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Research Paper

Effect of Yoga practice in the management of risk factors associated with obesity: A pilot study

S. Dhananjai [Lucknow]
Sadashiv [Lucknow]
Kumar Rajjan [MJP Rohilkhand University]

Abstract

Obesity is a multi-factorial disorder; therefore, its treatment varies considerably. Yoga has shown its effectiveness in many health related disorders, but its efficacy in reducing obesity is not well documented. The aim of this study is to find out whether yoga practices have any effect on reducing the risk factors of obesity. Effect of a yoga practice for 12 weeks on lipid profiles of 56 obese subjects (32 females and 24 males) age ranged from 20 to 45 yrs were evaluated. Results revealed a significant ($p<0.01$) decrease in anthropometric variables (weight, body mass index, waist circumference and hip circumference). Further, total cholesterol, triglyceride, very low density lipoprotein, low density lipoprotein and fasting plasma glucose decreased significantly ($p<0.01$) while high density lipoprotein increase significantly when compare to the basal variables before intervention given ($p<0.01$). A significant and positive correlation was evident among pretreatment anthropometric variables ($p<0.01$) while most of the lipid profiles parameters also showed a significant ($p<0.05$ or $p<0.01$) positive or negative correlation with each other. The pretreatment weight ($r=0.49$; $p<0.01$), waist circumference ($r=0.39$; $p<0.01$) and hip circumference ($r=0.26$; $p<0.05$) showed significant and positive correlation with pretreatment Triglyceride. The change (improvement) in weight and TG were significantly ($r=0.49$, $p<0.01$) associated with each other. However, the improvement in all anthropometric variables and lipid profiles parameters of females and males were found to be similar ($p>0.05$). This pilot study indicates usefulness of yoga practices in reducing obesity and reduces risk factors associated with obesity. The findings of this study may useful in management of obesity without any side effects.

Key words: lipid profiles, Triglyceride, HDL, VLDL, LDL, WHR

Introduction

Obesity defined as excess of body fat relative to weight, is an important risk factor contributing to the overall burden of lifestyle disease worldwide.1 It has been associated with a broad spectrum of cardio metabolic disturbances, including hypertension, dyslipidemia, glucose intolerance and even cardiovascular disease (CVD). Abdominal obesity particularly plays a major role in the development of metabolic syndrome and CVD.2 The simplest and most widely used method of assessing abdominal fat accumulation is measuring the waist circumference3. Abdominal obesity is related to alterations in plasma lipoprotein-lipid levels, particularly increased plasma triglyceride and low high-density lipoprotein (HDL) cholesterol concentrations, as expected from the association of insulin resistance with disturbances in plasma lipid transport and lipoprotein levels.4 The most likely contributing factor for obesity-related dyslipidemia is uncontrolled fatty acid lipolysis from visceral adipose tissue leading to increased delivery of fatty acids to the liver to act as a substrate for very low density lipoprotein (VLDL) synthesis.5,6,7 It is now well documented that obesity is a significant risk factor for coronary artery disease, hypertension, cholelithiasis, diabetes, osteoarthritis.8,9,10

Yoga has become increasingly popular in Western countries as a means of exercise and fitness.11 It is an ancient mind-body discipline that has been widely used in India for improving strength and flexibility, and may help control physiological variables such as blood pressure, respiration and heart rate, and metabolic rate to improve overall exercise capacity12,13 and in the management of hypertension, diabetes, and related chronic insulin resistance conditions14-17 and may hold promise as a therapeutic intervention and health promotion measure for Western populations as well. There is a growing body of research suggesting that practice of yoga may reduce insulin resistance syndrome(IRS) related risk factors for CVD, and may attenuate signs, reduce complications, and improve the prognosis of those with frank or underlying disease.11,15-22

The aim of present study is to assess whether the specific yoga practices targeting central obesity and have any contribution in reducing the risk factors of obesity.

Methods

Participants and Selection: Study group comprised of 56 (32 females 24 males) volunteers in the age range of 20 to 45 years practicing yoga for 12 weeks under supervision at Physiology Department, CSM Medical University, Lucknow, UP, India. Subjects with a family history of diabetes, high resting blood pressure and on medication were excluded from the study. The research protocol was approved by institutional ethics committee of CSM Medical University, Lucknow, UP, India. In all cases informed consent was obtained from subjects or cohabiting next-of-kin.

