DOI: 10.5958/2319-5886.2014.00001.0

International Journal of Medical Research & Health Sciences

www.ijmrhs.com Volume 3 Issue 4 Coden: IJMRHS Copyright @2014 ISSN: 2319-5886

Received: 9th April 2014 Revised: 28th Jul 2014 Accepted: 29th Aug 2014

Research article

EFFECTIVENESS OF RESISTED ABDOMINAL EXERCISE VERSUS RESISTED DIAPHRAGMATIC BREATHING EXERCISE ON CARDIO VASCULAR ENDURANCE IN SPORTS MEN

*Sathish Gopaladhas[1], Anilkumar Panigrahy[2], Elanchezhian Chinnavan[3], Rishikesavan Ragupathy[4]

[1]Professor, White Memorial College of Physiotherapy, Tamil Nadu, India
[2]Department of Physiotherapy, Institute of Medical sciences and Sum Hospital, Odisha, India
[3, 4] Lecturer, School of Physiotherapy, AIMST University, Malaysia

*Corresponding author email: gdssathish@gmail.com

ABSTRACT

Background and Purpose: The purpose of the study is to compare the effectiveness of resisted abdominal exercise and resisted diaphragmatic breathing exercise on cardiovascular endurance to prescribe a fitness program. **Study design and setting**: Experimental study, YMCA Fitness Foundation Academy, Pachaiyappa Arts and Science College. **Study Sample**: 30 sports men. **Inclusion criteria**: Sportsmen with the age group of 18-30 years. **Exclusion Criteria:** Individuals with postural deviations like scoliosis, Kyphosis, cardiovascular diseases like history of rheumatic heart disease, obstructive lung diseases, vascular problem in lower limb. **Tools**: Step up and step down endurance test **Procedure**: 30 individuals are divided into two groups. Group-I was taught resisted diaphragmatic breathing exercise. Group-II was taught resisted abdominal exercise. Pre-test values of step up and step down, endurance level of athletes were assessed and documented. Total duration of the study is 8 weeks. At the end of 8th week post-test endurance were reassessed using step test. **Results**: Paired t test was used to analyze the effect of cardiovascular endurance. The post test mean values of all the variables of group-I were improved than that of group-II ($p<0.005$). **Conclusion**: Resisted diaphragm breathing has shown improvement in cardiovascular endurance in sports men.

Keywords: Resisted Abdominal exercise, Resisted diaphragmatic breathing exercise, Cardio vascular endurance, Sports person

INTRODUCTION

The process of respiration plays an important role in body energy production that is required to meet the demands placed on body by various systems[1]. Cardiovascular endurance is essential for sports like football and hockey. Good endurance also sometimes plays a decisive role in victory and helps in preventing injuries related to poor fitness[2]. The body derives energy from two systems of energy production, namely aerobic and anaerobic. In aerobic system, the oxidative metabolism of blood glucose and muscle glycogen begins with glycolysis. Oxygen helps in converting the lactic acid produced during exercise to pyruvate. Pyruvate is not converted to lactic acid, but is transported to the mitochondria, where it is taken up and enters the Krebs cycle. Formation of ATP through the ATP-PC system and glycolysis does not involve oxygen and is called anaerobic metabolism[3].

Slow breathing and fast breathing techniques has produced a significant increase in respiratory pressures and respiratory endurance. They used to condition their body using the breathing exercises mentioned in our traditional yoga like Pranayama[4]. Aerobic capacity of a person determines the performance of an individual. The aerobic capacity is determined by many factors such as age, sex, obesity,

exercise module, training state and muscle power[2]. Skeletal muscles respond to training in well described ways which depends on the characteristics of the training load. Oxygen intake can be increased by strengthening the respiratory muscles. The extent of the muscle adaptation depends upon the application of the principle of training such as overload, specificity and reversibility[5].

The first attempt to apply the general principles of skeletal muscle training to respiratory muscles was described nearly two decades ago. Aerobic capacity is one of the important factors for marathon runners and cross country skiers. Improvement of aerobic capacity may enhance the cardio-respiratory fitness[2].

