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Research Article

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Effect of Buteyko breathing technique and Pranayama on bio-physiological and biochemical parameters in bronchial asthma.

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Abstract: Asthma is a chronic respiratory condition characterized by airway inflammation and bronchial hyperresponsiveness, significantly affecting patients' quality of life. Breathing techniques such as the Buteyko method and Pranayama (yoga breathing) are increasingly being explored for their potential to complement conventional asthma management by improving physiological and biochemical parameters. This pilot study aimed to determine the effectiveness of the Buteyko breathing technique versus Pranayama on physiological and biochemical parameters among patients with bronchial asthma. A quantitative research approach and quasi-experimental research design were adopted. Twelve bronchial asthma patients meeting the inclusion criteria were divided into three groups: Buteyko (n=4), Pranayama (n=4), and Control (n=4). Pretests assessed pulmonary function, heart rate, respiratory rate, blood pressure, oxygen saturation (SaO_2), biochemical markers (total count, eosinophil count, absolute eosinophil count, IgE), asthma control, and quality of life. The intervention spanned 8 weeks, with Buteyko and Pranayama groups practicing their respective techniques, while the control group received routine hospital treatment. Posttests were conducted in the 4th and 8th weeks. Statistical analysis using SigmaPlot 14.5 revealed no significant differences in biochemical markers among groups ($P=0.821$), but significant improvements were observed across pretests and posttests ($P<0.001$). Both Buteyko and Pranayama showed notable improvements in asthma control and quality of life by Posttest 2 ($P<0.0001$), although changes remained within clinical limits. These findings suggest that breathing techniques can enhance asthma management and improve patient outcomes, warranting further investigation in larger studies.

Keywords: Biophysiological Markers, Biochemical Markers, IgE, SaO2, Yoga, Pranayama, Buteyko, breathing exercises, Asthma.

