



The Effect of Yoga practice on Muscle Fitness and Body Composition in Middle age Women with Overweight

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ABSTRACT: Type 2 diabetic besides hyperglycemia and deranged lipid profile is an impaired insulin secretion, peripheral insulin resistance and obesity which has become a major health concern worldwide. Yoga is a physical and mental discipline that originated in Indian culture over 2,000 years ago. The aim of the present study was to determine the impact of general program of yoga on the muscle fitness, body composition and metabolic risk factors in middle age women with overweight. Thirty middle age women with overweight were randomly assigned to the yoga intervention group or the control group. Muscle endurance and flexibility, fat percentage, body mass index (BMI), blood glucose and lipids levels were obtained, before and after 8 weeks of yoga practice. Data analyzed with independent t test by SPSS 19. Data indicates that significant increased in muscle endurance ($p = 0.012$) and flexibility ($p = 0.049$) occurred in yoga group but not in control group. Significantly decrease in BMI and body fat percentage than control group observed ($p = 0.0001$). There were no significant differences between control and yoga group in glucose, total triglyceride and total cholesterol. These findings suggest that middle age women with overweight may benefit from yoga practice to improve the muscle fitness and body composition.

Keywords: Yoga, Muscle Fitness, Body Composition, overweight

INTRODUCTION

Yoga is a physical and mental discipline that originated in Indian culture over 2,000 years ago. From 1997, the number of yoga practitioners significantly increased in the world. In addition, adults participating in a yoga intervention found that yoga was easily learned and performed. Once learned, yoga can be practiced at any time on an individual basis, thus reducing common barriers to physical activity such as time conflicts and poor weather. The physical practice of postures (Asanas) was originally intended to prepare the body for meditation. Asana is only one of the eight "limbs" of yoga, the majority of which are more concerned with mental and spiritual well-being than physical activity. Asanas are the most common form of yoga practiced and their focuses on a combination of physical fitness factors and the mind-body-breath coordination (Morone and Greco 2007, Barnes *et al.*, 2007, Khalsa, 2004, Kaitlyn and Roland 2011, Smith *et al.*, 2007). Asana yoga uses various postures to develop physical strength, flexibility, balance and endurance (Collins, 1992), and can be used as a moderate-intensity exercise for patients with limited aerobic capacity or restricted ability to exercise. Furthermore, yoga has been shown to decrease hypertension and cardiac inflammation, stabilize the sympathetic nervous system, and improve psychological health and cardiac function (Birdee *et al.*, 2008, Vempati and Telles 2002).

Women after 30 and marriage may be engaged in less physical activity during days in different positions. This is the most important reason for Obesity and overweight in middle age women. In other hand obesity and Excessive body weight is associated with various diseases particularly cardiovascular diseases, type-2 diabetes mellitus, hypertension, hyperlipidemia, osteoarthritis, certain types of cancer etc. in reality, a major cause of all these diseases was found to be improper lifestyle and stress. Excessive stress is known to cause hormonal imbalances and chemical imbalances in human body. It disturbs the metabolic activities and causes improper coordination of the metabolic and biochemical functions like type-2 diabetes mellitus and hyperlipidemia. Yoga has been shown to be a simple and economical therapeutic modality, may be considered as a beneficial adjuvant for many of the health problems. Yoga possibly concentrates on purification of body and mind, through this integrated holistic approach one can overcome almost all kinds of afflictions in life. Therefore, we evaluated the effect of an 8-week of yoga-asana training on body composition, lipid profile, and fasting blood sugar in overweight middle age women.

METHODS

Participants in this study are obese middle aged women between the ages of 30 to 50 years with body mass index (BMI) was greater than the 25 kg/m² who volunteered to participate.

They were randomly assigned experimental (N = 15) and control group (N = 15). All subjects were nonalcoholic, non-smokers, not taking any drug and were having similar physical activities in daily life. The characteristics of the experimental and control groups

are presented in the Table 1. We have fully explained the potential risks and benefits in the study before starting of research protocol. The research protocol was approved by Islamic Azad University ethics committee.

