



Impact of own body resistance exercises and plyometric training with yogic practices on explosive power, speed and agility development among adolescent school boys

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Abstract

The purpose of the study was to examine the influence of the own body resistance exercises and plyometric training with yogic practices among adolescent boys. Forty school boys (age 13 - 15 years) were randomly assigned into two groups: an own body resistance exercises and plyometric training with yogic practices group (n=20) and a control group without any training activity (n=20). Experimental group performed the training for 3 days per week for 12 weeks. The data were analyzed by paired 't' test. The results showed that the experimental group following the exercise training intervention significantly increased the explosive power, speed and agility of the adolescent boys. With regard to control group, there were no significant changes in explosive power, speed and agility. This study provides support for the use of yogic practices with own body resistance exercises and plyometric training to increase explosive power, speed and agility among adolescent school boys to improve sports performance skills.

Keywords : Own body resistance exercise, plyometric training, explosive power, speed and agility

Introduction

The muscle inactivity always leads to weakness and wasting of muscles. Muscles are no exception to the saying "use it or lose it". Regular exercise not only increases muscle size, strength and endurance but can also improve the physical health in three ways: more efficient heart and lungs, improve muscle tone, and more supple joints (Low Steven, 2010). In our daily life style activity, we make muscular movement and some play activities, but due to the mechanical and electronic development, the daily routine and play activity of the adolescent school boys are now diverted to play with computers and video games than the play ground activity. So, to maintain a good health at this age adolescent school boys have to be involved in muscular activity for minimum of 20 minutes (Low Steven, 2010).

Movements such as, push-up, pull-up, and sit-up are some of the most common own body weight exercises without any weight equipment that are to be done to maintain muscular movement. And as far as plyometric is concerned it is the exercises that enable the muscles to reach maximum strength in minimum time (Baechle Thomas, 1994). To gain good health, it is suggested that a total of at least 20 minutes per day, of moderate exercise, to burn around 200 calories a day, is required. In order to burn calories, an individual can do the own bodyweight resistance exercises which can be easily done anywhere. Increasing the amount of repetitions of exercises, will focus on improving endurance, while strength gains by increasing the intensity of the exercise through decreasing leverage and working at the ends of range of motion (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), which has been claimed to be particularly useful for explosive power based sports such as basketball, volleyball, throwing and sprinting (Geiger, 2004). Yoga has a unique place in the search of realization and through good realization our body will respond to our mind and soul in a better way. In order to extricate the body from the tackle of disease, the emotional disturbance of the mind and ruffled intellect, yoga practices to be performed to the level of perfect consciousness to avoid of prejudices (Datey and Gharote, 1985). Yoga is an ancient Indian practice, first described in Vedic scriptures around 2500 B.C., which utilizes mental and physical exercises to attain samadhi, or the union of the individual self with the infinite (Lidell, 1983). Yogic techniques are known to improve one's overall performance. Pranayama (breathing exercise) is known to be a part of yogic techniques. By keeping this as a concept, the own body resistance exercises and plyometric training with yogic practices were implemented for the present study.

The present study was to investigate the impact of own body resistance exercise and plyometric training with yogic practices on explosive power, speed and agility among adolescent school boys. Modern education emphasises to keep individual fit physically and mentally. The previous studies (Adams *et al.*, 1992; Fatouros *et al.*, 2000) acknowledge that the resistance exercise coupled with plyometric training and yogic practices improved various physical parameters. An attempt is made to give own body resistance exercise along with plyometric training and yogic practices among the adolescent school boys to understand the change in physical parameters. In this view, it was hypothesized that own body resistance exercise along with plyometric training and yogic practices

significantly improved the selected physical parameters such as, explosive power, speed and agility among adolescent school boys.

Selection of subjects

For the present study, forty adolescent boys were selected from Sri Visweswara Vidyalaya Martic Higher Secondary School, Coimbatore, (Tamil Nadu, India) who have volunteered to participate in this investigation. The age of the selected subjects ranged from 13-15 years. The nature of this study was explained to the subjects and the subjects have expressed their willingness to serve as subjects in this study. The subjects who had muscular pain, orthopedic or neurological impairment, any surgery or having pathological or systematic disease were excluded from the study.

Experimental design

The study was formulated as random group design, consisting of experimental Group I which had undergone own body resistance exercises and plyometric training with yogic practices and Group II was designated as a control group which had not performed any prescribed training program other than the normal daily activities. Forty subjects were divided into two groups consisting of 20 subjects each. All the training programmes were scheduled for 3 days per week for 12 weeks. The physical parameters such as explosive power, speed and agility were recorded in both the Group I and II before the start of the training programme and those values were treated as pre test values. After 12 weeks of exercise in Group I (own body resistance exercises and plyometric training with yogic practices) and after 12 weeks without any exercise in Group II (control Group), the physical parameters were recorded as post test values.