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1. INTRODUCTION

Asthma is a condition where the aviation routes of an individual become kindled, thin, enlarged, and produce more bodily fluid, making it hard for them to relax. Asthma can be minor or cause daily activities to be slowed down. It might bring about a possibly deadly assault in certain cases. The public weight of asthma was assessed at 17.23 million by the Indian Concentrate on the study of disease transmission of "Asthma, Respiratory Side effects, and Constant Bronchitis in Grown-ups", with a general pervasiveness of 2.05%) [1] Asthma affects 34.3 million Indians, or 13.09 percent of the world's population, according to the most recent Global Burden of Disease (GBD, 1990–2019). Asthma symptoms include difficulty breathing, chest pain, a cough, and wheezing. The symptoms may sometimes get worse. Around 300 million people worldwide have asthma, and each decade, its prevalence rises by 50%. 10% of people in North America suffer from asthma [2]. Over the past two decades, India's economy, industrialization, air pollution levels, and environmental and cultural factors have all changed. Besides the ISAAC studies, no other overall multicenter study has inspected what these progressions mean for asthma pervasiveness and seriousness. In 2012, the Worldwide Asthma Organization "Global Asthma Network "(GAN) replaced the ISAAC focus group to measure the ongoing prevalence of asthma-related side effects and sensitivities.[3] Clinically, asthma is characterized by intense episodes of dyspnoea, hacking, and wheezing that typically last minutes to hours. Amazingly, asthma attacks can result in an obstruction of the entire aviation route and death. Airway inflammation is thought to be involved despite the unknown pathophysiological mechanism underlying asthma's bronchial hyperresponsiveness. According to the article, immunomodulators like steroids or mast cell stabilizers comprise most preventative asthma treatments. By encouraging airway smooth muscle relaxation, beta-adrenergic agonists alleviate asthmatic patients' symptoms.[4] Various breathing strategies have been recommended to assist with controlling asthma. However, the techniques and systems that are proposed for them shift altogether. According to advocates of Buteyko breathing techniques, asthma is the body's typical defense against persistent overbreathing. Specifically, hypocapnia, because of relentless hyperventilation, is remembered to assume a part in asthma's pathophysiology. Buteyko breathing techniques aim to normalize ventilation and increase awareness of breathing in general by lowering tidal volume and respiratory rate. Additionally, patients are instructed to breathe through their symptoms and only take medication to control them if they become more severe. Yoga puts a lot of accentuation on Pranayama, or controlling one's breath, and mainstream researchers have focused on this pacing or slowing down one's breathing, manipulating one's nostrils, making chanting or humming sounds, holding one's breath, and other variations. A chronic inflammatory condition of the airways called bronchial asthma is thought to afflict 339 million individuals globally[5]. It is characterized by repeated attacks of chest tightness, coughing, shortness of breath, and wheezing, which are frequently worse at night or early morning[6]. Airway inflammation, bronchial hyperresponsiveness, and airflow restriction are all caused by a complex interaction of hereditary and environmental variables contributing to asthma pathogenesis[7]. Clinical history, physical examination, and lung function testing are used to diagnose asthma[8]. Clinical therapy for asthma aims to achieve and maintain asthma control, which includes limiting symptoms, preserving healthy lung function, and avoiding asthma attacks and their unfavorable effects. Conventional asthma treatment options include inhaled medicines, such as bronchodilators and anti-inflammatory drugs, and nonpharmacological measures, such as quitting smoking and avoiding triggers like allergens. Asthma can be controlled with various breathing techniques, but the methods and mechanisms proposed for them vary significantly. Buteyko strategy and the Pranayama are two particular breathing activities that have been demonstrated to be useful in the administration of respiratory circumstances like asthma[9]. The Buteyko procedure was made by a Russian specialist named Konstantin Buteyko during the 1950s and incorporates a movement of breathing exercises expected to reduce hyperventilation and augmentation of carbon dioxide levels in the body. The Buteyko strategy depends on the possibility that exorbitant breathing can bring about an absence of carbon dioxide in the body, which can cause various medical problems, including asthma[10]. In contrast, Pranayama, a yogic breathing technique, has been practiced for thousands of years in India. It incorporates different breathing exercises to foster lung capacity, increase oxygenation, and advance loosening up[11]. The Buteyko method and Pranayama have both been shown to be effective in treating respiratory conditions, but their approaches and methods differ. The Buteyko method focuses on reducing hyperventilation and increasing carbon dioxide levels, whereas Pranayama focuses on improving lung function and increasing oxygen levels. The Buteyko breathing method has been suggested as a supplemental therapy for managing bronchial asthma. It is a non-pharmacological intervention. The method is predicated on the idea that asthmatic symptoms are frequently brought on by excessive breathing or hyperventilation, which can cause carbon dioxide loss from the body and bronchoconstriction and airway inflammation[12]. Through a series of exercises that entail breathing less and more slowly and holding one's breath after exhaling, the Buteyko breathing technique seeks to decrease over-breathing and raise carbon dioxide levels in the body. The method's proponents contend that it can improve asthma management, decrease the need for medication, and increase the quality of life[13] The effects of the Buteyko breathing technique on bronchial asthma have been the subject of several studies with varying degrees of success. While some studies have found no significant effects, others have found improvements in asthma symptoms, medication use, and quality of life[14,15] More examinations are expected to decide the viability and security of the Buteyko breathing method as a correlative treatment for bronchial asthma. Traditional yoga includes breathing exercises known as pranayama. It entails breathing control through various methods, including breath retention, deep breathing, and breathing through alternate nostrils. Because it may help to improve lung function and reduce asthma symptoms, Pranayama has been proposed as a non-pharmacological treatment for bronchial asthma. [16] The effects of pranayama on bronchial asthma have been the subject of numerous studies. A randomized controlled preliminary distributed in 2020 found that pranayama practice was related to critical enhancements in lung capability, asthma side effects, and personal satisfaction in grown-ups with moderate to serious asthma.[17] Pranayama practice significantly reduced asthma symptoms, medication use, and hospital admissions in children with asthma, according to a 2021 study[18] While the proof supporting the utilization of pranayama for asthma the executives is promising, more exploration is expected to completely figure out its adequacy, ideal length, and recurrence of training, and long haul benefits[19] The study