Table1: Subject characteristics in study groups1.

Groups	age (year)	Height (cm)	Body mass (kg)	
			Post training	Pre training
Control	37.45±9.40	160.26±6.59	72.63±10.18	73.82±9.90
Yoga	40.75±6.82	161.53±5.12	69.12±12.04	70.72±11.13

A. Experimental Procedure

In experimental group, Yoga training was performed three times per week, from 9:30-11:00 a.m., for 8 weeks under the direct supervision of a trained yoga expert. This practical session utilized a standard sequence of selected pavanmuktas, Asanas, Pranayamas and Relaxation Techniques.

Yoga treatment as described in Table 2 consisted of practice of (1) asanas (body postures), (2) pranayama (breathing exercises) and (3) meditation. Subjects in the control group did not participate in any physical training program. Subjects were advised not to change their diet and physical activity lifestyles during the study.

Table 2: Yoga practices specified for the experimental group.

Suryanamaskaram (sun salutation)	5 minutes
Yoga Mudrasana (psychic union pose)	2-3 minutes
Pavanamuktasana (wind relieving pose)	2-3 minutes
Thunderbolt pose	2-3 minutes
Twisted pose	2-3 minutes
Locust pose	2-3 minutes
Seated forward bend	2-3 minutes
Hare pose	2-3 minutes
Camel pose	2-3 minutes
Cobra pose	2-3 minutes
Bow pose	2-3 minutes
Lateral arc pose	2-3 minutes
Revolved triangle pose	2-3 minutes
Corpse pose	2-3 minutes
Bout pose	2-3 minutes
Chair pose	2-3 minutes
Alternate Kapalapathi pranayama	5 repeats
One-one meditation	5 minutes
Breath counting meditation	10 minutes

B. Measures and biochemical analyses

Measurements were made during the weeks prior to and immediately following the 8-week training program. All procedures were demonstrated prior to testing. Testing was divided into two sessions, with each session separated by 1 day of rest. Blood samples and body composition were evaluated on day 1, and Muscular endurance, flexibility, were measured on day 3.

Clinical Measures include blood glucose; insulin, lipid levels [cholesterol; triglycerides] and body weight were obtained at baseline and at the end of 8 weeks. For blood testing, 20 ml of blood was obtained via a venipuncture in the arm with the individual in seated position and after at least 5min in a 12-h fasting state.

We measured weight and body composition after an overnight fast with the participant dressed in light clothing and without shoes using the Tanita bioelectrical impedance scale (Tanita Corporation of America, Inc., Illinois, USA), and height (in centimeters) on a wall-mounted stadiometer. The Body Mass Index (BMI) was estimated in all the participants before and after the experimental procedure using the formula, BMI = Weight in kg/ Height in meter.

Muscular endurance was measured with sit up test in 1 minute and Flexibility was also measured with Sit & Reach test. Two trials for each subjects performed. The average of the top two scores was used to represent maximal flexibility for that movement.

C. Statistical analysis

The results are expressed as the mean \pm standard deviation. Within-group comparisons were made using paired sample t-tests. The unpaired t-test was used for baseline group comparisons and changes in differences before and after in the control and yoga groups. All statistical analyses were performed using the SPSS version 20.0 for Windows. Statistical significance was set at p value <0.05 .

RESULTS

The changes in variables before and after the study in both groups are shown in Table 3. Fasting blood Glucose, triglyceride and blood cholesterol were normal range before and after the study. Fat percentage, muscle percentage, water percentage and body mass index were significantly ($p<0.01$) decreased in the yoga group. Muscular endurance and Flexibility were significantly increased in the yoga group ($p<0.05$). No significant changes were found in glucose, fasting blood triglyceride and blood cholesterol in both groups.

