

Buteyko Breathing Technique Effectively Improves Cardiorespiratory Endurance in Students

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ABSTRACT

Background: As many as 51.32% of students from the Department of Physiotherapy at the Health Polytechnic of the Ministry of Health fell into the category of cardiorespiratory endurance (VO₂max) less than normal. The VO₂max value is influenced by breathing, physical activity and hemoglobin levels. There has not been much research on the influence of breathing without physical activity, so it is necessary to conduct research on the influence of breathing on cardiorespiratory endurance. The aim of this research was to determine the effect of Buteyko Breathing Technique on cardiorespiratory endurance. Buteyko Breathing Technique can significantly increase cardiorespiratory endurance. The breath-holding effect of the Buteyko Breathing Technique is the condition of maintaining high carbon dioxide levels all the time which can lower blood pH, causing more oxygen to be released into the tissues and cardiorespiratory endurance to increase.

Subjects and Method: Randomized Control Trial research design, Buteyko Breathing Technique treatment group (n=29) and group II was the control group (n=30). Harvard Step Test research measuring tool. The research subjects were students majoring from the Department of Physiotherapy at the Health Polytechnic, Ministry of Health, Surakarta.

Results: The results of the paired sample t test in the treatment group obtained a value of $p=0.027$ ($p<0.05$), meaning that Buteyko Breathing Technique can increase cardiorespiratory endurance, while in the control group, a value of $p=0.425$ ($p>0.05$) was obtained, meaning there was no change in cardiorespiratory endurance. in the control group.

Conclusion: Buteyko Breathing Technique can significantly increase cardiorespiratory endurance.

Keywords: Buteyko breathing technique, cardiorespiratory endurance, harvard step test, VO₂max, breathing exercise

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BACKGROUND

The development of the times and technology has significantly changed the previously active lifestyle into a sedentary lifestyle. Students are one of those affected by

changes in lifestyle patterns. The convenience of technological developments makes students behave more sedentary. Decreased physical activity is a factor that influences a person's fitness. Based on

research from Handari & Kusumaningtyas (2021) data was obtained that 51.32% of the 226 students from the Department of Physiotherapy at the Ministry of Health's Health Polytechnic fell into the cardiorespiratory endurance category of less than normal.

Cardiorespiratory endurance can be seen from the VO₂max value. VO₂max measurements are carried out to determine the maximum amount of oxygen needed when doing physical exercise. Someone who does light activities and feels tired may have a low VO₂max value, because the amount of VO₂max affects the body's ability to send oxygen as the main element for burning energy to all the body's muscles (Sihombing, 2018). The determining factor for VO₂max is breathing. Oxygen requirements are obtained from ventilation and diffusion in the lungs. After oxygen has diffused into the pulmonary capillaries, it will be distributed throughout the body through the blood vessels, so that meeting maximum oxygen needs is strongly influenced by the good performance of the lungs, capillaries, and pulmonary vessels (M. Dallam et al., 2018).

One breathing technique that can increase cardiorespiratory endurance is the Buteyko Breathing Technique (BBT). Exercise combined with BBT is significantly more effective in increasing cardiorespiratory endurance in basketball players compared to exercise alone (Fahrizal et al., 2017). This is in line with the research conducted by Chaudhary et al. (2021) which states that the combination of regular training with the Buteyko Breathing Technique can significantly increase cardiorespiratory endurance compared to just regular training in football players.

Both studies show the role of BBT in increasing cardiorespiratory endurance when combined with exercise. On the other

hand, single studies on the effect of BBT on cardiorespiratory endurance are rare. Based on this, the researchers wanted to conduct research with the aim of finding out the effect of Buteyko Breathing Technique on cardiorespiratory endurance in students majoring from the Department of Physiotherapy at the Surakarta Ministry of Health Polytechnic.

SUBJECTS AND METHOD

1. Study Design

This research is a randomized controlled trial with two groups, namely a treatment group and a control group, which was conducted in May 2023 at the Physiotherapy Department, Health Polytechnic, Ministry of Health Surakarta.

2. Population and Sample

The population in this study were physiotherapy students at the Surakarta Ministry of Health Polytechnic. The sampling technique is simple random sampling. The number of research subjects used was 60 students who met the inclusion and exclusion criteria. Inclusion criteria include 1) age ≥ 18 years, (2) willing to be a research subject by signing informed consent, (3) systolic blood pressure 90-120 mmHg and diastolic blood pressure 60-100 mmHg, (4) resting pulse 60-90 times/minute, (5) resting breathing 16-20 times/minute, (6) temperature 36-36.9 °C, and (7) oxygen saturation 95-100%. The exclusion criteria for this study were: having a history of shortness of breath, heart and lung disease. Criteria for dropping out are if the subject does not participate in training during the specified schedule, and does not take the pre-test and post-test.

3. Study Variables

The variables in this study are Buteyko Breathing Technique as the independent

variable and cardiorespiratory endurance as the dependent variable.

