

Original Research Article

Effect of Inspiratory Muscle Trainer on Running Performance and Respiratory Muscle Strength in Athletes

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Abstract

Background: Athletes are trained for specific games and for specific muscle groups. In all the games respiratory muscles with proper strength are needed so as to provide better outcome. But as the peripheral muscles are trained the Respiratory muscles are not trained specifically in any of the athlete. The less trained Respiratory muscles can directly affect the output of the Athlete by activating Metaboreflex. This reflex is activated when the Respiratory muscles gets fatigued; in which the blood is pulled towards the fatigued Respiratory muscles; due to which the peripheral muscle gets less blood and oxygen to work longer; which results in reduced output. So as to improve overall output, along with specific muscles, the Respiratory muscles should also be trained.

Aim: This study was designed to evaluate the effect of Inspiratory Muscle Trainer on Running Performance and Respiratory Muscle strength in Athletes.

Materials and methods: An Interventional study was conducted on Athletes studying in a Physical Education college Gujarat. The subjects were selected according to inclusion criteria. The Pre-training outcome of P_Imax (Inspiratory Mouth Pressure); P_Emax (Expiratory Mouth Pressure) and time taken for 30m sprint was taken. And then subjects were divided into two groups' one training and other control. **Group A:** Training for Respiratory muscles by Inspiratory Muscle Training Device along with other regular physical activity. **Group B:** Not getting any additional training for Respiratory muscle other than regular physical activity. The training was given at 50% P_Imax for 15 min a day for 6 weeks. At the end of 6 weeks postdata of P_Imax P_Emax and speed were collected.

Results: Data analysis was done using SPSS20 version. In Experimental group Inspiratory Mouth Pressure, Expiratory Mouth Pressure improved significantly ($p < 0.05$) also time taken for completion of 30m sprint reduced significantly. ($p < 0.05$)

Conclusion: The Inspiratory Muscle Trainer can be used to improve Inspiratory Mouth Pressure, Expiratory Mouth Pressure and Running Performance in Athletes.

Key words

Athletes, Metaboreflex, Respiratory Muscle Strength, Inspiratory Mouth Pressure, Expiratory Mouth Pressure, Running Performance, 30m sprint, Inspiratory Muscle Trainer.

Introduction

Adequate physical fitness is a prime requisite to perform any activity efficiently and without getting fatigued. According to the United States Department of Health and Human Services (USDHHS); Physical fitness is defined as “a set of attributes that people have or achieve that relates to the ability to perform physical activity. The attributes of Physical activities are Health Related like: Cardio Pulmonary Endurance, Muscular Endurance, Muscular Strength, Flexibility and Body Composition. The Cardio Pulmonary Endurance plays a very major role for improving physical fitness in Healthy Individuals and Athletes. Respiratory muscle fitness may affect exercise performance in healthy individuals. Isolated respiratory muscle training increases respiratory muscle endurance and endurance time in response to whole body exercise [1]. The respiratory muscle training has been used to improve respiratory muscle function in healthy subjects and in patients [2]. Research has shown that the work done by these muscles is very substantial, so their training status has profound influence upon exercise performance [3]. In athletes, respiratory muscle work has an impact on whole body exercise performance by affecting limb blood flow and muscle fatigue during heavy exercise [4, 5]. The Diaphragm fatigue can occur during sustained high intensity exercises [6, 7]. Several studies have shown that unloading respiratory muscles can lead to increase in exercise performance [8, 9]. One mechanism to explain these improvements in exercise performance is the “Respiratory Muscle Metaboreflex”. Therefore, a rational basis exists for improving the strength and endurance of the

respiratory muscle in order to improve exercise performance. The respiratory muscle training can be done by using Threshold Loading. This resistance is flow-independent. So the need of the study is to whether the respiratory muscle training is effective in sprint running.

Materials and methods

An interventional study was conducted at Mahadev Desai Sharirik Shikshan Mahavidhyalay Sadra Gandhinagar, Gujarat for 5 days a week for 6 weeks. Using random sampling 60 athletes between the age of 18 to 25 years both male and female were included in the study. The athletes who had history of any injury, respiratory disease or any doping were excluded from the study.

60 athletes were randomly divided in to two groups, group A (experimental group) Group A: Experimental group, which received Inspiratory Muscle Training with IMT threshold device at 50% pre training Pimax for 15mins every day for 5 days a week for 6 weeks, along with their routine exercises.