DISCUSSION

The present research aims at investigating the influence of 8 weeks of yoga exercises on metabolic parameters, body composition, and muscular fitness in middle-aged over weight women. The findings revealed that generally yoga exercises had an impact on some of the parameters measured in this research and helped them improve. Broadly speaking, nutritional status and the amount of daily physical activity are among the most significant causes of getting overweight.

The results of the present study indicated that 8 weeks of yoga exercises could very well improve muscular fitness in middle-aged women. The parameters measuring muscular fitness in this research included the endurance of midsection muscles, namely abdominal muscles, and also the flexibility of back muscles and the hind foot. Researches studying the effect of yoga on fitness parameters mostly suggest that yoga exercises, Asana in particular, improves muscular endurance and strength (Chen *et al.*, 2009, Mastrangelo *et al.*, 2007).

Table 3: Changes in body composition, metabolic risk factors and muscular fitness following 8week yoga-asana training.

Variables	Control		Yoga		P-value
	Pre training	Post training	Pre training	Post training	
Fat percentage (%)	33.01 \pm 5.98	33.70 \pm 6.02	32.58 \pm 6.41	31.52 \pm 6.33	0.0001
Water percentage (%)	48.32 \pm 5.60	48.33 \pm 4.40	46.73 \pm 7.69	49.41 \pm 4.22	0.0001
Muscle percentage (%)	33.74 \pm 4.82	34.00 \pm 5.12	31.82 \pm 2.57	32.82 \pm 2.68	0.019
Body mass index(kg/m ²)	28.42 \pm 1.86	28.27 \pm 1.93	28.10 \pm 1.28	27.52 \pm 1.34	0.0001
Fasting blood sugar (mg/dl)	90.26 \pm 15.75	84.66 \pm 9.60	91.53 \pm 14.89	86.66 \pm 10.09	0.15
Fasting blood triglyceride (mg/dl)	145.60 \pm 62.06	141.40 \pm 44.83	156.80 \pm 49.93	143.86 \pm 41.29	0.608
Blood cholesterol (mg/dl)	107.26 \pm 53.02	254.86 \pm 33.97	213.73 \pm 58.12	245.66 \pm 36.21	0.068
Muscular endurance	20.33 \pm 8.19	21.66 \pm 7.13	22.69 \pm 9.18	26.00 \pm 10.94	0.012
Flexibility (cm)	22.11 \pm 8.48	25.66 \pm 9.23	27.06 \pm 11.94	34.96 \pm 13.42	0.049

There are studies, however, that haven't reported any changes in subjects' physical function. Most styles of yoga consist of exercises that stretch muscles in a static position for long periods of time (Madanmohan, 2012). In these trainings, therefore, muscles, joints, and their surrounding soft tissues bear tensile stress. Moreover, it is clearly shown that stretching exercises increase muscular strength up to at most 20% of muscular maximal strength, whereas the yoga program in the present research consisted of exercises, some of which used body weight as the resistance force. Exercises such as leg stretching while lying, sitting on a chair, Ardha Navasana (Half Boat Pose), and Paripurna Navasana (Full Boat Pose) resemble greatly Swedish exercises. Hence, it was expected that exercises known as Asana in yoga, would invigorate muscular endurance and strength especially in abdominal muscles. Besides, as the pre-test scores show, subjects of this study had little daily physical activity and low muscular fitness. Thus, yoga exercises could very well improve subjects' fitness.

Change in subjects' body composition due to the yoga exercises was another finding of the present research. After 8 weeks of yoga exercises, subjects had lower body fat percentage and more muscle tissues in comparison with the control group. Although changes in body composition and body mass index (BMI) have been investigated many times, a distinction must be made between studies that consider subjects' nutrition as a control confounding variable and those that do not. Nutrition as one of the most important factors influencing body composition and its fat percentage was not controlled thoroughly in this study. Nevertheless, the results indicated the effect of 8 weeks of yoga exercises on subjects' body composition. This finding is significant in that majority of the previous studies suggested the influence of yoga exercises on body composition over time periods longer than 3 months (Satyanarayana *et al.*, 1992, Damodaran *et al.*, 2002, Kumari *et al.*, 2011).

