

# Effects of Buteyko Breathing Technique on Physiological and Psychological Parameters among University Football Players

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## ABSTRACT:

**Background:** A new conception is emerging by acknowledging that right breathing volume is elemental for good health, based on the devotional work of Russian scientist Konstantin Buteyko. Buteyko breathing technique (BBT) is committed to reduce pulmonary ventilation which raises the levels of carbon dioxide in the body. Thus, it increases oxygen delivery to the tissues and cells.

**Objectives:** To analyse the effectiveness of the Buteyko Breathing Technique on physiological and psychological parameters of football players.

**Methodology:** 40 male footballers were included in the study and randomly divided into two groups. Group A (n=20) received 6 weeks BBT (5 sessions/week) where as Group B (n=20) continued with regular training. Resting Heart Rate (RHR), Resting Blood Pressure (RBP), VO<sub>2</sub>max, Control Pause Test and Anxiety were measured at the beginning and after the completion of the protocol in both the groups.

**Results:** Paired t test revealed a significant decrease in RHR, and Anxiety by 5.76% and 12.4% respectively. Resting Systolic and diastolic blood pressure decreased by 4.26% and 5% respectively, whereas massive improvement was seen in Control Pause by 134.2% and VO<sub>2</sub>max by 15.54% in Group A. No significant change was seen in group B.

**Conclusion:** BBT was found to be useful technique to enhance endurance of the players as it has showed a positive improvement in cardio respiratory parameters. This technique was also helpful in reducing anxiety.

**Keywords:** Buteyko Breathing Technique (BBT); VO<sub>2</sub>max; Resting Heart Rate; Anxiety

## INTRODUCTION

For the purpose of maintaining or improving health, controlling one's breath is vital and this has been practised for thousands of years among Eastern cultures. For instance, yoga breathing (pranayama) is a renowned early exercise for breathing regulation, frequently executed in combination with meditation or yoga, for its spiritual and distinguished health improving effects. Many types of pranayama are present, for example nostril breathing (double, single or alternate), abdominal breathing, strong and forceful breathing and vocalised (chanting) breathing, which are carried out at altering rates and depths (Jerath, 2006).

Dr. Konstantin Buteyko is the inventor of the essentially new, drug free therapy for bronchial asthma, well recognized nowadays as The Buteyko Method (Dani Fahrizal, 2017). The Buteyko Breathing Technique (BBT) is based on reducing minute volume by slowing the respiratory rate with breath-counting, using distraction by rocking and walking, and at night lying on the left side and taping the mouth closed. BBT is intended to decrease pulmonary ventilation which raises the carbon dioxide levels in body. The increase in the levels of carbon dioxide leads to an increase in the oxygen partial pressure that forces the oxygen to be released from the haemoglobin (Bohr Effect). In other words, it increases the oxygen delivery to the tissues and cells. (Guyton, 2007)

Increased oxygen in the blood has a tendency to release the carbon dioxide from the blood (the Haldane effect). When entering the lungs, the partial pressure of carbon dioxide decreases whereas the partial pressure of oxygen increases. Thus, the Haldane effect duplicate the number of carbon dioxide released from the blood into the lungs and increases the carbon dioxide uptakes from the tissues (Guyton, 2007). There is a well-known notion that the more air we breathe, the healthier we are with respect to increased blood flow and delivery of oxygen to the tissues, breathing should be slowed down so that less air penetrates the body. While captivating less air into the lungs than usual, one experiences a fair feeling of air hunger. Within few minutes of sustained slowing of the breath to experience air hunger, body temperature increases to signify an improvement in blood circulation. Simultaneously, there is an increase in watery saliva in the mouth that is conventionally observed in Yoga as activation of the body's relaxation response (Buteyko clinic International, 2015).