This study was concentrated on strengthening the respiratory muscles to improve uptake of oxygen and thereby increasing aerobic capacity. For many athletes, the core musculature is the weak link in the kinetic chain. A strong core is critical because all movements originated in trunk; this coupling action connects movements of the lower body to those of the upper body and vice versa[6]. Optimal core strength and stability can promote efficient biomechanical movement patterns and reduce the potential for injuries. Resistance training is a valuable tool that can contribute to the development of endurance athletes of all levels and abilities[3]. Traditionally, coaches and athletes were reluctant to certain level to include strength training program because the "extra bulk" would reduce cardiovascular performance. In recent years, research has shown that strength training has no adverse effect on aerobic capacity. In addition, other benefits to the endurance athlete include: maintaining proper muscular strength ratios, increasing bone mineral density, enhancing connective tissue, preventing overuse injuries, improving lactate threshold and improving exercise economy[4].

Diaphragm has endurance properties which exceed that of a limb muscle and also of abdominal muscle[7]. Strengthening the diaphragm could also help in improving general endurance as diaphragmatic breathing is the only way to get air into the lower third of our lungs, where two third of the blood supply is in the body[5]. This breath technique may improve the efficiency of the athlete's lungs. It will enhance the ability to metabolize oxygen. Diaphragmatic breathing has been suggested by many pioneers to improve endurance[8, 9].

On the contrary the abdominal muscles are probably one of the most targeted areas in the world of health and fitness marketing. The abdominal exercises comprised of curl ups followed by progressive resisted exercise patterns, the exercise program is progressed by manual weights[6]. Numerous fitness experts and physiotherapists advocate strengthening some component of the abdominal musculature to prevent musculoskeletal injury, overcome deficiencies in sporting skill or generally enhance performance[6]. Virtually every athlete is advised to stabilize his back and pelvis. Abdominal training programs have stayed at the top of exercises regime. So the study is to determine the effective technique among resisted abdominal exercise and resisted diaphragmatic breathing exercise to improve cardiovascular endurance.

MATERIALS AND METHODS

Ethical Clearance: The study was approved by the Meenakshi College of Physiotherapy review board and complies with the principle laid down in the declaration of Helsinki in 2005.[10]

Study Design: Experimental study

Study Setting: YMCA Fitness Foundation Academy, Pachiyappas Arts and Science College, Chennai

Inclusion criteria: Individuals in the age group of 18-30 years, only male subjects were included, Hockey and football players, Non-smoking athletes

Exclusion criteria: Individuals with postural deviations like scoliosis, kyphosis, cardiovascular diseases like history of rheumatic heart diseases, any obstructive lung diseases, any recent injury to chest and vascular problems in lower limb.

Procedure:

The sampling technique used in this study was non-probability sampling. Totally 30 both hockey and football players were selected for this study and they were divided into Group-I and Group-II consists of 15 subjects in each group respectively.

All the subjects were informed about the study and their consent was obtained prior to training. The subject's aerobic endurance was analyzed using steptest[2]. All subjects underwent two minutes of the warm up period, which consisted of stepping up and down.

Group-I were taught resisted diaphragmatic breathing exercise. Group-II was taught resisted abdominal

exercise. Pre test values of step test, endurance levels of athletes were assessed and documented. Total duration of study was 8 weeks. At the end of 8th week, endurance is reassessed using step test and progression was recorded.

Exercise Prescription:

Group-I: Athletes included in the group-I was taught resisted diaphragmatic breathing.

Resisted diaphragmatic breathing (Inspiratory muscle strength training) is given by using weight plates. The weight plates were placed on a folded Turkish towel to prevent friction between weights and skin of the subjects. The weights were placed on the epigastric region. The weight is placed in such a way that one of the corners touches the xiphisternum and other two corners touches the anterior borders of the rib cage. The subjects were in supine and directed to do the breathing exercise[11]. Inspiratory muscle training was done for 8 weeks with progressively increasing weights in the following manner (table 1):

Table: 1. Progressions of Duration / Weight for Group- I and Group- II

Duration	Weight
1st and 2nd week	2 Kg
3rd and 4th week	3 Kg
5th and 6th week	4 Kg
7th and 8th week	5 kg

Each session lasted for 30 minutes per day for six days weekly for a period of 8 weeks. At the end of the training, i.e. at the end of 8th week, the step test performance of the subjects was assessed and score was obtained in minutes[12].