A study conducted in 2009 showed that even 2 weeks of yoga exercises along with a diet could influence subjects' BMI and body fat percentage. Probable mechanisms of weight loss, decrease in body fat percentage, and decrease in BMI due to yoga exercises are as follows:

1. Yoga exercises do not consume much energy and many of them accompany isometric contractions. These contractions do not increase energy consumption much comparing with rest time. Yet, part of the change in body composition and BMI can be attributed to this issue.

2. The function of the thyroid gland as one of the most important glands of the human body is to control the secretion of hormones T3 and T4. These hormones boost the general cellular metabolism, leading to an increase in basal metabolic rate. Some of the previous studies have shown that yoga exercises can boost the function of the thyroid gland and increase T3 and T4 concentrations in people without physical activity (Rawal *et al.*, 1994). Thus, enhancement in the function of the thyroid gland and its hormones can be deemed as one of the probable mechanisms of changes in body composition, body weight, and BMI. To confirm this, Yadav *et al.* proved that 6 weeks of yoga exercises in ordinary people could increase subjects' basal metabolic rate (Yadav and Tadang 2013). In the present research, changes in subjects' hormone levels were not measured, but it is possible that the increase of T3 and T4 have boosted subjects' basal metabolic rate and reduced their BMI.

3. As noted above, perhaps subjects' nutrition is among the most significant factors influencing body composition. In this study, however, the researcher did not seek to make nutritional intervention so that the external validity of the research would increase. Hence the reduction of energy intake can be a cause of change in subjects' body composition. There is also the possibility that knowing they were participating in a research, the subjects decreased their calorie intake with the start of the study protocol so as to increase the effect of the training program. This could be another cause of reduction in subjects' body fat percentage, body weight, and BMI.

The findings of this research also revealed that some of the biochemical parameters associated with middle-aged women's metabolic diseases improved as a result of 8 weeks of yoga exercises. In this case, yoga exercises reduced subjects' blood fat and total blood cholesterol, but no changes were detected in their fasting blood sugar.

Majority of the previous studies on the impact of yoga on blood glucose level have been conducted on diabetic subjects and they mostly have used diet control as a combinatorial treatment with yoga exercises (Gordon *et al.*, 2008, Telles *et al.*, 2004, Kumara *et al.*, 2012). Since people with type 2 diabetes suffer from insulin

resistance, it can be concluded that probably the combination of yoga exercises, diet, and in some studies drug treatment influence blood glucose level, and that this training program does not have much impact on overweight women whose fasting blood sugar is only slightly higher than the average of normal range. Nonetheless a small reduction in subjects' blood sugar can be attributed to their increased activity.

This research also showed that 8 weeks of yoga exercises did not have an effect on subjects' blood fat concentration and total blood cholesterol. Although some reduction in the amounts of these variables was observed, they weren't significant. Blood fat concentration and blood cholesterol depend on various factors, including nutrition, daily physical activity, stress, some diseases, etc.. As noted in many of the previous studies (Yang *et al.*, 2011, Forcheron *et al.*, 2002, Hadi and Hadi 2007).

such factors as reduction of stress and mental pressure and nutritional parameters can be regarded as the most important causes of decrease in blood cholesterol and fat in other studies. In the present study, the yoga exercises program was chosen in a way that would include the most motor exercises in yoga. Yet, it seems that in studies where yoga resulted in the improvement of subjects' blood lipid profile, other elements such as the length of study time etc. were influential.

Overall, this conclusion can be drawn from the findings of this research that yoga and its exercises, specially the motor ones known as Asana can enhance muscular fitness factors, for instance strength, endurance, flexibility of joints, and also body composition in overweight women between the ages of 35 and 50. In a literature review published recently, yoga was introduced as one of the best and safest training methods for people over the age of 40 (Kaitlyn and Roland 2011). Women in this age period have little physical activity and thus, these exercises are very appropriate for these people.

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