Rakhimov (2013) acknowledged that control pause and diaphragmatic breathing are needed to be proficient in BBT. Control pause is a part of breath holding technique that can be applied to establish the type of activity which can be pooled with Buteyko method. While, diaphragmatic breathing is needed to adjust the effectiveness of oxygen delivery and carbon dioxide elimination. Having a control pause of less than 25 seconds is poor and 25 seconds to 35 seconds suggests that there is scope of improvement. The goal is to reach a comfortable breath hold time of 40 seconds. (Buteyko clinic International, 2015)

The foundation of Buteyko breathing method is to breathe only through the nose. Breathing through the nose is great start to improve health. It is also important that breathing volume is normal and regular. (Buteyko clinic International, 2015). If a person holds breath after a

normal exhalation, approximately for 40 seconds, the urge to breathe increases enough to initiate inspiration. (McArdle W, 2010). Nasal breathing during physical exercise allows for a work intensity great enough to produce an aerobic training effect. (McKeown, 2015).

Reductions in blood pressure have been observed with yoga that lay emphasis on slow and regular breathing and numerous studies have demonstrated that the patients who train with slow and regular breathing over a period of eight weeks get benefit with reduction of blood pressure (C. U. Jones, 2015).

Although we see very less researches which show direct relationship of anxiety with breathing but there is documented literature which explains that people who are prone to panic attacks and anxiety show tendency of dysfunctional breathing patterns like breathing irregularity and sighing frequently (Abelson J L., 2001). BBT provided a sense of control on breathing. Hence it decreased the anxiety, concerning to the symptoms of asthmatics (Courtney, 2008).

There are many known breathing techniques to improve cardiorespiratory parameters, to best of our knowledge a few literature is available regarding the effect of buteyko breathing technique on physiological and psychological parameters of athletic population. As BBT is a newly introduced technique so it has not gained much popularity among athletic population. This research is a pioneer study which has been done on football players to see the effect of buteyko breathing technique. The purpose of this study is to evaluate the effectiveness of buteyko breathing technique on those important physiological and psychological parameters which are responsible for improving the endurance.

## **METHODOLOGY**

**Study setting:** Study was conducted in Guru Nanak Dev University, Amritsar, Punjab.

**Study design:** It was an experimental study (Pre test and Post test) and written informed consent was obtained from all participants before the initiation of study. The protocol was approved by institutional ethics committee.

### **Criteria for selection**

#### **Inclusion criteria:**

1. Football players aged between 18-25 years
2. Players should be regularly involved in sport since last 2 years
3. Gender: Male

#### **Exclusion criteria:**

1. Recent history of any pulmonary complication
2. Subjects with any Cardio Respiratory or musculoskeletal condition that might limit participation in protocol
3. Players with History of Thoracic surgery

**Participants:**

All the participants were screened for inclusion and exclusion criteria and 40 healthy university level football players were randomly assigned into two groups. Twenty players in group A (Experimental Group) were of mean age ( $19.85 \pm 1.137$ ) years, mean height ( $172.95 \pm 4.605$ ) cm and mean weight ( $66.40 \pm 5.295$ ). The other twenty players in group B (Control Group) were of mean age ( $19.55 \pm 1.146$ ) years, mean height ( $173.60 \pm 5.020$ ) cm and mean weight ( $63.45 \pm 4.466$ ).

**Measurement of parameter to be evaluated:**

**Resting heart rate (RHR)-** Resting Heart rate was measured by using pulse oximeter. RHR was taken thrice in the morning about two hours after the subjects have been awake and 1 hour after the breakfast. Mean of the three readings was used.

**Resting blood pressure (RBP)-** Resting Blood pressure was measured by using sphygmomanometer. RBP was measured the in the morning approximately two hours after the subjects have been awake and 1 hour after the breakfast. The subject was made to sit upright on the chair and the RBP was measured. Readings of Systolic Blood pressure (SBP) and Diastolic Blood Pressure (DBP) were noted down.

**Control pause (CP)-** Control Pause (breath holding) was measured using stopwatch. Control pause was measured in the morning, two hours after the meal.

**Anxiety-** Anxiety was evaluated by using Sports Competitive Anxiety Test (SCAT). The questionnaire was explained and given to the subjects. The score evaluation was made and noted.