to our knowledge is first of its kind comparing the yogic methods of breathing with Buteyko technique. Yogic techniques are not mere breathing techniques as they involve a lot of non-empirical belief-based science. The common aspect of both techniques is breath control and reduction of hyperventilation. Thus, this study is very significant because it compares two techniques, one very commonly prescribed (Pranayama) and the other less known (Buteyko), in a very sensitive respiratory problem, Bronchial asthma.

2. MATERIALS AND METHODS

2.1 *Recruitment and Participants*

A pilot study was conducted to determine the viability of the Buteyko breathing procedure versus Pranayama. This study utilized a quasi-experimental design. To get formal consent, a patient with bronchial asthma was enlisted from the short-term facility of Saveetha Medical College and Hospital, Thandalam. Using the convenience sampling method, 12 patients with bronchial asthma who met the inclusion criteria were divided into three groups: The Buteyko group (n=4), the Pranayama group (n=4), and the control group (n=4). Pulmonary Function Test, Heart Rate, Respiratory Rate, Blood Pressure, Saturation of Oxygen (SaO2), Biochemical Markers like Total Count, Absolute Count, IgE, Asthma Control, and Quality of Life of Asthma Patients were also evaluated for each of the three groups. After that, the Buteyko group practiced Buteyko breathing for eight weeks, while the Pranayama group practiced Pranayama (Yoga breathing) for 20-30 minutes each. The control group received standard hospital care. In the fourth and eighth weeks, post-tests 1 and 2 were carried out.

2.2 INCLUSION CRITERIA

1. Patient with a confirmed diagnosis of bronchial asthma,
2. Patient Age group between the ages of 18 and 60
3. The patient had to have never used the Pranayama or Buteyko breathing techniques before.

2.3 EXCLUSION CRITERIA

1. Pregnancy,
2. The inability to perform the breathing techniques due to cognitive or physical impairment.
3. Patients with mental illness.
4. Clients with chronic asthma were excluded from the study.

