## Conclusion

Regular yoga practice helps to maintain normal healthy lifestyle and physical fitness which is indicated by decreasing body fat. The findings of the study demonstrate the efficacy of yoga exercise on body composition parameters in healthy male participants. The findings of the present study suggest that yoga can be used as an effective lifestyle modality to reduce body composition and to

enhance anti-oxidant defense. Thus, regular practice of yoga may be helpful to body composition and maintain disease-free lifestyle.

### **Conflict of competing interest**

None of the authors have any competing interests concerning the research work.

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