Group-II: The athletes included in group-II were taught abdominal curl ups[2]. The athlete laid on his back with his knees bent and arms crossed over his chest with the weights held in hand. Simultaneously lifts his head, neck, shoulders and shoulder blades off the floor in a slow controlled manner for 2 seconds. The position, pauses for 2 times and allow the rest of the air out of the lungs. Then slowly lower to the initial position barely allowing the shoulders to touch the floor before he begins the next repetition. He exhales as he lifts and inhales while lowering. Athletes performed this exercise 20 times (1 set). An interval of 2 minutes was given before starting the next set. The session lasted for 30 minutes. The subject's aerobic endurance was analyzed using step test which is measured in minutes [13]. Abdominal curls ups were done 6 days a week with an interval of not exceeding 48 hours between each workout[3]. Resisted abdominal exercise was done 8 weeks with progressively overloading in according the inspiratory muscle training method (Table 1) each session lasted for 30 minutes and it was followed twice a day. At the end of training, i.e. at the end of 8th week, step test performance of the subjects was assessed and the score was obtained. All the statistical analysis was performed using SPS Software package (20.0 version). Values were presented as mean, ± standard deviation and paired t test were used to analyze the effect of resisted diaphragmatic breathing exercise.

RESULTS

Table: 2. Comparison of Step test between Group-I and Group-II before study:

Group	Mean ± SD (Minutes)	T-value	P- Value
Group –I	5.00 ± 1.02	- 0.526	0.627
Group - II	4.57 ± 1.01	- 0.526	0.627

Values are mean ± SD and tests showed a statistical insignificance before test (*p>0.005)

Using Independent sample "t" test, we compared both the groups, the results showed both groups had very less difference in the mean and standard deviation and the P values were insignificant initially.

Table 3: Comparison of step test in Group – I and Group –II (pre – post test values)

Group	Pre Test Mean±SD (Minutes)	Post Test Mean ± SD (Minutes)	T-value	P Value
Group -I	5.00 ±1.02	10.80 ±1.02	-0.1738	0.00
Group - II	4.57 ±1.01	4.45 ± 0.39	-0.335	0.769

Values are mean ± SD and tests showed a statistical significance (*p<0.005)

Paired t-test was done to compare the pretest and Group-I and Group –II. Significantly group –II mean lower than the Post test, Group I showed greater increases in cardiovascular endurance than the other group. So we conclude that the group-I which had achieved the higher mean has developed better endurance. Statistical significance was accepted at p<0.005. The 'P'value of 0.001 suggests that there is

99.99%significance of the result. Subjects from the group-I had improved better in cardiovascular endurance.

DISCUSSION

The present study was designed to determine the effectiveness of resisted diaphragmatic exercise and resisted abdominal exercise and to compare the more effective way to improve cardiovascular endurance.

The male athletes were selected for the study and were divided into two groups. Group-I received resisted diaphragmatic exercises while Group-II received resisted abdominal exercise. The post-test measures were calculated on the basis of step test score and their results were tabulated. Both the groups had registered an increase in their cardiovascular endurance. But the statistical analysis indicates that Group-I subjects who underwent resisted diaphragmatic breathing exercise reported a higher level of improved cardiovascular endurance. This has been supported by various research papers: They demonstrated that a significant improvement in diaphragm thickness increased lung volumes and exercise capacity in healthy individuals [3].

A study has proved that specific inspiratory muscle training can increase the inspiratory muscle performance in well trained athletes [13]. A study stated that the purpose of the endurance component is to improve cardio-respiratory and musculoskeletal function, which will be reflected in increased exercise capacity [14]. Also, this was supported by an author in his book of exercise physiology stating that when endurance training is added to strength training additional improvements occur in endurance than that was generated by strength training alone [8]. The resisted abdominal exercises which were prescribed to Group-II is one of the widely performed exercises irrespective of the type of sports. It is one of the most focused areas of fitness and the exercise program showed improvement in cardiovascular endurance in athletes. The improvement in endurance of athletes who underwent resisted abdominal exercise is supported by a study, they pointed out that strengthening the abdominal muscles helped in improving the overall endurance in cyclists[15].