4. Operational Definition of Variables

Buteyko Breathing Technique is a breathing technique to reduce alveolar ventilation so that it can improve the diaphragm and reduce respiratory frequency. BBT consists of Control Pause and Shallow Breathing stages. Control Pause is carried out by: (1) inhaling for 2 seconds, (2) exhaling for 3 seconds, (3) holding the breath and closing the nose as much as possible, the breath holding time is recorded, (4) breathing normally. Shallow Breathing is done by: (1) sitting up straight, (2) placing your index finger horizontally under your nose to monitor air flow, (3) inhaling and exhaling slowly, (4) doing this for 4 minutes. Repeat the Control Pause and Shallow Breathing steps for 3 cycles with a 2 minute rest period between cycles. This exercise is done 3 times per week, for 4 weeks.

Cardiorespiratory endurance is the ability of the heart and lungs to supply oxygen to muscles used to work for a long time to determine VO₂ max levels as measured by the Harvard Step Test.

5. Study Instruments

Cardiorespiratory endurance is measured using the Harvard step test, namely carrying out a test up and down on a bench for 5 minutes following the rhythm of a metronome, then measuring the pulse after carrying out the test and converting the results into VO₂ max.

6. Data analysis

Data normality test using the Kolmogorov-Smirnov test (sample > 50). Test homogeneity using Levene's test. Next, a different test was carried out on each group parametrically using a paired t test.

7. Research Ethics

Research ethical issues including informed consent, anonymity, and confidentiality, were addressed carefully during the study process. The research ethical clearance approval letter was obtained from KEPK FK UMS, Surakarta No. 4865/B.2/KEPK-FKUMS/V/2023

RESULTS

1. Sample Characteristics

Subject characteristics based on gender in the treatment group were 13 male subjects and 16 female subjects, while in the control group there were 8 male subjects and 22 female subjects. Meanwhile, subject characteristics based on age showed that the mean age of subjects in the treatment group was 19.79 and the mean age of subjects in the control group was 20.40.

Subject characteristics based on the results of VO₂ max measurements showed that the pre-test mean in the treatment group was 93.07 and the post-test was 96.93, resulting in a difference of 3.86, while in the control group the pre-test mean was 89.60 and the post-test was 91.13. so that a difference of 1.53 is obtained.

2. Bivariate Analysis

The results of the normality test showed that all data were normal, so parametric statistical analysis was carried out. The homogeneity test results show a p-value = 0.865, which means the data obtained is homogeneous. Statistical tests for each group obtained a value of p=0.027 in the treatment group, which means there is a significant difference, and a value of p=0.425 in the control group, which means there is no significant difference.

Table 1. Sample characteristics of the subject of physiotherapy students at the Surakarta Ministry of Health Polytechnic (continuous data)

Variables	Group 1				Group 2			
	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.
1. Age (years)	19,79	0,491	19	21	20,40	0,563	19	21
2. VO ₂ max (pre-test (ml/kg min)	93,07	10,783	71	109	89,60	11,060	69	116
3. VO ₂ max (post-test) (ml/kg min)	96,93	13,869	73	135	91,13	9,365	65	109

Table 2. Sample characteristics of the subject of physiotherapy students at the Surakarta Ministry of Health Polytechnic (categorical data)

Characteristics	Category	Group 1		Group 2	
		Frequency	Percentage	Frequency	Percentage
Gender	Male	13	44,8%	8	26,7%
	Female	16	55,2%	22	73,3%

Table 3. Results in increase of cardiorespiratory endurance

	Group 1			Group 2		
	Mean	SD	p	Mean	SD	p
Pre-test	93,07	10,783	0,027	89,6	11,060	0,425
Post-test	96,93	13,869		91,13	9,365	

DISCUSSION

Based on the research results, it show that the Buteyko breathing technique provides significant results in increasing cardio-respiratory endurance. These results are in line with the research Chaudhary et al. (2021) which states that the Buteyko Breathing Technique performed 5 times per week has been proven to improve respiratory endurance's health parameters, including reducing resting heart rate, anxiety, resting blood pressure, and increasing VO₂ max.

Buteyko Breathing Technique can improve diaphragmatic breathing and provide a relaxing effect, thereby reducing shortness of breath and reducing hypoventilation (Fahrizal et al., 2017). Buteyko

Breathing Technique is proven to reduce symptoms of shortness of breath by improving sufferers' breathing patterns by balancing CO₂ and increasing oxygen and cellular oxygenation values (Sutrisna & Pranggono, 2018).

The effect of reducing breathing and holding one's breath causes the human body to adapt to high carbon dioxide levels all the time (Rakhimov, 2013). Increasing carbon dioxide levels can reduce blood pH and increase the synthesis of proteins, peptides, nucleic acids, lipids, and carbohydrates, and can increase the formation of ATP. A decrease in blood pH causes the oxygen-hemoglobin dissociation curve to shift to the right, reducing the affinity of hemoglobin for oxygen, so that more

oxygen is released into the tissue (El-Nahas et al., 2019)

One of the effects of holding a long breath is that it allows the body to reverse the exchange of carbon dioxide gas so that the body reabsorbs carbon dioxide. Repeated breath holding can increase the body's production of endogenous antioxidants and increase the anaerobic threshold, thereby increasing the capacity for exercise and higher levels of physical activity, an effect similar to training at altitude or hypoxia. (Chaudhary et al., 2021)

AUTHOR CONTRIBUTION

Author 1 contributed to compiling research proposals, monitoring research implementation, compiling research reports, compiling articles. Author 2 contributed to monitoring research implementation, processing data and statistical analysis, and helping prepare research reports.

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CONFLICT OF INTEREST

The authors declare that the study was no conflict of interest.

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