Group B: Control group, in which only routine exercises were conducted. Written informed consent was taken from the athletes.

The pre training outcome measures Inspiratory Mouth Pressure (Pimax), Expiratory Mouth Pressure (Pemax), and Running Performance (time) were taken.

The effect of IMT (Inspiratory Muscle Trainer) was to increase the strength of the respiratory

muscles so that the muscle will not get fatigued and so the metaboreflex which gets elicited in fatigued muscles will not be elicited and so the overall performance of the athlete will increase.

For the experimental group the Pimax was checked weekly so as to reset the threshold load for training. After completion of 6 weeks training program the post training outcome measures were taken. The Pimax and Pemax were assessed by the machine designed for testing it. And the Running Performance was taken by assessing the time taken to completing the 30m sprint.

Statistical analysis

Level of significance was kept at 5%. Within group analysis was done using Wilcoxon test and between group analysis was done using Mann Whitney U test.

Table - 1: MEAN and SD of both the group - pre and post.

GROUP	PRE PIMAX	POST PIMAX	PRE TIME	POST TIME	PRE PEMAX	POST PEMAX
EXP	88.5+/-22.7	105.2+/-23.5	4.80+/-0.26	4.74+/-0.26	98+/-23.88	116.1+/-23.27
CONT	89.6+/-19.8	89.6+/-21.4	4.78+/-0.28	4.79+/-0.26	96.8+/-21.87	96.9 +/-22.7

Table - 2: Within Group Analysis.

TEST	OUTCOME	EXPIRIMENTAL	CONTROL
T test	TIME	0.01<0.05	0.81>0.05
WILCOXON	PIMAX	0.00<0.05	0.25>0.05
WILCOXON	PEMAX	0.02<0.05	0.53>0.05

Table - 3: Between Group Analysis.

TEST	OUCOMES	P VALUE
MANN-WITNEY U	TIME	0.01<0.05
MANN-WITNEY U	PIMAX	0.00<0.05
MANN-WITNEY U	PEMAX	0.02<0.05

Discussion

This study was designed to see the effect of Threshold Inspiratory Muscle Trainer on Running Performance and Respiratory Muscle Strength in Athletes who are regular players (22 hours a week). The within group analysis when done for the experimental group showed

Results

Sixty athletes who fulfilled all the inclusion criteria were divided into two groups, thirty in control group and thirty in experimental group. There no drop outs in experimental group as well as in control group as the athletes were dedicated to the study moreover all were living in the hostel provided by their college. Study was completed with 60 athletes with 30 athletes in each group.

Table - 1 shows the Mean and SD of pre and post data of both the groups. **Table - 2** shows differences in Time, PIMAX and PEMAX for within group analysis of both the groups. **Table - 3** shows significant difference between groups for Time, PIMAX and PEMAX ($p \leq 0.05$).

improvement in the Inspiratory Mouth Pressure, Expiratory Mouth Pressure and Running Performance (time taken for 30 m sprint) But there was no significant improvement seen in the within group analysis of control group for any of the outcome. When analysis was done between the groups the experimental group showed

significant improvement in all the outcome measures compared to control group. IMT enhances the exercise performance of athletes across a range of endurance sports, as well as during repeated sprinting. The study done by Samuel Verges, et al., showed improvement in MIP after the training with IMT [10]. 50% pressure was taken from the study done by Jernej Kapus in which the pressure set was 50% of MIP it was done on swimmer and significant improvement was observed in MIP and also in swimming performance [11]. Moreover, as there are no Indian studies available till date the pressure taken for this study was set to minimum pressure on which significant improvement was observed. The study done on animals stated that respiratory muscle endurance is increased in response to various types of endurance training due to increased oxidative metabolism activity in the diaphragm [12]. The increased capacity of the respiratory muscles might be the reason for improvement in the running performance as the Metaboreflex would have stimulated later. There are very scarce evidences to support the study. That can be a limitation of the study. So, as to improve overall output, along with the specific muscles, the respiratory muscles should also be trained.

Limitations for the present study were the time problem of the athletes as they had their schedules for practices. The other limitation can be the limited number of studies. And the long term follow up of the residual effect was not taken.

Conclusion

The study concludes that Inspiratory Muscle Trainer can be used to improve Inspiratory Mouth Pressure (PIMAX) Expiratory Mouth Pressure (PEMAX) and Running Performance in athletes as compared to routine exercises alone and so thereby it can improve overall performance of the athletes.

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