**VO<sub>2</sub>max-** VO<sub>2</sub>max was assessed by yo-yo intermittent endurance test level 1. The Yo-Yo intermittent endurance test is a simple method to assess several aspects of performance. The test consists of running activities that are relevant to a lot of sports. In the test, physical fitness is evaluated in a fast and easy manner. Two pointers were sited at a distance of 20 m. A CD was placed in a CD player and the test was performed. The participant ran like a Yo-Yo backward and forwards between the markers at certain speeds that were controlled by the CD. The speed was increased on a regular basis. The test was terminated when the participant could not maintain the speed any longer. The test outcome was determined as the distance covered for the duration of the test. The Yo-Yo intermittent endurance test lasts for about 20 min and running intervals of about 5–18 s combined with uniform 5-s rest intervals. The test assesses an individual's ability to repeatedly perform running intervals over an extended period of time. (Jens Bangsbo, 2006)

VO<sub>2</sub>max was calculated by using the formula:

VO<sub>2</sub>max (ml/min/kg) = distance (m) x 0.0084 + 36.4 (Bangsbo, et al 2006)

**Protocol:**

Group A (experimental group) received the designed Buteyko breathing technique (BBT) for 6 weeks. Each athlete was trained by Buteyko breathing technique, intensively for 5 days a week and the session was of 20 minutes. The time of the session was in the morning at least two hours after meals. Each athlete was asked to perform the technique by himself at home twice daily (in the morning and in the evening, at least 2 hours after meals) during the time of the study. Group B (control group) continued with regular training.

**Buteyko Breathing Technique:****Step1: The “Control Pause” (CP) breathing test**

Take a small breath in (2 s) and a small breath out (3 s). Hold your nose on the “out” breath, with empty lungs but not too empty.

Holding your nose is necessary to prevent air entering into the airways.

Count how many seconds you can comfortably last before you need to breathe in again. Hold your breath until you feel the first need to breathe in. Release your nose and breathe in through it.

Your first intake of breath after the CP should be no greater than your breath prior to taking measurement; you should not hold your breath for too long as this may cause you to take a big breath after measuring the CP. (Mckeown, 2015)

**Step 2: Shallow breathing**

Sit up straight. Monitor the amount of air flowing through your nostrils by placing your finger under your nose in a horizontal position. Your finger should lie just above your top lip, close enough to your nostrils so that you can feel the airflow, but not so close that the airflow is blocked. Now, breathe air slightly into the tip of your nostrils. As you exhale, pretend that your finger is a feather. Breathe out gently onto your finger so that the feather does not move. Concentrate on calming your breath to reduce the amount of warm air you feel on your finger. As you reduce the amount of warm air onto your finger, you will begin to feel a need or want for air. Try to maintain the need for air for about 4 min. (Mckeown, 2015)

**Step 3: Putting it together**

Take Control Pause. Reduced breathing for 4 min. Wait for 2 mins and take control pause. Repeat it for 3 times again.

Group B (control group) did not receive any protocol during the time of the study but continued with their regular training.

