



# EFFECT OF HYPOVENTILATION TRAINING ON STRENGTH ENDURANCE OF BOXERS

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**Abstract:** The objective of the study was to investigate the effect of hypoventilation training at low lung/pulmonary volume on strength endurance of National level male boxers. A total of sixty subjects (N=60) were selected from Sports Complex Sector-42 Chandigarh. The purposive sampling technique was used to select the subjects. The subjects were equally divided into two groups: experimental (n=30) and control (n=30) by random assignment. Randomized subjects, pretest-posttest control group design was adopted for the experiment. The age of the subjects ranged between 18 to 25 years. The subjects of both groups were tested before and after the 12-weeks of intervention with pull-ups test on strength endurance. The experimental group underwent hypoventilation training (at low lung volume) for 12-weeks period, three times in a week (Monday, Wednesday and Friday). Shadow boxing, punching bag or pads exercises were carried out as a hypoventilation training by the boxers of experimental group. The control group boxers continued to participate in the normal training program. To find out the effect of hypoventilation on strength endurance paired samples t-test was applied. Level of significance was set at 0.05. Significant improvement was observed in strength endurance in experimental group.

**Keywords:** Boxers, hypoventilation training, low lung volume and strength endurance.

## I. INTRODUCTION

The 1968 Olympic games were held in Mexico City. This was the first time in the history of Olympic games when Olympic games took place at elevation. This was the time when the sporting community's interest begins towards altitude training. As time passed, scientists, coaches and athletes began to explore different ways to take advantage from altitude training. Thereafter numerous studies/experiments have been conducted to take advantage of manipulation in oxygen availability (Sheaff, 2018).

Dr. James Counsilman, a famous swimming coach, experimented on his swimmers and developed a training method that comprised of limiting the frequency of breathing to rebuild a hypoxic effect for swimmers who were unable to train at altitude. Counsilman's goal was to simplify 'training at altitude' while still remaining at sea level. While this type of training has become a common practice in swimming, and may very well have benefits due to respiratory adaptations (Burtch et al. 2017), it does not create the

hypoxic environment that we see at altitude. Although, the tempt of altitude training is still very attractive, and continued efforts have been made to create hypoxic environments at sea-level. Traditional respiration restriction – called as ‘hypoventilation training’ – has recently been amended with a novel twist, and the results are auspicious (Sheaff, 2018).

Counselman was not the only renowned coach to advocate hypoventilation training. Other coaches and athletes such as Emil Zatopek, Xavier Woorons, Frederick Bousquet, Andrew Sheaff, Cyril Burdet, Eric Laperriere, Bruno Le Gal, Joaquim Cruz, Luiz De Oliveira, Kenny Moore, Daouda Sow, have experimented with this idea while attempting to improve performance. Emil Zatopek was a Czech long-distance runner used hypoventilation training. He is the pioneer of hypoventilation training (high pulmonary volume). He won five medals in Olympic Games. In 1948 London Olympic Games, he won silver medal in 5,000 m and won gold in 10,000 m. Zatopek won three gold medals in 1952 Helsinki Olympic Games in 5,000 m, 10,000 m and in Marathon events. Frederick Bousquet, the French swimmer, former holder of the world record in the 50 m freestyle, performed aqua biking with hypoventilation for his physical preparation.

Andrew Sheaff, a scientist and swimming coach used hypoventilation exercise for their swimmers during their training at Northwestern University, Chicago, Illinois. He also explained how hypoventilation training can boost endurance performance. Cyril Burdet, a coach, have also experimented hypoventilation training for improving performance in its skiers of French cross-country skiing team. Eric Laperriere, the swimming coach used hypoventilation training with his triathletes. He believed that this method is efficient for reducing the feeling of fatigue during a race. Bruno Le Gal, coach of the French team of Judo-Jujitsu trained their team with hypoventilation and won four championship titles and 13 medals overall in the 2016 world championships in Poland. In 1983, Joaquim Cruz, the Brazilian middle distance runner started his preparation for 1984 Olympic games with hypoventilation training. He trained by coach Luiz De Oliveira. A few months later Joaquim Cruz won gold medal in the 800 m in the Los Angeles Olympic Games. In boxing, Daouda Sow, silver medallist at the 2008 Olympic Games, prepared his come back to competition by using hypoventilation training.