Evaluation

All the procedures were explained and demonstrated to the subjects prior to testing. Recordings of physical parameters were made

prior to training (pre test) and immediately after the 12 weeks of training programme (post test). Among the physical parameters, explosive power was measured by vertical jump test and the score was recorded in centimeters, Speed was measured by 50 meters dash test and the score was recorded in seconds, Agility was measured by 10 meters shuttle run test and the score was recorded in seconds.

Training program

The experimental group was trained three days in a week on nonconsecutive days (Monday, Wednesday and Friday) for 12 weeks. Prior to the training session, all the subjects underwent 10 minutes warm-up period which included jogging followed by stretching exercises.

Yogic practices

The subjects in Group I (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 and 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 specific 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.

Own body resistance exercises

The resistance exercise programme 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 the 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 performance. During weeks three and four, seven and eight, eleven and twelve the subjects performed three sets of each exercise. Subjects performed 8 resistance exercises during all weeks. Summary of the resistance exercises training programme is presented in Table - 1.

Plyometric training schedule

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

Statistical Analyses

The significant difference between the mean values obtained for experimental (Group I) and control (Group II) was tested by 't' test. All collected data were statistically analyzed at 0.05 level of confidence (Harison Clarke *et al.*, 1972).

Table - 3 indicates the obtained 't' ratios for all the physical variables of explosive power, speed and agility of adolescent school boys for own body resistance exercise and plyometric training with yogic practices. The obtained 't' ratios of 3.33 (explosive power), 6.25 (speed) and 4.41 (agility) respectively were greater than the critical value of 2.09 for degrees of freedom 19. Hence the formulated hypothesis that the own body resistance exercises and plyometric

Table – 1. Summary of own body resistance exercises program

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

Table – 2. Summary of plyometrics training program

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

Table - 3. Significance of mean gains / losses between pre and post test of combination of own body resistance exercises and plyometric training with yogic practices on explosive power, speed and agility of adolescent school boys

Variables	Pre test Mean ± SD	Post test Mean ± SD	Mean Difference	SEM	't'- ratio
Explosive power (cm)	42.30 ±4.84	47.25 ± 4.62	4.95	1.48	3.33*
Speed (sec)	7.48 ± 0.50	6.47 ± 0.50	1.01	0.16	6.25*
Agility (sec)	12.16 ± 0.64	11.19 ± 0.65	0.97	0.21	4.41*

*Significant at .05 level of confidence.

Table – 4. Significance of mean gains / losses between pre and post test of control group on explosive power, speed and agility of adolescent school boys

Variables	Pre test Mean ± SD	Post test Mean ± SD	Mean Difference	SEM	't'- ratio
Explosive power (cm)	42.65 ± 5.17	42.90 ±4.10	0.25	0.67	0.37**
Speed (sec)	7.49 ± 0.65	7.43 ± 0.48	0.05	0.09	0.60**
Agility (sec)	12.47 ± 0.64	12.45 ± 0.63	0.02	0.02	1.00**

**Insignificant at .05 level of confidence.

training with yogic practices would significantly improve the selected variables of explosive power, speed and agility may be accepted.

The table - 4 indicates the obtained 't' ratios for all the physical variables of explosive power, speed and agility of adolescent school boys for control group. The obtained 't' - ratios of 0.37 (explosive power), 0.60 (speed) and 1.00 (agility), respectively for the physical variables were lesser than the critical value of 2.09 for degrees of freedom 19. Hence, it could be observed that the mean gains and losses made from pre-test and post-test in the control group were statistically insignificant.

Discussion

We tested the hypothesis that twelve weeks of own body resistance exercises along with plyometric training and yogic practices would lead to greater improvements in explosive power, speed and agility. It was observed that the subjects of own body resistance exercises and plyometric training with yogic practices programme were able to achieve greater improvements in explosive power, speed and agility. Though the previous studies stated that plyometric training along with own body resistance exercises improve explosive power, speed and agility, it was observed from this study that there was a highly significant improvement in the physical parameters such as explosive power, speed and agility when yogic practices was combined with resistance exercises and plyometric training.

Results from several investigations involving adults suggest that combining plyometric training with resistance training may be useful for enhancing muscular performance (Adams *et al.*, 1992; Fatouros *et al.*, 2000). Similar findings were recently reported by Myer *et al.* (2005) who observed that a six week, multi-component training program which included resistance training, plyometric training and speed training

significantly enhanced strength, jumping ability and speed in female adolescent athletes as compared to a non-exercising control group. Some evidence suggests that plyometric training and resistance training can increase speed in adults (Delecluse *et al.*, 1995), Combined resistance and plyometric training significantly improved the performance in pro agility shuttle run as compared to resistance training alone (3.8% vs. 0.3%, respectively) (Vossen *et al.*, 2000).