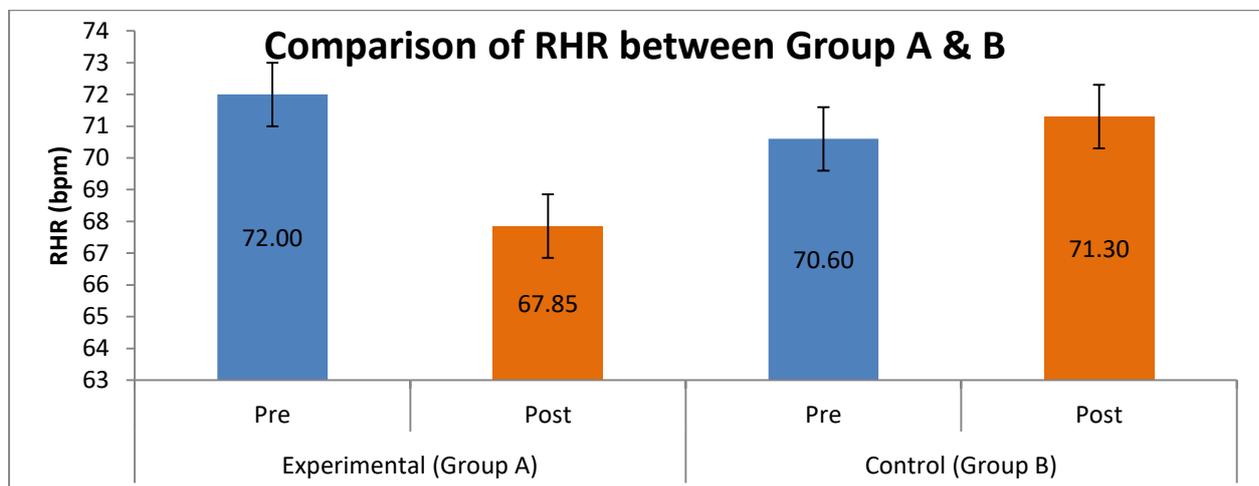
**RESULTS**

All the data was entered into statistical package for social sciences (SPSS Inc. version 21.0, Chicago III). Significance was defined as  $p \leq 0.05$ .

Table 1 Demographic data of all participants.

		Mean	S.D.	Number	Mean Difference	Unpaired T Test	P value	Table Value at 0.05	Result
Age	Experiment	19.85	1.137	20	0.3	0.831	0.411	2.02	Not-Significant
	Control	19.55	1.146	20					
Height	Experiment	172.95	4.605	20	0.65	0.427	0.672	2.02	Not-Significant
	Control	173.6	5.02	20					
Weight	Experiment	66.4	5.295	20	2.95	1.904	0.0644	2.02	Not-Significant
	Control	63.45	4.466	20					

Graph 1 shows comparison of Resting Heart Rate (RHR) between group A and B.



Graph 2 shows comparison of resting systolic and diastolic blood pressure between group A & B.

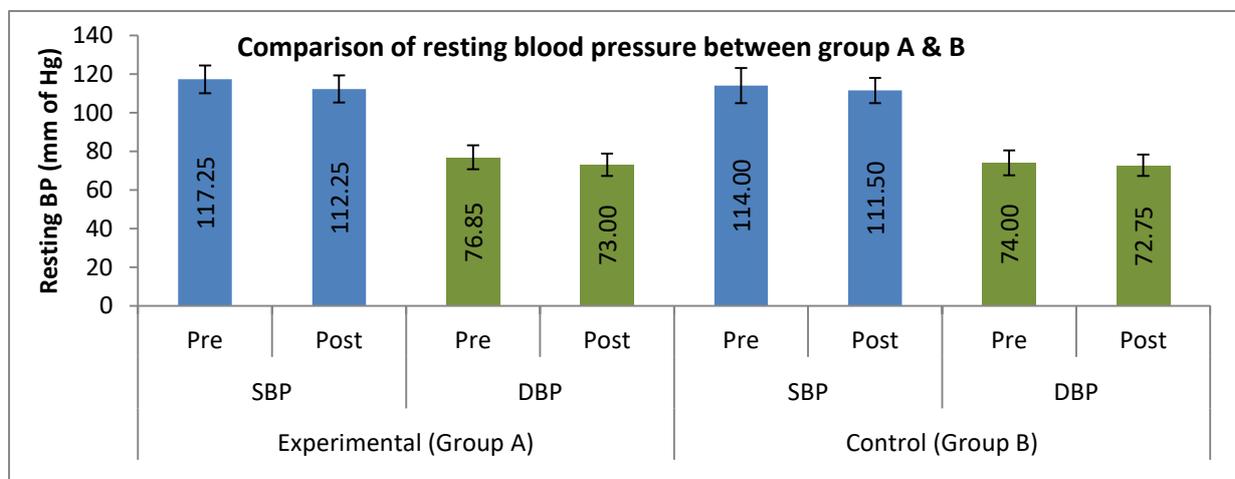


Table 2 shows comparison of VO<sub>2</sub>max between group A(Experimental) & B (Control).