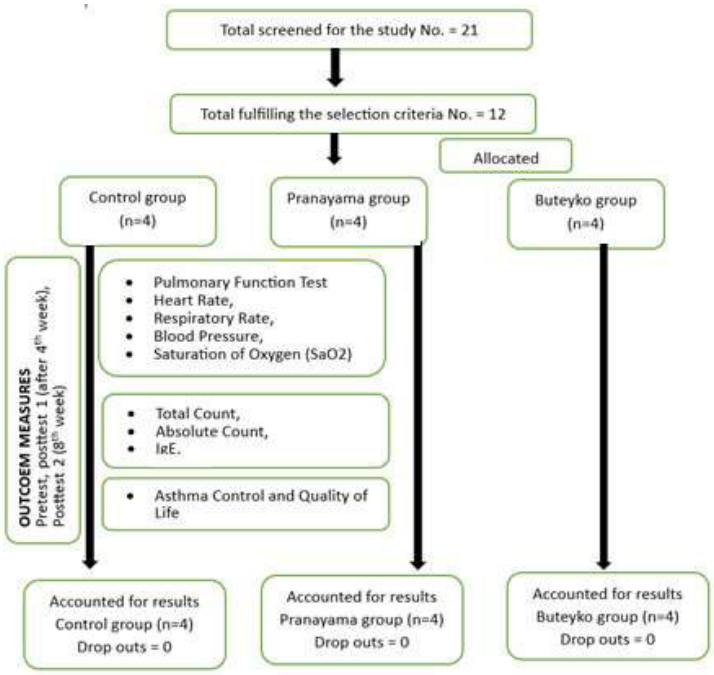

Fig 1- Flow of the study

2.4 *Interventions*

The patients were assigned using a method known as non-probability convenience sampling. Buteyko Group with Buteyko breathing procedure. [21] Pranayama group with Pranayama (Yoga breathing) conveyed both by a researcher. Slow, controlled breathing through the nose was the goal of the Buteyko breathing method, which focused on lowering the breathing volume [22] for eight weeks; students learned and practiced both methods for 20 to 30 minutes each day for 8 weeks. The Buteyko breathing technique, a set of breathing exercises designed to alleviate and manage asthma symptoms, was used in Buteyko Group practice. A set of reduced-breathing exercises is the core of the Buteyko method.

2.5 *Steps of the Buteyko Breathing Technique*

- Nasal Breathing
- Breath Holding
- Relaxation

1. When practicing Buteyko breathing, the first thing to remember is to breathe shallowly and controlled. Air should not be sucked in like your last breath; rather, it should be a gentle rhythm of breathing in and out [22].
2. Buteyko breathing necessitates breathing into the diaphragm, or stomach, rather than the chest, so keep the mouth shut and breathe extremely slowly.
3. Maintain an upright position while sitting and take shallow breaths for approximately two to three minutes. Remember to inhale fully and not in short bursts.

4. Pinch your nose shut and stop breathing (control pause) until you feel the urge to breathe after 2-3 minutes of getting the exhaling part of your breath.
The Pranayama technique included a variety of breathing exercises, such as Nadishodhana, Kapal Bhati, and Bhastrica, which were practiced in Pranayama.

2.6 *Pranayama's Steps* [21]

Shodhana Nadi
- With the Right hand, block the left nostril and inhale from the right.
- Block the right nostril and exhale from the left side using the same hand.
- Now, exhale from the right nostril and inhale from the left nostril.

Kapal Bhati
- Take a deep breath,
- bring your abdomen closer to the spine, and exhale slowly and steadily.
- Slowly work toward increasing the count of the breath spurt to 20.

Bhastrika
- Take a profound inhale and extend the midsection as relax
- Breathe out strongly and take in another inhale with force
- Do however many as could be expected under the circumstances without pushing excessively hard
- The control group was practiced using hospital routine measures.

2.7 *Outcome Measures*

The primary outcome measures were lung function, as measured by Pulmonary Function test, Bio biophysiological parameters like Heart rate, Blood pressure, Respiratory Rate, Saturation of Oxygen, and biochemical parameters like complete blood count, eosinophil count, Absolute oesinophil count, IgE. Asthma symptoms, as measured by the Asthma Control Test (ACT). Quality of life of Asthma patients as measured by the Asthma Quality of Life Questionnaire (AQLQ),

2.8 Ethical Considerations:

The institutional ethics committee approved the study (No.004/09/2021/IEC/SMCH). Informed consent was obtained from all participants.

3. DATA ANALYSIS

The data were represented as mean ± SEM and analyzed by two-way repeated measures analysis of variance (RM ANOVA) for one-factor repetition and Bonferroni 't' test for post hoc multiple comparisons. Factor A was groups (between-group comparison – Control, Buteyko and Pranayama), Factor B tested (within-group comparison, i.e., repetition factor – Pre-test, Post-test 1 and Post-test 2), and the group X test interaction. A probability of 0.05 or less was considered statistically significant. SigmaPlot 14.5 version (Systat Software Inc., San Jose, USA) was used for statistical analysis.

4. RESULTS

The study results were discussed based on demographic homogeneity and outcome measures. Due to the small sample size, the study did not consider doing a distribution or normality test. The demographic data analysis (Table 1) showed that the groups were similar during recruitment. Hence, any changes in the dependent variable should be because of the independent variable.

Table 1: Comparison of demographic variables of control, Buteyko, and Pranayama groups for homogeneity.

