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RESEARCH ARTICLE

Effect of 12 weeks of slow breathing exercise practice on anthropometric parameters in healthy volunteers

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ABSTRACT

Background: Regular practice of slow breathing technique shows improvement in the cardiorespiratory functions. The previous studies have reported that it is well known to decrease the effect of stress which, in turn, improves the physical and mental health of an individual. **Aims and Objectives:** This study aims to assess the effect of 12 weeks of slow breathing exercise practice on anthropometric parameters in healthy volunteers. **Materials and Methods:** A total of 59 young, healthy volunteers of both genders participated in this study. The subjects were allocated to the study group ($n = 29$) and control group ($n = 30$) based on simple random technique. Slow breathing exercise training was given to the study group for 20 minutes daily in two sessions for 12 weeks. Height, weight, body mass index (BMI), waist circumference, hip circumference, and waist/hip ratio were recorded at the start of the study and after 12 weeks in both the groups. Longitudinal changes in both the groups were compared by Student's paired *t*-test. Comparison between the study group and control group was done by Student's unpaired *t*-test. The statistical analysis was carried out at 5% level of significance and $P < 0.05$ was considered as statistically significant. **Results:** The average age of the study group and control group participants was 19.9 ± 1.8 years and 19.2 ± 1.9 years, respectively. BMI was significantly decreased in the study group from 21.75 ± 4.14 to 19.51 ± 3.95 ($P < 0.05$). There was a trend toward decrease in the waist–hip ratio from 0.77 ± 0.67 to 0.71 ± 0.58 ($P > 0.05$) which was not statistically significant. **Conclusion:** Results of our study indicate that 12 weeks of slow breathing exercise training improve the anthropometric parameters in the study group. This indicates that regular, long-term slow breathing exercise training helps in weight reduction among the obese population.

KEY WORDS: Anthropometric Parameters; Slow Breathing Exercises; Healthy Volunteers

INTRODUCTION

Anthropometry is dealt with the measurement of an individual anatomical structure and its application in the form of proportions, composition, and shape and body maturation. It uses non-invasive, portable instruments to calculate height, weight, and body circumferences which can be performed in a large sample size.[1]

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Regular practice of slow breathing technique shows improvement in the cardiorespiratory functions. The previous studies have reported that it is well known to decrease the effect of stress which, in turn, improves the physical and mental health of an individual. Slow and deep breathing is economical which reduces dead space ventilation. Breathing with maximum contraction of diaphragm and intercostal muscles massages abdominal viscera, improves venous return, and stretches all parts of the thorax and lung. Slow,

deep breathing renews air throughout the lungs in contrast with shallow breathing which renews air only at the base of the lungs.[2-4]

During slow, deep breathing, there is conscious alteration of cerebral activity with a definite pattern of activity seen in the respiratory centers which modulates neuronal activity in cardiovascular and other medullary centers. Breathing with concentration improves mind-body coordination which helps to cope up with stress, anxiety, and depression making one feels relaxed and calm.[5-7] In view of the above background, this study is aimed to assess the effect of 12 weeks of slow breathing exercise practice on anthropometric parameters in healthy volunteers.

MATERIALS AND METHODS

This study was performed in the Human Physiology Laboratory, Government Thiruvarur Medical College, Thiruvarur, at the end of approval from the Ethics Committee and Institute Human Research. The sample size was 59 medical students (females: 32 and males: 27) who were recruited after meeting inclusion and exclusion criteria. The volunteers were exposed about the purpose, procedures, and benefits of the study. They were informed that they have freedom to withdraw from the study at any time. After getting informed written consent, the willing participants were allocated into study group (n = 29) and control group (n = 30) based on simple random technique generated through computer.

Inclusion Criteria

Healthy volunteers of age group between 18 and 25 years (both genders).

Exclusion Criteria

The following criteria were used to exclude subjects from the study:

- History of chronic respiratory ailments
- Subjects taking drugs/medication
- Smokers
- Alcoholics
- Sports or athletic personnel
- History of previous yoga training within 1 year.

