



## Effects of combination of own body resistance exercises and plyometric training with yogic practices on cardio respiratory endurance, blood pressure and breath holding time among adolescent school boys

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Article History : Received 05 February 2014, Accepted 13 April 2014

### Abstract

The purpose of the study was to compare the effects of two different training protocols – (i) own body resistance exercises and plyometric training, and (ii) own body resistance exercises and plyometric training with yogic practices on different parameters such as cardio-respiratory endurance, systolic and diastolic blood pressure and breath holding time. Sixty adolescent school boys were divided into 3 groups i.e., group I as own body resistance exercises and plyometric training group (n=20), group II as own body resistance exercises and plyometric training with yogic practices group (n=20) and group III as control group (n=20). One mile run, systolic and diastolic blood pressure and breath holding time were measured before and after a twelve weeks training period. Subjects in each of the training groups were trained three days per week, whereas control group did not participate in any training activity. The data were analyzed by analysis of co-variance (ANCOVA). The results showed that all the trainings elicited significant ( $p < 0.05$ ) improvement in all the tested variables. However, the own body resistance exercises and plyometric training with yogic practices group showed signs of better improvement in the one mile run, systolic and diastolic blood pressure and breath holding capacity than own body resistance exercises and plyometric training. This study provides support for the use of traditional yogic practices with own body resistance exercises and plyometric training to increase the cardio-respiratory endurance, breath holding time and reduce systolic and diastolic blood pressure.

**Keywords :** Own body resistance exercises, plyometric training and yogic practices.

### Introduction

Own body resistance training is a form of exercise consisting of a variety of exercises, often rhythmical movements, generally without using any equipment or apparatus. It is intended to increase body strength and flexibility with movements such as, bending, jumping, swinging, twisting or kicking, using only one's own body weight for resistance. When performed vigorously and with variety, own body resistance training can benefit both muscular and cardiovascular fitness, in addition to improving psychomotor skills such as balance, agility and coordination. Movements such as, push-up, pull-up, and sit-up are some of the most common own body resistance exercises

without any weight equipment which are to be done to maintain muscular movement (Low Steven, 2010).

Plyometric is a form of power training that consists of an eccentric contraction followed by a concentric contraction (i.e., a vigorous stretch shortening cycle). It has been claimed that plyometric training is particularly useful for explosive power based sports such as basketball, volleyball, throwing and sprinting. Plyometric is defined as the exercise that enables a muscle to reach more strength as short as possible (Geiger, 2004).

Now a days, stress is a dangerous and significant problem of world that affects physical,

mental, behavioral and emotional health of an individual. Yoga has been reported to reduce stress which is found to be beneficial in treating stress related disorders, in improving autonomic functions, lowering blood pressure, increasing strength and flexibility of muscles, improving the sense of well being, delaying ageing process, control of breathing, reducing signs of oxidative stress and improving spiritual growth.

Yoga has been practiced for thousands of years. It is based on ancient theories, observations and principles of the mind-body connections. Substantial research has been conducted to look at the health benefits of yoga postures (asanas), yoga breathing (pranayama) and meditation (Malhotra and Singh, 2002). The overall performance of an athlete is known to be improved by practicing yoga techniques (Upadhyay *et al.*, 2008). In the present study an attempt has been made to study the effects of own body resistance, plyometric training and yogic practices on the cardio respiratory endurance among adolescent school boys of Coimbatore city.

### **Materials and Methods**

For the present study, sixty adolescent school boys were randomly selected from Sri Visweswara Vidyalaya Martic Higher Secondary School, Coimbatore (Tamil Nadu, India) to participate in this investigation. The age of the selected subjects ranged from 13-15 years and they were divided into three groups i.e., Group I as own body resistance exercises and plyometric training group (N=20), Group II as own body resistance exercises and plyometric with yogic practice group (N=20) and Group III as control group (N=20).

### **Experimental design**

The study was formulated as pre and post test design, consisting of two experimental groups and one control group. Group I had undergone own body resistance exercises and plyometric training (OBREPT), Group II had undergone own

body resistance exercises and plyometric training with yogic practices (OBREPTYP) and Group III was designated as a control group which had not undergone any prescribed training programme other than the normal daily activities. The subjects were tested at the beginning of the 12 weeks of training and data were recorded as pre - test data and those tested after 12 weeks of training and the data were recorded as post -test data. The programme was scheduled in the morning and evening sessions on alternate days (ie. 3 days in a week).

### **Testing procedures**

All procedures were instructed and demonstrated to the subjects prior to testing. Measurements of various parameters such as cardio respiratory endurance, systolic and diastolic blood pressure and breath holding capacity were made prior to training (pre test data) and immediately after the 12 weeks training programme (post test data). Cardio respiratory endurance was assessed by using 1 mile run test and the score was recorded in minutes. Systolic and diastolic blood pressure was measured by using Sphygmomanometer and stethoscope and the score was recorded in mmHg pressure. Breath holding capacity was measured by closing the noses with nose clip and the score was recorded in seconds with a stop watch.