S.No.	Parameter	Category	Control	Buteyko	Pranayama	Statistics
1	Gender	Male	1	2	2	χ^2 = 0.91
		Female	2	1	1	P = 0.637
2	Age (years)	< 40	1	1	1	χ^2 = 0
		41-50	1	1	1	
		>50	1	1	1	P = 1
3	Occupation	Unskilled/skilled	1	1	1	χ^2 = 0
		Clerical/Office	1	1	1	
		Professional	1	1	1	P = 1
4	Residence	Urban	1	2	1	χ^2 = 0.9
		Rural	2	1	2	P = 0.637
5	Family history of asthma	Yes	2	1	1	χ^2 = 0.9
		No	1	2	2	P = 0.637
6	Habit of smoking	Yes	2	1	2	χ^2 = 0.9
		No	1	2	1	P = 0.637
7	Duration of asthma	< 3 years	1	1	2	χ^2 = 0.9
		> 4 years	2	2	1	P = 0.637

n = 3 each, total samples = 12.

The demographic data analysis showed that the three groups were similar at the baseline analysis, which proves that the changes in the groups are due to intervention and not to the demographic variables.

Two-way RM ANOVA revealed no significant difference in the groups (Control, Buteyko, and Pranayama) (P = 0.821). The tests (Pre-test, Post-test 1, and Post-test 2) showed statistical significance (P=<0.001). The mean IgE Pre-test, Buteyko Pre-test, Pranayama Pre-test, Control Post-test 1, Buteyko Post-test 1, Pranayama Post-test 1, Control Post-test 2, Buteyko Post-test 2, Pranayama Post-test 2 are, 788, 679.5, 767, 771, 598, 702, 712.8, 586.8, and 676 respectively. Two-way RM ANOVA revealed no significant difference in the groups (Control, Buteyko, and Pranayama) (P =0.203). The tests (Pre-test, Post-test 1, and Post-test 2) showed statistical significance (P=<0.0001). It shows a reduction in total count and IgE among tests. The results are summarized in Table 2.

Table 2: Comparison of control and experimental groups on respiratory parameters by two-way RM ANOVA with Bonferroni 't' test. Eosinophils, IgE, Total count