Parameters

Height

Wall-mounted stadiometer (easy care, Hong Kong) was used to measure the height of the study participants. The calibration of stadiometer was done using standardized measuring rod. The subjects were instructed to stand erect on a flat surface with feet flat, heels almost together, legs straight and knees together, with arms at the side and looking horizontally straight ahead. Heels, hip, shoulder blades, and occiput pressing against the vertical bar, then the slider were brought down to rest on the top of the head pressing hairs. It is an arrow which accurately measures height in centimeters.

Weight

Weighing machine with spring balance (to avoid zero and parallax errors) (Crown, India) was used to measure weight of the study participants. The accuracy of the machine was checked routinely with other weighing machines available. Subjects were asked to wear light clothing with no footwear. They were instructed to stand erect on the foot bar. The legs were positioned on each side of the digital scale and weight was measured in kilograms.

Body mass index (BMI)

BMI is the indirect measurement of nutritional status of the individual. Quetelet formula is used to calculate BMI = Weight in Kg/ (Height in m)^2.

Waist–hip circumference ratio (WHR)

Waist circumference is a good index of centripetal obesity and is measured at the midpoint between lower costal margin and iliac crest, while holding the breath at expiration (centimeters). The measurements were taken in subjects using anthropometric tape by asking them to stand straight with back facing a mirror so that the horizontal placement of the tape can be assured. The hip circumference is measured at the level of gluteal region with maximum girth (centimeters). WHR was obtained by dividing the waist circumference with hip circumference.

Breathing exercise training

The volunteers were practiced for the breathing technique as per Pal *et al*.[8] in comfortable sitting posture and well-ventilated room. The following are the steps:

- The subjects were instructed to close one of the nostrils (e.g., right nostril) by thumb and to slowly inhale through the opposite nostril (left nostril) in 6 counts.
- Volunteers were asked to close the left nose by little finger and to hold the respiration for 6 counts. Then, they were instructed to open the right nose to slowly exhale for 6 counts.
- They were asked to performed inspiration through the right nostrils over the period of 6 s, close the right nose and hold the respiration for 6 s after that open the right nostril to exhale for 6 s.

These three steps complete one breathing cycle and this was repeated for 20 minutes. The subjects were motivated to practice this technique for 5 days in a week (both morning and evening session) for a total period of 12 weeks under our direct supervision. Rest of days the subjects were instructed to practice at their home. Attendance register was maintained for

training sessions. The post-test parameters were collected only from the subjects with attendance percentage of at least 80%.

Ethics

The present study was carried out after obtaining clearance from the Institute Ethics Committee for human studies and the study caries less than minimal risks.

Statistical Analysis

Data for all parameters were collected and computerized in Microsoft Excel. Longitudinal changes in both the groups were compared by Student's paired *t*-test. Comparison between the study group and control group was done by Student's unpaired *t*-test. The statistical analysis was carried out at 5% level of significance and $P < 0.05$ was considered as statistically significant.

RESULTS

After excluding the dropouts, a total number of volunteers included in the final analysis in the study group and control group were 29 and 30, respectively. The average age of the study group and control group participants was 19.9 ± 1.8 and 19.2 ± 1.9. Comparison of anthropometric parameters at baseline between the study group and control group is given in Table 1. It shows that there was no significant difference in the baseline values of age and anthropometric parameters ($P > 0.05$). Therefore, both the groups can be considered comparable.

Table 2 shows the effect of 12 weeks of slow breathing exercise training ($n = 29$) on anthropometric parameters in which BMI of the study group showed a statistically significant reduction from 21.75 ± 4.14 to 19.51 ± 3.95 ($P = 0.03$). Furthermore, there was a trend towards decrease in WHR from 0.77 ± 0.67 to 0.71 ± 0.58 ($P > 0.05$) which was not statistically significant.

Table 3 shows the changes in control group ($n = 30$) after 12 weeks of study period on anthropometric parameters. BMI of the control group was increased from 21.42 ± 2.91 to 22.13 ± 2.21 and WHR of the control group was increased and 0.78 ± 0.08 to 0.79 ± 0.24 which were not statistically significant ($P > 0.05$).

