Effect of Yoga Training on Handgrip, Respiration and Blood Pressure

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Abstract: Although there are a number of reports on the effect of yoga training on blood pressure, very few studies have been undertaken on the effect of yoga training on respiratory pressures and handgrip endurance. Hence the present work was planned to study the effect of yoga training on hand grip strength (HGS), hand grip endurance (HGE), maximum expiratory pressure (MEP), maximum inspiratory pressure (MIP), systolic blood pressure (SBP) and diastolic blood pressure (DBP). 15 male students in the age group of 15 to 16 years were given yoga training (asans and pranayams) for 4 months. 15 male students of the same age group formed the control group. Yoga training produced statistically significant ($P<0.05$) increase in HGS, HGE, MEP, MIP, SBP and DBP after the yoga training. In contrast, the increase in these parameters in the control group was statistically insignificant. This study shows that yoga training for 4 months improves strength of inspiratory and expiratory muscles, skeletal muscles of arm and shoulder. Positive improvement was also observed in systolic and diastolic Blood Pressure. It is suggested that yoga should be introduced at school level in order to improve physiological functions, overall health and performance of students.

Keywords: Yoga, Grip, Training, Respiratory, Muscles.

Introduction: There are a number of reports on the effect of yoga training on blood pressure (1, 2). However, very few workers have studied the effect of yoga training on respiratory pressures i.e. maximum expiratory pressure (MEP) and maximum inspiratory pressure (MIP). Respiratory pressures are easily measured, objective and sensitive indices of respiratory muscle strength and can be altered in disease states even when other commonly measured pulmonary function tests show little abnormality (6). In an earlier work, we have found that yoga training for 12 weeks results in a significant improvement in MEP and MIP in normal young volunteers (7). In the same study, we also observed a significant increase in handgrip strength (HGS) after yoga training and this is in agreement with the findings of other workers (8, 9, 10). However, the effect of yoga training on handgrip endurance (HGE) has been studied by only a few workers. While Tran et al (10) have reported a significant increase in muscular endurance after 8 weeks yoga training program, Dash and Telles (11) have concluded that yoga training does not increase muscle endurance. Handgrip dynamometry is an indicator of muscle function and nutritional status. As an objective and accurate physiological test that is easy to perform, it can be used as a bedside test to predict preoperative nutritional status and postoperative complications (12). Keeping this in mind, we planned to study the effect of yoga training on these parameters. Since most of the studies on the effect of yoga training on pulmonary functions have been conducted on subjects above 18 yr in age, the present study was carried out on school going children from younger age (15-16 yr) group.

METHOD:

Subjects and Training: 30 male student volunteers studying in 10th standard Hisar District Schools were selected and recruited for the present study. They were not practiced yoga earlier and none of the subjects had a history of substance abuse. All were free from respiratory and cardiovascular diseases. Their age was 15 to 16 years, weight 49 to 65 (59.25 ± 1.92, SEM) kilograms, height 1.57 to 1.74 (1.63 ± 0.03, SEM) meters and body mass index (BMI) 10.87 to 28.75 (19.90 ± 0.35, SEM) units. The consent was obtained from them as well as from their parents. The subjects were divided randomly into two groups of 15 each.

Group I (yoga group) subjects were taught the following asanas and pranayams: pashchimottanasan, trikonasan, navasan, utkatasan, ardhamatsyendrasan, noukasan, talasan, halasan, bhujangasan, shalabhasan, sarvangasan, bakasan, pavanmuktasan, mukh-bhastrika, matsyasan, shavasan, mahat yoga pranayam, nadi shuddhi and savitri pranayam. Each pose was held for 30 seconds and a short period of rest was given between the poses. Each pranayam was performed nine times. Shavasan was performed at the end for ten minutes. The subjects under direct supervision had undergone yoga training over a period of 4 months, six days a week.

Group II (control group) subjects did not practice yoga during this period. They were following their normal routine.

The subjects were get familiarized with the laboratory environment and their anthropometric measurements were taken. They were given instructions about the experimental procedures and practice trials were also administered. The tests were performed prior to the start of training and after the completion of training programme.

Handgrip strength was measured with the handgrip dynamometer (**Fabrication Enterprises, Inc.**).

The subjects hold the dynamometer in the right hand, with the arm at right angles and the elbow by the side of the body. The base should rest on first metacarpal (heel of palm), while the handle should rest on middle of four fingers. When ready, the subjects squeezed the dynamometer with maximum effort, which was maintained for about 5 seconds. No other body movement was allowed. The subjects was strongly encouraged to give a maximum effort. For determining HGE, the subjects were asked to maintain 1/3rd of HGS in a sustained squeeze for as long as possible and the time (sec) was noted.

Respiratory pressures: Subjects were instructed to exert maximal inspiratory and expiratory effort during each measurement to maintain pressure level for at least 2 s. This was determined by the use of a stop watch. The subjects were asked to look at the needle of the pressure gauge as visual feed-back. No pressure time course for time tracing was adopted during the study measurements. Five consecutive efforts were performed and recorded allowing a 1-min pause between each effort.

