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Effect of yoga techniques practice in obese adults

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Abstract: *Obesity is a chronic medical condition characterized by excessive fat causing a generalized increase in the body mass. Apart from being a health concern worldwide, obesity may affect lung function. This study evaluated the effect of a four weeks yoga training protocol on anthropometric measures and peak expiratory flow (PEF) rate in obese adults.*
Twenty-three obese adults (11 male and 12 female) aged mean±SD 36.17±12.87 with BMI greater than 25 were enrolled in the study. Anthropometric measurements and PEF were recorded before and after four weeks of Yoga training. A pre- post assessment of the participants was done on the first and last day of the yoga sessions.
Analysis was done using paired-samples t-test. After four weeks of yoga training there was statistically significant reduction in the weight ($p<0.05$) and body mass index ($p=0.005$) and improvement in PEF ($p<0.005$) in the obese participants. No significant changes were observed in waist circumference, hip circumference, waist-hip ratio, pulse rate and blood pressure.
There is a significant statistical correlation between regular yoga practice and weight loss, reduction in body mass index and improvement in PEF in obese adults. Studies on larger sample size are warranted to establish yoga as an independent modality for managing obesity and improving lung function.

Keywords: *yoga, obesity, anthropometric measures, BMI, PEF*

Introduction

Obesity is a chronic medical condition characterized by excessive fat causing a generalized increase in the body mass. It is estimated using body mass index (BMI) which is calculated as the weight in kilograms divided by the square of the height in meters [BMI = weight (kg)/ height (m2)]. Waist-hip ratio (WHR) and waist circumference (WC) complement the measurement of BMI in the identification of individuals at increased risk of obesity‐related morbidity. The waist circumference divided by the hip circumference) is an additional measure of body fat distribution. The ratio can be measured more precisely than skin folds, and it provides an index of both subcutaneous and intra-abdominal adipose tissue (Bjorntorp, 1987). Although BMI is correlated with WHR and WC (as measures of abdominal obesity), the level of association is varied, suggesting that these measures may provide different information and thus may not be interchangeable (WHO, 2008).

Apart from being a health concern worldwide, obesity may affect lung function (Ylikahri, et al., 2007). Reduction in expiratory flow rates and lung volumes are commonly reported along with pulmonary function abnormalities related to obesity. The exact mechanism of impaired lung function is not clear. Obesity can affect the thorax, diaphragm, and abdominal muscles, and, due to increased respiratory effort

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and impairment of the gas transport system, can result in altered respiratory function even if the lungs are normal (Zuhal, Nihal, 2011).

Reversible and variable airflow limitation are measured with a spirometer (forced expiratory volume in 1 s (FEV1) and forced vital capacity (FVC)) or a peak expiratory flow (PEF) meter (Pocket Guide for Physicians and Nurses, 2005). PEF is the most commonly used method to monitor lung function (Brand, Roorda, 2003). Several kinds of peak flow meters are available and the technique for use is similar for all (Sly, Flack, 2001).

Yoga as therapeutic method

Yoga was developed in India and due to its efficiency, it was spread around the world. According to Patanjali, it involves yama, niyama, methods of modification of breath (pranayama), assuming and maintaining specific postures (asana), concentration (dharana) and meditational practices (dhyana). Short-term yoga and diet change have shown to decrease BMI and the fat-free mass (Telles, Naveen, Balkrishna & Kumar, 2010). Regular practice of sun salutation series (surya namaskara) may maintain or improve cardiorespiratory fitness, as well as promote weight management (Mody, 2011). Yoga and stretching postures are implicated in increasing respiratory stamina, relaxing of chest muscles, expansion of lungs, raising of energy levels (Singh, Soni, Singh, Tandon, 2012).

Limited information is accessible regarding the effect of yoga practice on obesity and lung function collectively. The aim of this study was to investigate the effect of four weeks yoga practice on anthropometric measures and PEF in obese adults.