### **Training programme**

The own body resistance exercises and plyometric training with yogic practices programme was constructed based on the training principle. The training programme was carried out and the subjects underwent their respective training programme as per the schedule. The experimental groups were trained thrice per week on nonconsecutive days (Monday, Wednesday and Friday) for 12 weeks under the supervision of the investigator. Each training session was conducted in morning and evening time. Prior to every training session, all the two groups had

**Table – 1. Own body resistance exercises training schedule**

<b>Weeks 1-4 1-2 SETS/10 REPETITIONS</b>	<b>Weeks 5-8 1-2 SETS/8 REPETITIONS</b>	<b>Weeks 9-12 1-2 SETS/8 REPETITIONS</b>
Wall pushups V – sit ups Plank Trunk lifts Wall squat Lunges Wall jumps Standing side leg raises Bar hang Forward kicks	Knee pushups Sit ups Side plank Tummy lying leg lifts Half squat Side lunges Star jumps Standing rear leg Pronated grip Back kicks	push ups Incline sit ups Bridge Alternating superman arm / leg lifts Squat Reverse lunges Forward jumps Lying side leg raise Supinated grip Side kicks

**Table – 2 - Plyometric Training Schedule**

<b>Weeks 1-4 1-2 SETS/10 REPETITIONS</b>	<b>Weeks 5-8 1-2 SETS/8 REPETITIONS</b>	<b>Weeks 9-12 1-2 SETS/8 REPETITIONS</b>
Clapping push ups Tuck jump Alternate leg diagonal bound Double leg jump forward Arrow cone drill Squat jump Vertical jump Box skip	Shock push ups Ankle jump Lateral cone hops Double leg butt kick T-drill Split jump Long-jump & sprint Front box jump	Decline push ups Depth jump leap Standing broad jumps Fast skipping X-drill Split Jump & turn 90° Box jump

10 minutes warm up. None of them reported any injury. However muscle soreness and fatigue were reported in the early weeks which subsided later. At the end of the training session 10 minutes warm down exercises were given.

#### **Own body resistance exercises**

The resistance exercises programe progressed from phase one (weeks one to four; 2-3 sets of 8-10 repetitions) to phase two (weeks five to eight; 2-3 sets of 8-10 repetitions) and phase three (weeks nine to twelve; 2-3 sets of 8-10 repetitions). During weeks one and two, five and six, nine and ten the subjects performed two sets of each exercise, so that, the subjects become adapted to proper technique. During weeks three and four, seven and eight, eleven and twelve the

subjects performed three sets of each exercise. Subjects performed 10 resistance exercises during all weeks. Summary of the resistance exercises training programme is presented in Table – 1.

#### **Plyometric training schedule**

The plyometric training programe progressed from level one (weeks one to four; 1-2 sets of 10 repetitions) to level two (weeks five to eight; 1-2 sets of 8 repetitions) and level three (weeks eleven to twelve; 1-2 sets of 8 repetition). During weeks one and two, five and six, nine and ten, and the subjects performed only one set of each exercise, so that the subjects become adapted to proper technique performance. During weeks three and four, seven and eight, eleven and twelve the subjects performed two sets of

**Table – 3. Changes in cardio respiratory endurance, systolic and diastolic blood pressure and breath holding time during 12 week training period**

Group	Test	Cardio respiratory endurance (minutes)	Systolic blood pressure (mmHg)	Diastolic blood pressure (mmHg)	Breath holding time (seconds)
Own body resistance exercises and plyometric training (OBREPT)	Pre	16.60 ± 1.36	108.60 ± 5.04	78.30 ± 4.42	17.61 ± 5.72
	post	15.11 ± 1.06 †§	106.45 ± 9.00 †§	78.20 ± 2.74 †§	23.12 ± 8.61 †§
Own body resistance exercises and plyometric training with yogic practices (OBREPTYP)	Pre	16.51 ± 1.50	107.05 ± 4.61	78.25 ± 2.84	17.50 ± 2.08
	Post	15.02 ± 1.05 †§‡	106.45 ± 9.00 †§‡	76.20 ± 2.74 †§‡	26.25 ± 3.88 †§‡
Control group	Pre	16.48 ± 1.17	115.65 ± 5.12	79.45 ± 3.99	17.32 ± 3.76
	Post	16.58 ± 1.31	116.70 ± 4.93	79.40 ± 3.97	17.39 ± 3.71

† Significant difference between pre test and post test (p<0.05)

§ Significant difference compared with the control group (p<0.05)

‡ Significant difference between OBREPT and OBREPTYP groups (p<0.05)

each exercise. Subjects performed 8 plyometric exercises during all weeks. Summary of the plyometric training schedule is presented in Table - 2.