Table 1: Comparison of age and baseline anthropometric parameters in the study group and control groups

Parameters	Study group (n=29)	Control group (n=30)	P value
Age	19.9±1.8	19.2±1.9	0.152
BMI	21.75±4.14	21.42±2.91	0.728
WHR	0.77±0.67	0.78±0.08	0.935

BMI: Body mass index, WHR: Waist–hip circumference ratio. Analysis done by Student's unpaired t-test. Values are expressed as mean±SD. *P<0.05, **P<0.01, ***P<0.001

Table 2: Effect of 12 weeks of slow breathing exercise training (n=29) on anthropometric parameters

Parameters	Pre-test	Post-test	P value
BMI	21.75±4.14	19.51±3.95*	0.03
WHR	0.77±0.67	0.71±0.58	0.72

BMI: Body mass index, WHR: Waist–hip circumference ratio. Analysis done by Student's paired t-test. Values are expressed as mean±SD. *P<0.05, **P<0.01, ***P<0.001

Table 3: Changes in control group (n=30) after 12 weeks of study period on anthropometric parameters

Parameters	Pre-test	Post-test	P value
BMI	21.42±2.91	22.13±2.21	0.29
WHR	0.78±0.08	0.79±0.24	0.83

BMI: Body mass index, WHR: Waist–hip circumference ratio. Analysis done by Student's paired t-test. Values are expressed as mean±SD. *P<0.05, **P<0.01, ***P<0.001

DISCUSSION

Slow breathing exercises have a pacifying action and it relaxes the body. The possible mechanism is generation of inhibitory signals and hyperpolarizing currents within neural and non-neural tissue by mechanically stretching tissues during inspiration and holding the breath. This increases the parasympathetic activity and decreases sympathetic activity. The shift in autonomic balance towards parasympathodominance is proposed due to the generation of hyperpolarization current which initiates the synchronization of neural elements in the central nervous system, peripheral nervous system, and surrounding tissues.[9] WHR is used as an important indicator for the anthropometric component in all the subjects or patients with risk of cardiometabolic conditions, for example, prediabetes and cardiovascular disease.[10]

After 12 weeks of slow breathing exercise training, BMI was decreased significantly in the study group ($P < 0.05$). Our results are in agreement with the previous studies which reported that integrated yoga practices lead to reduction in anthropometric parameters such as BMI and WHR. It is proposed that regular slow breathing exercise practice produces reduction in body weight due to reduction in stress as well as parasympathodominance which ultimately causes sense of well-being and reduces over eating to the individual.[11-13] These results are also in concordance with the previous research results by Desika *et al*. in which Nadi shuddhi pranayama intervention produced a significant difference ($P \leq 0.05$) in the BMI, WHR, heart rate (HR), systolic blood pressure, and diastolic blood pressure in both phases of menstrual cycle at the end of the study period when compared with the control group.[14]

Very few studies have evaluated the exclusive effect of pranayama practices on anthropometric parameters. In a previous study by Telles *et al.* reported that there was a significant decrease in BMI even after 1 month of practice with various pranayama techniques.[6] However, they have mentioned that the reason for this reduction might be due to their change in diet as well as increased physical activity which did not correlate with their reduction in anthropometric parameters with pranayama practices.

Previous studies have been reported that the effect of yoga on human system accomplished by decrease in the action of hypothalamic–pituitary–adrenal axis. Early assessment of anthropometry which helps to decrease weight and reduces the cardiovascular mortality and morbidity by increase in HR variability.[15]

Anthropometric parameters provide indirect assessment of physical fitness of the individual and it should be carried out in a multidisciplinary level. Regular weight reduction sessions include low-fat/carbohydrate diets, cognitive behavioral therapy programs, and regular exercise. These are given in an individualized way to maintain anthropometric parameters within normal range. The yoga-based lifestyle modification sessions include asana, pranayama, and lifestyle interventions.[16]

Limitations of the Study

Physical activity, diet pattern, and other adverse lifestyle factors were not controlled in the study groups as this would require a residential program.

CONCLUSION

Regular practice of slow breathing exercises improves the psychosocial and physiological well-being in healthy as well as obese individuals along with diet and other lifestyle modifications. Therefore, slow breathing exercise and relaxation techniques can be prescribed along with conventional weight reduction techniques to restore homeostatic set point in obese and overweight individuals.

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