Methods

Subjects and study design

Twenty-three obese adults (11 male and 12 female) age ranging from 18 to 53 years (mean age±SD, 36.17±12.87 years) with BMI greater than 25 were enrolled in the study through advertisement in local newspaper. Prior experience of yoga in any form of the participants ranged from 0 to 10 months (mean experience±SD, 2.6±3.3 months). After an initial health screening by a naturopathy and yoga medical practitioner, those participants having systemic complications, on medication or unable to perform basic exercises were excluded. Two participants overall were excluded from the analysis because of low compliance to the yoga training defined as missing more than four sessions. A pre- post assessment of the twenty-three participants was done on the first and last day of the yoga sessions which lasted for four weeks. All participants received general health education and diet counseling during the 4-week study. This study was part of NIN's yoga training program and hence having a control group was not feasible. Potential risks and benefits were explained to the participants and written informed consent was obtained. The study was approved by the Institutional Ethics Committee of NIN.

Yoga training protocol

Yoga training was conducted by a qualified yoga and naturopathy physician, six times per week for four weeks consisting of traditional loosening practices (*sukshma vyayama*), postures (*asana*), breathing exercises (*pranayama*), cleansing procedures (*kriya*) – once a week and relaxation techniques (Table 1). Day 1 and day 5 of all weeks consisted of loosening exercise series traditionally known as sukshma vyayama. Day 2 to day 4 consisted of 12-steps sun-salutation poses, basic to intermediate postures, and breathing exercises. Day 6 of the week was dedicated to internal cleansing procedures. Guided relaxation techniques were administered where necessary and as deemed fit by the instructor.

Table 1: Yoga training protocol

Days	Practices	Duration	Description
Days 1 & 5	*Sukshma vyayama*	60 mins	Traditional loosening exercise series
Days 2, 3 & 4	*Suryanamaskar*	15 mins	Bihar School of Yoga 12 steps – 18 rounds
	Asana	30 mins	Traditional basic to intermediate postures in supine lying, prone lying, sitting and standing
	Pranayama	15 mins	*Suryabhedana*, *Nadi shuddhi*, *Bhastrika*, *Bhramari*
Day 6	*Kriya*	60 mins	Pre-*kriya* practice: Prayer Main *kriya* practices: Jalaneti and *Vamana dhauti* Post-*kriya* practices: *Kapalabhati*, *uddiyana bandha*, *pawanmuktasana*, alternate *parvatasana* and *sarpasana*

Assessments

Anthropometric measurements and PEF were recorded before and after four weeks. Anthropometric measurements included measuring height and weight to calculate body mass index (BMI), waist circumference (WC) and hip circumference (HC). Body weight and height were measured with the participants wearing light clothes and without shoes. Waist and hip circumference were measured using standard measuring tapes with 0.1 cm accuracy. Waist-to-hip ratio was then calculated. The same anthropometric equipment was used for each participant.

Peak expiratory flow (L/min) was measured using Air Zone peak flow metre (Clement Clarke International, Edinburgh). Each participant was asked to sit erect with the mouthpiece of the peak flow meter in close contact with the mouth without an angle (inclination or declination). The participant was then required to inhale actively and exhale forcefully into the mouthpiece. Three measurements were taken and the highest reading was recorded. To avoid variability due to different technicians and devices, all the tests were performed by one designated person (MK). All measurements were done before the first Yoga session on the first day and after the last session on the last day, between 5pm to 6 pm. Besides, the participants were advised to record their food habits regularly after initial diet counseling. Use of low-calorie vegetarian food was advocated.

Data analysis

Paired-samples t-test was computed using the Statistical Package for the Social Sciences version 17.0 for Windows (SPSS, Inc., Chicago, IL, USA). Statistical significance was set at p-value$<$0.05.

Results

The study included twenty-three adults classified as obese (BMI 31.36±3.86 kg/m2). Changes in anthropometric measures and lung function (PEF) are summarized in Table 2. After four weeks of yoga training there was significant reduction in the weight ($p<0.05$) and body mass index ($p=0.005$) and improvement in the peak expiratory flow rate ($p<0.005$) in the obese participants. No significant changes were found in waist circumference, hip circumference, waist-hip ratio, pulse rate and blood pressure.