<i>VO<sub>2</sub>max</i>	.	<i>Mean</i>	<i>S.D.</i>	<i>Number</i>	<i>Mean Difference</i>	<i>Paired T Test</i>	<i>P value</i>	<i>Table Value at 0.05</i>	<i>Result</i>
<i>Experimental</i>	Pre	52.31	5.615	20	8.12	13.799	<0.001	2.09	Significant
	Post	60.44	5.127	20					
<i>Control</i>	Pre	55.29	5.901	20	0.93	0.834	0.4147	2.09	Not-Significant
	Post	56.22	4.185	20					

There was a significant increase in VO<sub>2</sub>max by 15.54% in group A and there was a little change in VO<sub>2</sub>max by 1.68% in group B.

Table 3 shows comparison of Control Pause between group A(Experimental) & B(Control).

<i>Control Pause</i>	.	<i>Mean</i>	<i>S.D.</i>	<i>Number</i>	<i>Mean Difference</i>	<i>Paired T Test</i>	<i>P value</i>	<i>Table Value at 0.05</i>	<i>Result</i>
<i>Experimental</i>	Pre	46.45	9.881	20	62.35	24.674	<0.001	2.09	Significant
	Post	108.8	16.741	20					
<i>Control</i>	Pre	40.85	7.625	20	2.15	3.209	0.0046	2.09	Significant
	Post	43	7.65	20					

Group A showed a huge increase in the Control pause test by 134.2% and there was slight increase in Control Pause by 5.2% in group B.

Table 4 shows comparison of sports competitive anxiety test (SCAT) between group A & B.

<i>SCAT</i>	.	<i>Mean</i>	<i>S.D.</i>	<i>Number</i>	<i>Mean Difference</i>	<i>Paired T Test</i>	<i>P value</i>	<i>Table Value at 0.05</i>	<i>Result</i>
<i>Experimental</i>	Pre	17.7	1.867	20	2.2	6.114	<0.001	2.09	Significant
	Post	15.5	1.235	20					
<i>Control</i>	Pre	17.55	2.282	20	0.8	2.32	0.0317	2.09	Significant
	Post	18.35	1.872	20					

Group A showed decrease in anxiety by 12.4% and a slight increase in anxiety by 4.5% was seen in group B.

## DISCUSSION

This study demonstrated that the Buteyko breathing technique test can effectively improve the physiological parameter like Resting Heart rate,  $VO_2$ max, Resting Blood Pressure, Control Pause Test as well as important psychological parameter like Anxiety SCAT test among the football players.

### Resting heart rate

The present study demonstrated significant decrease in resting heart rate by (5.76 %) in group A whereas group B did not show any significant change.

Sroufe (1971) has also observed that shallow breathing reduced both heart rate and heart rate variability. P. Raghuraj (1998) explained that autonomic status gets modified with kapalabhati (breathing technique) by increasing sympathetic activity with reduced vagal activity. The findings of C.-K. Penga (2004) also supports the concept of a “meditation paradox,” since a variety of relaxation and meditative techniques may produce active cardiac dynamics, associated with prominent low frequency heart rate oscillations.

### Resting blood pressure

The present study revealed a significant decrease in Systolic Blood Pressure by 4.26% and Diastolic Blood Pressure by 5% in group A. whereas group B did not show significant change.

The results are in agreement with Reuven Viskoper (2003) who found that resistant hypertensive get benefit from self-treatment by device guided slow breathing. The previous literature suggests that slow breathing shows modulating effects on cardiovascular system. These effects beneficial in hypertension as they increase baroreflex sensitivity, heart rate variability, venous return, and decrease peripheral resistance. These effects are mediated by both mechanical and neural pathways, which may differ from those affected by drugs. Anderson et al., (2010) investigated the effects of daily practice of device-guided slow breathing (DGB) on (a) 24-h BP and breathing patterns in the natural environment (b) BP and breathing pattern during clinic rest and found that The DGB intervention decreased clinic resting BP, mid-day ambulatory systolic BP (in women only) and resting breathing rate, and increased resting tidal volume.