Hypoventilation training generally involves taking a breath, holding it for a set amount of time, exhaling, and then repeating the process. Xavier Woorons, a French physiologist, revolutionized hypoventilation training by focusing on low pulmonary volume techniques. Before Woorons, no one had explored this method of training. Woorons believed that exhaling immediately after inhaling and holding the breath could improve hypoventilation. While most training focused on high lung volumes, Woorons introduced the concept of training at low pulmonary volumes. To study the effects of this new approach, Woorons (2008) conducted a groundbreaking study on ten triathlete cyclists. In a study, triathletes cycled for five minutes at 70% of their VO<sub>2</sub>max on two occasions. During one session, they cycled with normal breathing, while during the other session, they included a prolonged exhalation after each inhalation. This method reduced ventilation frequency and average pulmonary volumes. The results showed that cycling with prolonged exhalation led to severe hypoxemia, with blood oxygen levels dropping significantly (87.4%). In contrast, breathing normally during moderate-intensity cycling resulted in blood oxygen levels of 95%. These findings have been supported by later research, which also compared the effects of prolonged exhalation hypoventilation during exercise with exercising in a hypoxic environment. The results were similar, indicating that this method of breathing can mimic the low blood oxygen levels experienced at high altitudes. Xavier Woorons' hypothesis appears to be correct based on these results. Ambrozy, Snopkowski, Rydzik, Kedra and Wasacz (2025) examined that hypoventilation training significant improved strength endurance. Xavier Woorons have conducted many experiments/studies on hypoventilation training at low pulmonary volume. He is the pioneer of this new technique (exhale hold) of hypoventilation training. Hypoventilation training at low pulmonary volume also known as Voluntary

Hypoventilation (VHL). Hypoventilation training has been used in many sports and obtained remarkable results. It is possible to obtain positive results after 7-8 training sessions with hypoventilation, however, at least 12 sessions are necessary to get best results. Hypoventilation training has been used in many sports and obtained remarkable results. Depending on the time of year, the weekly training volume, the athletes' level and the objective pursued, hypoventilation work should be included between 1 to 3 times per week (Woorons, 2014).

## OBJECTIVE OF THE STUDY

The objective of the study was to investigate the effect of hypoventilation training on strength endurance of boxers.

## HYPOTHESIS OF THE STUDY

It was hypothesized that there would be significant effect of hypoventilation training on strength endurance of boxers.

## II. METHODOLOGY

The present study is an experimental study. It comprised 60 National level male boxers. The purpose of the study was described to the subjects with the help of demonstration. Further, all precautions were taken to maintain the accuracy, uniformity and standardization of the test. Sixty (N=30) subjects were selected from Sports Complex Sector-42, Chandigarh through the purposive sampling technique. Randomized subjects, pretest-posttest control group design was adopted for the experiment. After the preliminary medical examination of the test, the subjects were equally divided into two groups of 30: the experimental and control group by random assignment, ensuring the same number of competitors from similar weight categories (fly weight, bantamweight, lightweight, welterweight, light middleweight, middleweight, light heavyweight, cruiserweight, heavyweight and superheavyweight) be included in both groups. The age of the subjects ranged between 18 to 25 years. The subjects of both groups were evaluated before and after the 12-weeks of training program with pull-ups test on strength endurance. Hypoventilation training at low pulmonary volume was given three times in week only to the boxers of experimental group (Monday, Wednesday and Friday). Shadow boxing, punching bag and pad exercises were carried out as a hypoventilation training at low pulmonary volume by the boxers of experimental group. The control group boxers continued to participate in the normal training program. To compare the effect of hypoventilation training on strength endurance of boxers paired samples t-test was used. Mean, MD, SD and SEM were used as descriptive statistics. Level of significance was opted at 0.05.

## III. RESULTS

**Table-1: SHOWING COMPARISON OF DIFFERENCE IN PRE-TEST AND POST-TEST RESULTS AMONG BOTH GROUPS ON STRENGTH ENDURANCE**

| GROUP        | Test      | N  | Mean  | MD   | SD   | Df | SEM  | t-value | Sig.  |
|--------------|-----------|----|-------|------|------|----|------|---------|-------|
| Experimental | Pre-Test  | 30 | 13.98 | 1.03 | 2.85 | 29 | 0.52 | -13.08  | 0.00* |
|              | Post-Test | 30 | 15.1  |      | 2.11 |    | 0.51 |         |       |
| Control      | Pre-Test  | 30 | 13.37 | 0.15 | 2.45 | 29 | 0.45 | -1.96   | 0.06  |
|              | Post-Test | 30 | 13.52 |      | 2.26 |    | 0.41 |         |       |