Table 2: Changes in anthropometric measures and lung function (PEF) following a 4-week yoga intervention

	Before	After	% change	t value	P value
Weight (kgs)	86.48 ± 2.68	85.66 ± 3.01	-0.95	2.66 (22)	0.014*
Body Mass Index	31.36 ± 0.80	31.02 ± 0.81	-1.09	3.09 (22)	0.005**
Waist Circumference (cm)	101.57 ± 1.61	101.72 ± 2.02	0.15	-0.18 (22)	0.86
Hip Circumference (cm)	108.98 ± 1.88	108.30 ± 1.86	-0.63	0.92 (22)	0.366
Waist-Hip Ratio	0.94 ± 0.01	0.94 ± 0.01	0.60	-0.64 (22)	0.527
Sytolic Blood Pressure (mmHg)	117.74 ± 2.19	117.04 ± 1.52	-0.59	0.31 (22)	0.759
Diastolic Blood Pressure (mmHg)	77.74 ± 1.53	78.17 ± 1.62	0.56	-0.25 (22)	0.803
Pulse Rate (beats/min)	74.96 ± 1.45	72.09 ± 0.86	-3.83	1.92 (22)	0.068
Peak Expiratory Flow Rate (L/min)	292.17 ± 21.01	329.13 ± 20.42	12.65	-3.45 (22)	0.002**

Values are mean ± SEM for 23 participants. t and P values as obtained from Students t test for paired data.
* $p<0.0$; ** $p<0.005$

Discussion

The present study was designed to determine the impact of 4-week yoga training on body composition and lung function. The major finding of the present study was that a 4-week yoga training protocol improved body weight, body mass index and PEF in obese adults.

The effects of yoga training reported previously include the inhibition of weight gain, reductions in cholesterol levels (Pal, et al., 2011), and blood pressure, improvement in immune function (Gopal, Mondal, Gandhi, Arora & Bhattacharjee, 2011), beneficial psychological effects (Telles, Singh, Joshi & Balkrishna, 2010) and improvement in cardiovascular functions (Ankad, Herur, Patil, Shashikala &

Chinagudi, 2011). In the present study, even though overall weight loss is demonstrated, waist and hip circumference did not appear to change significantly.

Basal metabolic rate (BMR) may have increased causing a reduction in the body weight as is the case with conventional exercise (Wong, et al., 2008, and Slentz et al., 2004). Thus, yoga can be an effective alternative in weight-reduction by increasing BMR in obese adults.

Compared to athletes, long term yoga practitioners (yogis) by default seem to have better PEF (Prakash, Meshram & Ramtekkar, 2007). Yoga practice seem to significantly improve lung function including peak expiratory flow rate (Singh et al., 2012) and the results of the present study demonstrates a consistent trend. Regular practice of pranayama, specifically alternate nostril breathing (nadisuddhi) has shown to increase parasympathetic activity and significant increment in PEF (Upadhyay, Malhotra, Sarkar & Prajapati, 2008).

The results also indicate inconsistent change across the participants with respect to waist circumference, waist-hip ratio and diastolic blood pressure, although the levels dropped overall. Additional assessments, like free fat mass, would have been better indicators for explaining these individual variations. Differences in the amount of physical activity and lifestyle choices apart from the yoga intervention could be responsible for the variations reflected.
Some limitations of the current study are the relatively small sample size of twenty-three and absence of control group. Furthermore, obesity being a chronic condition requires long term follow-up, which was not done in this case. However, the participants were counselled individually on a weekly basis regarding their food habits, which probably enabled better results achievement.

Conclusion

The findings of the study indicate that regular yoga practice can initiate weight loss, reduce body mass index and improve lung function in obese adults, thereby, reducing the possibility of obesity related complications. Further controlled studies on larger sample size are warranted to establish yoga as an independent modality for managing obesity.

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