### Yogic practices

The subjects in Group II the own body resistance exercises and plyometric training with yogic practices performed eight asanas (Padmasana, Paschimottanasana, Bhujangasana, Halasana, Swastikasana, Vajrasana, Trikonasana and Dhanurasana) in a slow, deliberate manner with proper body alignment during the twelve weeks training period. In each asana subjects held at final posture for 20 seconds at a point of mild discomfort, relaxed for 5 seconds, and then repeated the same asana for another 20 seconds. Same procedure was followed for all the eight asanas and each asana was repeated for four times. At the end of each training session, the subjects performed savasana to relax the muscles of hip/low back muscles, hamstring muscles, quadriceps muscles, calf muscles, chest muscles, shoulder muscles, back muscles and arm muscles.

### Data analysis

The data was analyzed by analysis of Co-variance to determine the significant differences among the treatment means on each variable. When a significant difference among the training programme was detected, a pair-wise comparison of the programme was done using a Bonferroni post hoc test to identify significant differences between the training programme. The alpha level was set at 0.05 in order for the difference to be considered significant. The data analysis was done by using SPSS software package.

### Results

The data of Means ± SD for different parameters such as cardio respiratory endurance, systolic and diastolic blood pressure and breath holding time are given in Table - 3. Analysis of co-variance (ANCOVA) demonstrated a significant value (p<0.05) for all the tests and the results of the experimental groups were better than those of the control group. The Bonferroni post hoc test was used for a pair-wise comparison of the program. Own body resistance exercises and plyometric training with yogic practices

(OBREPTYYP) training was significantly better than own body resistance exercises and plyometric training (OBREPT) by way of increasing the cardio respiratory endurance and breath holding time and by decreasing the systolic and diastolic blood pressure.

Paired 't'-tests on the experimental groups showed significant increase on cardio respiratory endurance (OBREPT = 1.49; OBREPTYYP = 1.49) and breath holding time (OBREPT = 5.51; OBREPTYYP = 8.75), decrease on systolic blood pressure (OBREPT = 2.15; OBREPTYYP = 0.6), diastolic blood pressure (OBREPT = 0.1; OBREPTYYP = 0.05) in post-training in relation to pre-training.

### **Discussion**

All the subjects of the experimental groups involved in this study underwent own body resistance exercises with plyometric training (20 subjects) and own body resistance exercises, plyometric with yogic practice (20 subjects) which was assigned to them. It was evident that the significant changes in selected variables such as cardio respiratory endurance, systolic blood pressure, diastolic blood pressure and breath holding time were noticed after 12 weeks of training. In control group there were no changes in cardio-respiratory endurance, systolic blood pressure, diastolic blood pressure and breathe holding time.

Sandip Sankar Ghosh and Gopa Saha Roy (2013) while studying the effects of six month aerobic training on selected physiological variables, reported that the exercise training had significant effect on the cardio respiratory endurance after 25 weeks. Mark d. Tran *et al.* (2000) reported that after 8 weeks of hatha yoga practice on the health related aspects of physical fitness showed that there was a significant improvement in cardio respiratory endurance. Upadhyay Dhungel *et al.* (2008) indicated that there was a significant difference on cardio

respiratory endurance in yogic practice between pre test to post test is about (18.14 to 16.03) respectively. Similarly Sunitha and Ravi (2013) evaluated the result in cardio respiratory endurance and showed a significant decrease from pre test (16.55) to the post test (14.03) due to yogic training program.

The results of Jaykishan Santhoshi (2010) indicated that the calisthenics and yogic practices showed significant improvement of 7.54 mmHg and 14.47 mmHg in systolic and diastolic blood pressure respectively. Hamid Arazi *et al.* (2013), based on the post-plyometric exercises influence of exercise intensity, reported optimal decrease in systolic and diastolic blood pressure. Chanda Rajak *et al.* (2012) reported that the yogic exercises, pranayama and meditation program can produce significant reduction in systolic and diastolic blood pressure to about 4.45 mmHg and 2 mmHg respectively.

In the findings of Sani Kumar Verma (2014), it is stated that there was a significant relationship at 0.05 level between breath holding capacity and playing ability of the players. This could be because, it is usually seen that players hold their breath while executing any explosive action. Sanjay R Gamit (2013) reported that regular yoga practice for 3 months can elicit improvements in breath holding time. Madanmohan *et al.* (1992) observed that the 12 weeks of yogic practices improved breath holding time from  $63.69 \pm 5.38$  to  $89.07 \pm 9.61$  ( $p < 0.05$ ). Sunitha G. Ravi (2013) demonstrated a statistically significant improvement on breath holding time from pre test (48.30) to the post test (53.57) due to yogic training program. The maximal oxygen intake increased in yoga practice by 6% (Tran *et al.* 2001).

### **Conclusion**

Based on the finding of this study, it was concluded that the own body resistance exercises and plyometric training performed with yogic

practices showed comparatively more improved performance of the adolescent boys by way of increasing the cardio respiratory endurance, breath holding time and by decreasing the systolic and diastolic blood pressure than that by the own body resistance exercises and plyometric training. It is, therefore, recommended that coaches, trainers and athletes interested in improving the athletic performance should include yogic practice in their training which might help to calm their mind and should focus their concentration through pranayama (breath-holding exercises).

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