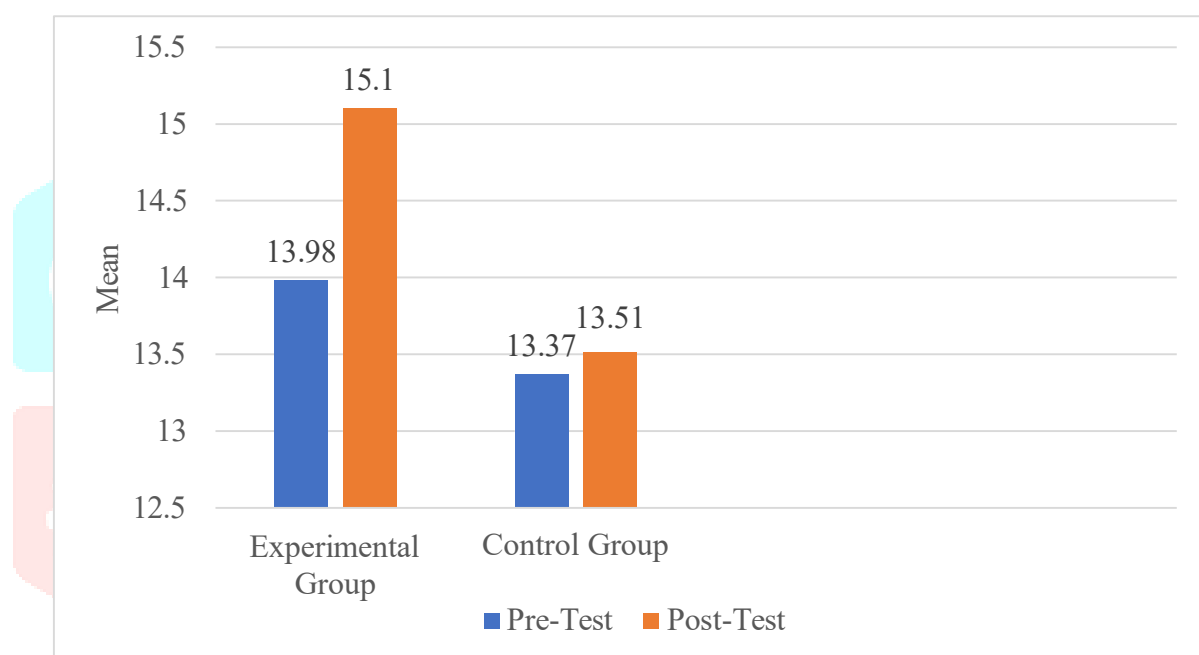
\*Significant at 0.05 level (t Critical value 2.045)

The above table-1 shows that the results of hypoventilation training on the variable strength endurance. Pre-test and post-test mean of experimental group on Strength endurance is 13.98 and 15.1 respectively. Mean difference between pre-test and post-test is 1.03. The SD of experimental group on pre-test and post-test on strength endurance is 2.85 and 2.11 respectively.

On the other hand, mean of control group on pre-test and post-test on Strength endurance is 2.85 and 2.11 respectively. Mean difference between pre-test and post-test is 0.15. The SD on pre-test and post-test is 2.45 and 2.26 respectively.

It can be observed from table-1 that significant difference was found with regard to the variable Strength endurance among experimental group. The p-value (Sig.) 0.00\* was found lesser than the 0.05 level of significance ( $p < 0.05$ ). While, insignificant difference was observed in control group with regard to the variable Strength endurance, as the p-value 0.06 was found greater than the 0.05 level of significance ( $p > 0.05$ ).

**Figure-1: Showing graphical representation of mean scores of per-tests and post-tests with regard to the variable Strength endurance among both groups**



#### IV. DISCUSSION OF FINDING

It has been observed from results (Table-1) that significant difference has been found among experimental group with regard to the variable strength endurance after 12-weeks training intervention. While calculated the mean values (pre-test and post-test) of experimental group, it has been observed that experimental group boxers had exhibited higher strength endurance than control group boxers. **Ambrozy, Snopkowski, Rydzik, Kedra and Wasacz (2025)** had conducted a study on the impact of the experimental “hypoxic boxing” training on the motor abilities and specialized fitness of national boxing champions: a randomized controlled trial. The result of the study showed that hypoxic group improved significantly on strength endurance.

#### V. TESTING OF HYPOTHESIS

In the beginning of the study, it was hypothesized that there would be significant effect of hypoventilation training on strength endurance of boxers. The obtained results also indicated that there was significant effect of hypoventilation training (at low lung volume) on strength endurance of boxers. Hence, the hypothesis ( $H_a$ ) is accepted.

## VI.CONCLUSION

Based on the results of the study, it was concluded that the experimental group was observed higher on strength endurance than control group. Hypoventilation positively affects strength endurance. Coaches may incorporate hypoventilation exercises into motor fitness training programs. The present study is significant because it investigates a relatively less explored training method among boxing players in Indian context.

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