Subjects were in a sitting position, connected to a portable differential pressure transducer (cmH_2O; Honeywell manometers, Freeport, IL, USA), breathing through a one-way valve with a tube-type piece with a small hole preventing closure of the glottis. This was then connected to the cannula, or to a flanged mouthpiece. A nose-clip was applied when using a mouthpiece. When using the mouthpiece, subjects were trained to prevent air leaks around it and to support the cheeks during the expiratory efforts, thus, helping them to pinch their lips around the mouthpiece.

Blood pressure: Blood pressure measurement through the sphygmomanometer is one of the most common ways of monitoring blood pressure. While measuring the blood pressure, the cuff was wrapped around the upper arm of the subjects. The cuff was placed around the upper arm at roughly the same vertical height as heart. Thereafter, the cuff was inflated by squeezing the rubber bulb. When the cuff was inflated well and truly as per the requirement then the pressure of the cuff was released very slowly while listening through the stethoscope. With the release of the pressure, the blood was pulsed in artery making a whooshing sound. The pressure at which the sound was heard for the first time was recorded as the systolic pressure. The pressure at which the last sound was heard was recorded as the diastolic pressure. The blood pressure was measured in millimeters of mercury (mm Hg).

Statistical analysis: The data was analyzed using Student's paired 't' test to compare the pre and post training values of both the groups. P value of less than 0.05 was accepted as indicating significant difference between the compared values

RESULTS: Yoga training of four months produced a significant ($P<0.05$) increase in HGS and HGE in our group I subjects (Table I). It also produced a highly significant ($P<0.001$) increase in MEP, MIP. Positive improvement was also observed in systolic and diastolic Blood Pressure. In contrast, the changes in these parameters in the control group subjects were statistically insignificant.

Table: Handgrip strength (HGS), handgrip endurance (HEG), maximum expiratory pressure (MEP), maximum inspiratory pressure (MIP), Systolic pressure and diastolic pressure before and after four months study period

Parameters	**Yoga group**		**Control group**	
	Pre Test	**Post Test**	**Pre Test**	**Post Test**
HGS (kg)	48.4 ± 2.7	56.5 ±3.4*	47.3 ±2.5	47.5 ±2.3

HGE (kg)	37.7 ±3.2	43.6 ±2.9*	35.6 ±2.5	36.1 ±2.1
MEP (cmH_2O)	57 ±2	63 ±3*	55 ±5	56 ±3
MIP (cmH_2O)	51 ±3	55 ±4*	52 ±3	52 ±3
Systolic Pressure (mm Hg)	134 ±3	122 ±3*	135 ±4	134 ±3
Diastolic Pressure (mm Hg)	72 ±5	81 ±2*	73 ±3	74 ±4

Values are Mean ±SEM for 15 subjects in each group. * P <0.05

DISCUSSION: In the present study, HGS and HGE increased significantly after four months of yoga training. This is consistent with earlier finding that yoga training produces a significant increase in HGS, Raghuraj *et al* (6). On the other hand, Dash and Telles (8) have concluded that yoga training produces an increase in motor speed for repetitive finger movements, but not in strength or endurance. The increase in HGS and HGE in yoga group is consistent with the findings of Tran et al (7) who have reported that eight week hatha yoga training results in a significant increase in kinetic muscular strength and isometric muscular endurance. Raju *et al* (12) have also reported that yoga training results in a significant increase in maximal work output with a significant reduced level of oxygen consumption per unit work. Some of the yogic postures in our study like bakasan, bhujangasan and shalabhasan involve sustained isometric contraction of the shoulder, chest and arm muscles. Consequent improvement in the strength and endurance of these muscles can explain the significant increase in HGS and HGE. In the present study MEP and MIP increased significantly following four months of yoga training in group I subjects. The results do not agree with those of Gopal *et al* (13) who have reported a lower MEP in yoga trained subjects as compared to untrained ones. Chen and Kuo (14) have reported that inspiratory muscle endurance is greater in physically active men than sedentary men. The increase in MEP and MIP in yoga group of this study indicates that yoga training improves the strength of the expiratory as well as inspiratory muscles. Mukh-bhastrika included in the present training program involves powerful strokes of exhalation, which trains the subject to make full use of diaphragm and abdominal muscles. Slow, deep and full exhalation and inhalation during mahat yoga and savitri pranayams also train the respiratory muscles. Respiratory muscles are vital and evaluation of their performance is important. Respiratory pressures are specific and sensitive indices of respiratory muscle strength and they are easy to measure and reproducible. Black and Hyatt (6) have demonstrated that their values are altered before there is alteration in other commonly used pulmonary function tests. Hence, evaluation of respiratory muscle strength is important from physiological as well as clinical point of view. Since the highest MEP is obtained at lung volumes of more than 70% of total lung capacity and the highest MIP is obtained at lung volumes of less than 50% of total lung capacity (16), we measured MEP after full inspiration and MIP after full expiration.

Yoga training resulted in appreciable and statistically significant improvement in all the parameters measured in this study. In conclusion, the present study shows that four months yoga training produces a

significant improvement in handgrip strength and endurance, respiratory pressures and blood pressure and this improvement is appreciable.

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