It is usually known in scientific text that blood pressure can be lowered with the help of regular practice of slow breathing. A study conducted in 2006, compared the effect of slow breathing and mental relaxation on blood pressure which showed a drop in systolic and diastolic blood pressure, respiratory rate and heart rate caused by parasympathetic response triggered by slow breathing. Moreover, slow breathing resulted in a greater decline of heart rate and blood pressure. (Mckeown, 2015)

By practicing slow breathing on a regular basis, it is likely to regulate blood pressure for a long term. This is in any case somewhat due to the association between stress and hypertension. Scientists have observed that people with high blood pressure experience drastically elevated respiratory rates under stress than those with normal blood pressure demonstrating a sharp stress response. (Mckeown, 2015)

**Vo<sub>2</sub>max**

The present study demonstrated a significant improvement in VO<sub>2</sub>max by 15.54% with mean in group A, whereas group B did not show significant change.

The results are consistent with the study of Edward Byrne-Quinn John V Weil (1971) who found that the athletes' response to increased carbon dioxide was 47% of that recorded by the non-athlete controls. Athletic ability to perform during lower oxygen pressure and higher carbon dioxide pressure corresponded to maximal oxygen uptake or VO<sub>2</sub> max. Dani Fahrizal, (2017) conducted a study to determine the effects of Buteyko Breathing Technique in improving cardiorespiratory endurance and found that the combination of Buteyko Breathing Technique and endurance training program is better in efficacy than just using the endurance-training program.

**Control pause (breath hold)**

The present study demonstrated a huge increase in the Control pause test by 134.2% with mean in group A and slight increase of 5.2% in group B.

Gregoire P. Millet (2010) found that repeatedly using breath holding following exhalation during training would represent an intermittent hypoxic exposure and could therefore be compared to Intermittent Hypoxic Training, although hypoventilation also induces hypercapnia. During a breath hold, the cells continue to extract oxygen from the blood while oxygen levels are not renewed, breath-hold training causes reduction in blood acidosis, higher tolerance to anoxia, decelerated metabolism and an increase in HCT value, Hb and EPO concentration as well as the mass and volume of the lungs (Andrzej Ostrowski 2012). Slight increase in control pause of group B could be the effect of their regular training.

**Anxiety**

In the present study the decrease in anxiety was also observed by 12.4% in group A and a slight increase by 4.5% was observed in group B.

Eunok Park (2013) examined the effects of an implemented relaxation breathing program on pain and anxiety in adult patients undergoing burn dressing changes. The major finding of the study is that Relaxation Breathing (RB) had a significant impact on pain and anxiety for burn patients during dressing changes. Relaxation breathing seems to be a hopeful technique for pain and anxiety. The study also demonstrated that simple and easy relaxation techniques can play a role in reduction of distress and an increase in relaxation levels. Control group showed increase in anxiety probably due to competition which was approaching.

At present, it cannot completely be explained how and why BBT works and what its real therapeutic potential is. A superior comprehension of the mechanisms would permit better application of this breathing technique to those who might benefit the most and be an evidence for its proper therapeutic potential.

## CONCLUSION

Resting heart rate showed significant decrease on pre test and post test after training with Buteyko breathing technique. There was a significant decrease in Resting blood pressure, both systolic and diastolic blood pressure after Buteyko breathing technique training and significant decrease in anxiety was also seen in after training with Buteyko breathing technique. A great amount of significant increase was found in control pause test and VO<sub>2</sub>max after training with Buteyko breathing technique.

### Significance of the study

Incorporating buteyko breathing method can regulate the cardiovascular system which could lead to overall health benefits and improvement of sports performance of an athlete. It also might be helpful for high intensity sports such as Basketball, Sprinting or Swimming. Players can use this protocol to improve their sports performance. This may also enhance endurance and reduce anxiety of high intensity sports persons.

**Limitations-**1. Only male football players were included.

2. Sample size was small.

**Future suggestions-** Implementation of BBT on the players of other endurance sports.

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**Conflicts of interest-** There are no conflicts of interest.

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