Data represent those subjects who enrolled in this particular program were included if: waist circumference >90cm for men or >80cm for women and WHR (Waist to hip ratio) should be > 0.88 for female and > 1.0 for male and Age group should be between 20 - 45 years. And subjects having cardiac diseases, asthma and any other metabolic diseases, Pregnant female, waist circumference <90cm for men or <80cm for women, WHR (Waist Hip Ratio) < 0.85 for female & < 1.0 for male, and age group <20 and > 45 years were excluded.

Study Variables: Information was collected through personal interview using a structured questionnaire followed by a

physical examination measurement of blood pressure and anthropometric measurements by trained personel.

Height and weight were measured with the participants standing without shoes and heavy outer garments. Waist circumference (WC) was measured at the level midway between the lower rib margin and the iliac crest with participants in standing position without heavy outer garments and with empty pockets, breathes out gently. Hip circumference (HC) was recorded as the maximum circumference over the buttocks. Body mass index (BMI) was consequently calculated as weight divided by height squared (Kg/m2) while waist hip ratio (WHR) was calculated as the ratio of waist circumference over the hip circumference (WC/HC).

Fasting blood sample of 5 ml blood (blood test required a 12-hour fast i.e. no food or drink, except water) was obtained via a venipuncture in the arm with the individual in an upright position and in a resting state for measurements including triglyceride, HDL cholesterol and blood glucose levels and estimated by hospital staffs who were blinded to the study.

The fasting blood glucose concentration was estimated by glucose-oxidase peroxidase method.23 Total cholesterol was estimated by using CHOD POD method, triglyceride by GPO POD method, HDL by using Phosphotungestase method.23All these estimations was done by using the Semi Auto analyzer Merck (MERCK Microlab 300 LX), The LDL fraction was calculated by the Friedwald formula.24 Base line data were obtained at zero day prior to treatment initiation and post treatment samples were obtained on 90th day at the end of the treatment.

Intervention

The subjects enrolled for this study were given instructions to follow the module: breathing exercise, asana and meditation a total of about 60 minutes a day for 5 days in a week, up to 12 weeks.

Module

Breathing Exercise: It includes tiger stretch breathing (TSB) and straight leg raise breathing (SLRB).

Warming Exercise: It includes jogging, forward backward bending (FBB), side bending (SB) and twisting.

Asana: It includes Dhanurasana, Ardha Matssyendrasana, Paschimottasana, Halasana, Vajrasana and Naukasana.

Meditation: Nadanusandhana (A U M and OM followed by silence)

Statistical analysis

Groups were compared by unpaired t test and paired t-test. Association among variables was done Pearson correlation analysis. A two-tailed (α=2) probability $p<0.05$ was considered to be statistically significant. STATISTICA version 7.0 was used for the analysis.

Results

56 obese subjects fulfilling the inclusion criteria were enrolled. The age and height of all subjects ranged from 20-45 yrs and 140-179 cm respectively with an average (± SE) of 39.32 ± 0.95 yrs and 158.86 ± 1.22 cm respectively.

The pre intervention and post intervention values after a period of 12 weeks anthropometric variables and lipid profiles of all subjects are summarized in Table 1. Table 1 showed that except HDL, the mean level of all parameters decreased at post intervention as compared to pre intervention. On comparing the mean, the weight, BMI, WC, WHR, TC, TC/HDL, TG, VLDL, LDL and FPG at post intervention was found to be significantly ($p<0.01$) lower while HDL was significantly ($p<0.01$) higher as compared to respective mean at pre intervention. The weight, BMI, WC, HC, WHR, TC, TC/HDL, TG, VLDL, LDL and FPG at post intervention decreased by 4.8%, 4.7%, 3.3%, 0.7%, 2.5%, 13.5%, 30.2%, 15.7%, 15.7%, 24.6%, and 8.0% respectively while HDL increased by 22.0% as compared to pre intervention.

The inter-correlation of pre treatment values of anthropometric variables and lipid profiles of all obese subjects were summarized in Table 3. All anthropometric variables s showed significant ($p<0.01$) and positive correlation with each other and among these weight showed comparatively high correlation. Similarly, most of the lipid profiles also showed significant ($p<0.05$ or $p<0.01$) either positive or negative correlation with each other and among these correlation between TG and VLDL and of TC andLDL were the highest. Further, most of the anthropometric variables showed significant ($p<0.05$ or $p<0.01$) and positive correlation with the TG and similarly with VLDL.

Similarly, correlating the change (Table 3), in anthropometric variables and lipid profiles of all subjects the change in weight is significantly ($p<0.05$) correlated with the change in TG and VLDL or in other words the change in weight, TG and VLDL are inter-related. Further, the change in anthropometric variables weight and BMI, WC and WHR, and HC and WHR and lipid profiles TC and LDL, and TG and VLDL all showed significant ($p<0.01$) and positive correlation except anthropometric variables HC and WHR.