Our findings suggest that a conditioning program which includes different types of training i.e., plyometric training and resistance training may be most effective for enhancing explosive power in youth. High velocity plyometrics which consist of a rapid eccentric muscle action followed by a powerful concentric muscle action are important for enhancing the rate of force development during jumping and sprinting. Thus the effects of plyometric training and resistance training may actually be synergistic, and thus the combined effects of various programmes being greater than individual program performed alone.

It is also possible that the practice of yoga, particularly asanas (Padmasana, Paschimottanasana, Bhujangasana, Halasana, Swastikasana, Vajrasana, Trikonasana and Dhanurasana) prior to resistance training, might have an adverse effect on performance. The static stretching before resistance training is a common practice for young athletes (Martens, 2004; Shehab *et al.*, 2006). Hence, the asanas which are static stretching in nature if practiced after resistance training might result in greater improvement of explosive power than without yogic practices.

Generally resistance training develops muscle fibers and increases number and size of myofibrils as speed depends up on muscle fibers and oxygen carrying capacity. The fast twitch muscle fibers are responsible for giving the athlete, speed, agility, quickness, and power. Fast twitch muscle fibers are up to 10 times faster than

slow twitch muscle fibers. Thus speed is increased due to own body resistance exercises training.

Cissik and Barnes (2004) reported that the speed is essential for sports technical skills and it was developed through own body resistance training. Speed is the capacity of the individual to perform successive movement of the same patterns faster. The present findings clearly indicated that speed increased significantly due to the influence of varied intensity of own body resistance exercises and plyometric training with yogic practices. The improvement of speed may depend upon the effect of training, increase in activity level of glycolytic enzymes following the own body resistance exercises and plyometric training with yogic practices. The findings of the study was supported by Manimaran and Angamuthu (2013) who stated that twelve week of aerobic training with two different frequencies of free hand exercises on speed and explosive power training significantly improved the speed performance. The findings of this study was also supported by Mayur Patel and Mahida (2013) who reported that there was a significant improvement on speed performance due to the plyometrics exercise in six weeks of training. Supporting studies by Vishaw Gaurav (2011) indicated that 8 weeks of hatha yoga training on the health-related physical fitness training improved the speed performance.

Agility is described as athlete's collective co-ordinative abilities from various body alignments. As the athletes have to react with strength, explosiveness and quickness from different positions, the basic technical skills were used to perform motor tasks spanning the power spectrum from dynamic gross activities to fine motor control tasks and include adaptive ability, balance, combinatory ability, differentiation, orientation, reactivity, and rhythm need this skills. Most athletic activities that utilize agility occur in less than 10 seconds and involve the

ability to coordinate a few or several sport specific tasks simultaneously like meeting a football in a pass and then making a series of different moves and cuts to avoid being tackled in order to advance the ball further down the field. Supporting study by Arthur and Bailey (1998) proves that agility is essential for sports technical skills and it was developed through own body resistance training.

Agility was the ability to change direction without losing speed, strength, balance, and body control. The results of the investigation are in accordance with previous studies. The finding of Danny J. Mcmillian *et al.* (2006) showed that in Dynamic Vs Static stretching warm up, there were significant effect in power and agility performance. This study, therefore contributes substantially to the knowledge that a reasonable duration of training will have significant improvement in agility. Results by Vishaw Gaurav (2011) indicated that 8 weeks of hatha yoga training programme showed significant improvement on agility.

Explosive power is often used by elite athletes to improve their ability to generate power and strength. This study proves that explosive power is essential for sports technical skills and it was developed through own body resistance training.

The types of exercises used to build the power are, the movements that require a maximum or near maximum power output from the athlete in a short amount of time. Explosive power is developed through teaching the body to produce maximal force in minimal time (Erik Boyd, 2012). As far as explosive power is concerned, similar findings are recently reported by Elisabeth Boland *et al.* (2009) who stated that the comparison of the power plates and free weight exercises on upper body muscular endurance showed significant improvement on explosive power. Supporting study of Thalia

Parkinson (2008) suggested that of about 22.38% improvements in vertical jump by implementing the plyometric training. Similar findings reported by Fatouros *et al.* (2000) determined that after 12 weeks of combined plyometric training with resistance training increased vertical jump performance by 15% whereas gains of 11% and 9% were reported for subjects who performed only resistance training and plyometric respectively. Vishaw Gaurav (2011) has concluded that 8 weeks of hatha yoga training showed significant improvement on explosive power.

Conclusion

The results of the study indicated that the addition of yogic practices with resistance exercises and plyometric training was more effective in improving explosive power, speed and agility among adolescent boys. The findings of this study highlight the potential value of combined fitness training in a conditioning program aimed at explosive power, speed and agility performance on adolescent school boys to improve sports performance skills. Owing to the growing popularity of adolescent boys fitness program, additional long term studies should be undertaken to find out the neuromuscular mechanisms responsible for training -induced adaptations in young boys.

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