Hence, both the interventions i.e. resisted diaphragmatic breathing as well as resisted abdominal exercise improved cardiovascular endurance. Group-I who underwent resisted diaphragmatic exercise showed an enhanced cardiovascular endurance than the athletes who underwent resisted abdominal exercise.

CONCLUSION

The study is found to be apparent; the results show that the improvement in cardiovascular endurance measured using resisted diaphragmatic breathing is higher than that of resisted abdominal exercises. Hence, this indicates that resisted diaphragmatic breathing exercise can successfully be incorporated in a fitness training program to improve cardiovascular endurance for sportsmen.

ACKNOWLEDGMENT

The authors extend their gratitude to the Department of Physical Education, Pachaiyappa Arts & Science College, The Young Men Christian Association (YMCA) College of Physical Education, Chennai and the participants.

Conflicts of interest: Nil

REFERENCES

1. William D Mc Ardle, Frank I. Katch, Victor L. Katch. Exercise Physiology: Energy, Nutrition, and Human Performance. Lippincott William's and Wilkins publisher.1996; 4th Edn.
2. ACSM's Guidelines for Exercise Testing and Prescription. American College of Sports Medicine, Lippincott Williams & Wilkins publisher.2006, 7th Edn.
3. Stephanie J Enright, Viswanathan B Unninathan, Clare Heward, Louise Withnall and David H Davies: Effect of High-Intensity Inspiratory Muscle Training on Lung Volumes, Diaphragm Thickness, and Exercise Capacity in Subjects Who Are Healthy. Phys Ther. 2006 ;86(3):345-54
4. Madanmohan, Udupa K, Bhavanani AB, Vijayalakshmi P, Surendiran A. Effect of slow and fast pranayamas on reaction time and cardio-respiratory variables. Indian J Physiol Pharmacol.2005; 49(3):313-8.
5. European Respiratory Monograph 31: Lung Function Testing. Volume 31of European respiratory Monograph, European Respiratory Society. Chapter 4, 2005, 51-77.

6. Hedrick, Allen MA. Training the Trunk for Improved Athletic Performance. Strength and Conditioning Journal.2005; 22(3):50-61.
7. Gandevia SC, McKenzie DK, Neering IR. Endurance properties of respiratory and limb muscles Respire Physiol. 1983; 53(1):47-61.
8. Scott K. Powers, Edward T. Howley- Exercise Physiology: Theory and Application to Fitness and Performance. Chapter 13, 2011, 8th Edn.
9. Leith DE, Bradley M. Ventilatory muscle strength and endurance training. J Appl Physiol. 1976; 41(4):508-16.
10. Lesley D Henley, Denise m Frank. Reporting ethical protections in Physical Therapy research Physical Therapy; 2006; 86(4), 499-09.
11. Stanley John Winser, Priya Stanley, George Tarion, Respiratory rehabilitation with abdominal weights: a prospective study. Scientific research.2010; 2(5):407-11.
12. Stanley John Winser, Jacob George, Priya Stanley, George Tarion, A comparison study of two breathing exercise techniques in tetra plegics.Health.2009; 1(2):88-92.
13. Inbar O, Weiner P, Azgad Y, Rotstein A, Weinstein. Y, Specific inspiratory muscle training in well–trained endurance athlete Med Sci Sports Exerc 2000; 32 (2):1233-7.
14. Mador MJ, MagalangUJ, KufelTJ. Twitch Potentiation Following Voluntary Diaphragmatic Contraction. Am.J.Resir. Crit. Care Med. 1994; 149(3):739-43.
15. Burke, Edmund R.Improved Cycling Performance through Strength Training. National Strength & Conditioning Association Journal.1983; 5(3),6-10.