Female vs. Male

Out of total 56 obese subjects, there were 32 (57.1%) females and 24 (42.9%) males. The age and height of all females ranged from 20-45 yrs and 140-171 cm respectively with an average (± SE) of 38.50 ± 1.36 yrs and 153.22 ± 1.16 cm respectively while the respective values of these in males ranged from 22-45 yrs and 154-179 cm respectively with an average (± SE) of 40.42 ± 1.28 yrs and 166.38 ± 1.28 cm respectively. On comparing the mean, the age of females and males were found to be the same ($p>0.05$) while the height of males was found to be significantly ($p<0.01$) higher than the females.

The change (post intervention - pre intervention) in anthropometric variables and lipid profiles of females and males were summarized in Table 4. The change in all anthropometric and lipid profiles were evident higher in males than females except WHR and TC. On comparing the mean, the change in all anthropometric variables and lipid profiles of females and males were found to be the same ($p>0.05$).

Discussion

This pilot study assessed the feasibility of implementing a yoga program for obese subjects. A significant reduction of 26.1%, 5.8%, 4.7%, and 39.4% respectively in

anthropometric weight, BMI, WC and HC was evident at post yoga program as compared to pre yoga program. Further biochemical risk factors TC, HDL, TG, VLDL, LDL and FPG improved by 13.5%, 22.0%, 15.7%, 15.7%, 24.6% and 8.0% respectively.

Participants in the yoga group showed increased confidence over time in recommending the yoga program to their friends who are obese and expressed high degree of satisfaction with the program. All participants completed the yoga program with an average attendance rate of 81.3%; consistent with prior research.25,26 The participants were asked not to change their exercise level by initiating any new form of exercise during this study, we limited our recommendations for physical activity to emphasizing the importance of being active in day-to-day life. Therefore, we do not have information on how yoga practice helps with adoption and maintenance of other physical activities.

This found that by the end of the 12 week program an average weight loss of 4.8% of baseline weight. Few published reports have provided rates of weight loss or other lifestyle change interventions. The present results, however, compare favorably to those from two large trials of non-surgical weight loss interventions. First, the Diabetes Prevention Program (DPP) for overweight and obese participants with impaired glucose tolerance included a lifestyle change intervention arm, which induced a weight loss of about 7% over the first 6 months. Among participants who initially met criteria for metabolic syndrome, those in the lifestyle change intervention demonstrated a remission rate of less than 10% after the first year and 38% at 3 years27. That group's results were superior to those of the placebo/standard care condition, which showed a negligible weight loss and achieved remission rates of only 18% at 3 years, a large 12-month weight loss trial of rimonabant among dyslipidemic patients, on 20mg rimonabant, loss 9.3% of weight from screening; the prevalence of Met Syn in this group dropped from 53 to 26%, although the 12-month prevalence included an unreported number of patients who developed Met Syn during the trial.28 Further, in a single-site study comparing 1-year treatment with lifestyle modification with and without sibutramine, sibutramine alone and sibutramine plus brief therapy, remission rates of 62, 72, 37 and 15% were reported, respectively.29

Our small sample size does not permit a definitive assessment of whether that degree of loss is a threshold level for resolution of associated risk factors i.e. Met Syn. It remains plausible that achieving a weight loss of at least 10% of baseline body weight does put one at an advantage for Met Syn improvement, but that particular level of loss appears neither necessary nor sufficient. The weight loss target of 7–10% recommended for management of Met Syn should be considered an initial, but not necessarily ultimate, goal.30

In this study, in addition to weight reduction there was a significant reduction of 8% in fasting blood glucose. Previous studies shows that yoga was effective in reducing blood glucose level31-36 after 4 months of yoga practice, fasting glucose decreased significantly in a group of adults with type 2 diabetes.32 Another study with type 2 diabetes had significantly decreased fasting glucose (from 190.1 to 141.5 mg/dl) after 40 consecutive days of yoga practice.33 Adults with normal blood glucose levels also had significantly lower glucose levels after 3–4 h of yoga practice for 8 days. 31

In this study, total cholesterol decrease by 13.5% after 12 weeks yoga program. In previous study of obese subjects at risk for cardiovascular disease and diabetes30,37,21 found significant improvements in total cholesterol, triglycerides, LDL, HDL and VLDL after short-term intensive yoga practice (3–4 h per day for 8 days). Notably, for subjects whose baseline total cholesterol was 200 mg/dl or higher, the significant reduction in triglycerides (from 151.5 to 132.7 mg/dl) and VLDL (from 36.7 to 30.2 mg/dl) was significantly greater than in subjects with lower baseline total cholesterol (triglycerides from 113.6 to 110.5mg/dl; VLDL from 23.7 to 23.2 mg/dl).

A study of healthy adults over 40 years old found that 5 years of yoga practice reduced age-related deterioration in cardiovascular functions.38 Similar study showed a significant fall in total cholesterol in women at the end of 3 months of yoga practice in comparison to men. In this study, though the improvement in males was higher than females, but their difference was found to be insignificant. In other words, the improvement in males and females were similar.

The studies conducted in western countries had reported a fall in triglycerides and increase in HDL-cholesterol, after physical activity.39 In this study also, triglyceride decrease by 15.7% while HDLincrease by 22.0%. On the other hand, a generalized reduction had been associated with dietary restriction or correction, including HDL-cholesterol. In the present study, a fall in the triglycerides and VLDL-cholesterol was observed at the end of 3 months of yoga practice. It is known that decreased concentrations of plasma HDL-cholesterol lead to increased risk of coronary heart disease whereas rise in its value exerts a protective effect.39 It seems quite probable that increased physical activity leads to lowered plasma triglyceride concentrations and ultimately increased plasma HDL-cholesterol. A meta-analysis of 59 exercise-training studies reported an average increase in HDL-cholesterol of only 0.052mmol/L.40

Though the present study is able to show the effectiveness of yoga on normal obese subjects, this study will help us to estimate sample size in planning the next intervention study considering the targeted hypothesis testing of immediate and long-term treatment effects of different yoga practices on risk factors associated with obesity. Thus the small sample of this study limits the generalizability. The randomized, controlled trial design helps to better understand the benefits of the intervention program, because such a design permits allocation of participants that minimizes any bias from known and unknown determinants of outcome.

In summary, the results of this pilot study suggest that a yoga program could potentially be a risk reduction option for obese. Moreover, additional research with a larger sample and a longer follow-up for diabetes development is warranted to further evaluate the beneficial effects of yoga practice. The preliminary study results indicate that this yoga program is feasible and acceptable to obese population.

CONCLUSIONS

The present study has demonstrated the efficacy of Pranayama and Yogasanas on blood lipid profiles in apparently healthy obese volunteers. Yoga practices may be helpful in patients with lipid metabolism disorders such as diabetes mellitus, coronary heart disease and dyslipidemia.

In summary, the results of this pilot study suggest that a yoga program could potentially be a risk reduction option for obese.

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Table1. Pre treatment and post treatment summary (Mean ± SE) of physical variables and biochemical parameters of all obese subjects (n=56)

Parameters	Pre treatment	Post treatment	% change
Physical			
Weight	79.12 ± 1.79	75.36 ± 1.73**	4.8
BMI	31.36 ± 0.63	29.88 ± 0.62**	4.7
WC	104.43 ± 1.40	101.02 ± 1.38**	3.3
HC	109.30 ± 1.18	108.50 ± 1.16**	0.7
WHR	0.96 ± 0.01	0.93 ± 0.01**	2.5
Biochemical			
TC	183.71 ± 3.61	158.84 ± 3.22**	13.5
HDL	38.90 ± 0.99	47.46 ± 1.00**	22.0
TC/HDL	4.95 ± 0.19	3.46 ± 0.12**	30.2
TG	121.52 ± 4.26	102.38 ± 3.84**	15.7
VLDL	24.30 ± 0.85	20.48 ± 0.77**	15.7
LDL	120.51 ± 4.05	90.90 ± 3.55**	24.6
FPG	106.26 ± 1.65	97.73 ± 1.43**	8.0

BMI- body mass index; WC- waist circumference; HC- hip circumference; WHR- waist to hip ratio; TC- total cholesterol; HDL- high density lipoprotein; TG- triglyceride; VLDL- very low density lipoprotein;LDL- low density lipoprotein; FPG- fasting plasma glucose

Table 2. Inter-correlation of pre intervention values of physical variables and biochemical parameter of all obese subjects (n=56)

Variables	*Weight*	*BMI*	*WC*	*HC*	*WHR*	*TC*	*HDL*	*TC/HDL*	*TG*	*VLDL*	*LDL*	*FPG*
Weight	1.00											
BMI	0.74**	1.00										
WC	0.81**	0.73**	1.00									