S.No	Groups and comparisons	Tests	Total count	Eosinophil	IgE
1	Control	Pre-test	10977.5± 528.2	583.3± 77.92	788.0± 77.6
	Buteyko	Pre-test	11045.0± 637.2.	579.0± 25.72	619.5± 58.5
	Pranayama	Pre-test	11175.5± 378.9	674.5± .68.44	767.0± 59.7
	Control	Post-test 1	10754.5± 518.1	620.5± 50.01	771.0± 73.3
	Buteyko	Post-test 1	10924.0± 528.2	546.0± 15.53	598.0± 49.9
	Pranayama	Post-test 1	11136.5± 386.8	642.5± 46.57	702.0± 39.3
	Control	Post-test 2	10362.0± 427.2	572.3± 49.34	712.8± 71.9
	Buteyko	Post-test 2	10695.0± 288.3	534.7± 14.41	586.8± 48.0
	Pranayama	Post-test 2	10787.5± 210.3	610.2.3± 36.89	676.0± 42.3
2	Significance among groups (Control, Buteyko and Pranayama)		F = 0.202 P = 0.821	F = 1.053 P = 0.388	F = 1.917 P = 0.203
	Significance among tests (Pre-test, Post-test 1 and Post-test 2)		F = 11.078 P =<0.001	F = 2.403 P =0.119	F = 19.058 P =<0.0001
	Significance in the interaction (groups X tests)		F = 0.413 P =0.097	F = 0.826 P =0.526	F = 2.106 P =0.122
3	Significance between Pre-test (Control and Buteyko)		t = 0.123 P = 1.000	t = 0.0632 P = 1.000	t = 2.013 P = 0.219
	Significance between Pre-test (Control and Pranayama)		t = 0.238 P =1.000	t = 1.352 P =0.596	t = 0.251 P =1.000
	Significance between Pre-test (Buteyko and Pranayama)		t = 0.362 P =1.000	t = 1.421 P =0.539	t = 1.762 P =0.329
4	Significance between Post-test 1 (Control and Buteyko)		t = 0.310 P =1.000	t = 0.108 P =0.866	t = 2.066 P =0.200
	Significance between Post-test 1 (Control and Pranayama)		t = 0.698 P =1.000	t = 0.327 P =1.000	t = 0.829 P =1.000
	Significance between Post-test 1 (Buteyko and Pranayama)		t = 0.388 P =1.000	t = 1.436 P =0.532	t = 1.242 P =0.731
5	Significance between Post-test 2 (Control and Buteyko)		t = 0.608 P =1.000	t = 0.558 P =1.000	t = 1.505 P =0.493
	Significance between Post-test 2 (Control and Pranayama)		t = 0.777 P =1.000	t = 0.565 P =1.000	t = 0.436 P =1.000
	Significance between Post-test 2 (Buteyko and Pranayama)		t = 0.169 P =1.000	t = 1.123 P =0.0847	t = 1.069 P =0.933
6	Significance within Control (Pre-test and Post-test 1)		t = 1.303 P =0.627	t = 1.131 P =0.819	t = 0.914 P =1.000
	Significance within Control (Pre-test and Post-test 2)		t = 3.596 P =0.006	t = 0.334 P =1.000	t = 4.048 P =0.002
	Significance within Control (Post-test 1 and Post-test 2)		t = 2.293 P =0.102	t = 1.465 P =0.481	t = 3.133 P =0.017
7	Significance within Buteyko (Pre-test and Post-test 1)		t = 0.007 P =1.000	t = 1.002 P =0.989	t = 1.156 P =0.788
	Significance within Buteyko (Pre-test and Post-test 2)		t = 2.045 P =0.167	t = 1.343 P =0.588	t = 1.762 P =0.285
	Significance within Buteyko (Post-test 1 and Post-test 2)		t = 1.338 P =0.593	t = 0.342 P =1.000	t = 0.605 P =1.000
8	Significance within Pranayama (Pre-test and Post-test 1)		t = 0.228 P =1.000	t = 0.971 P =1.000	t = 3.496 P =0.008
	Significance within Pranayama (Pre-test and Post-test 2)		t = 2.267 P =0.108	t = 1.950 P =0.201	t = 4.881 P =<0.001
	Significance within Pranayama (Post-test 1 and Post-test 2)		t = 2.039 P =0.169	t = 0.979 P =1.000	t = 1.385 P =0.549

Values are mean ± SE; n = 4 each in Control, Buteyko, and Pranayama groups

Comparison of control and experimental groups using within-group and between-group analysis on respiratory parameters by ANOVA with post hoc analysis using Bonferroni 't' test on Eosinophils, IgE, and Total count shows that both experimental groups were better than the control group.

Asthma Control Questionnaire, Two-way RM ANOVA revealed no significant difference in the groups (Control, Buteyko, and Pranayama) (P =0.181). The tests (Pre-test, Post-test 1, and Post-test 2) showed statistical significance (P=<0.001). Within-group comparisons of Pre-test, Post-test 1, and Post-test 2 of Control did not show significance (P > 0.05). Significance within Buteyko posttest I & II showed the statistical significance of (p=<0.001). However, Buteyko and

Pranayama showed a significant decrease in the Asthma Control Questionnaire Post-test 2 but were within the clinical limits. This showed that the Asthma Control Questionnaire is not affected by the control or the experimental groups. The Asthma Quality of Life Questionnaire Two-way RM ANOVA revealed no significant difference in the groups (Control, Buteyko, and Pranayama) (P =0.780). The tests (Pre-test, Post-test 1, and Post-test 2) showed statistical significance (P=<0.0001). The group X test interactions show significance (P =<0.001). Significance within control showed statistical signific of (P=<0.001), Significance within Buteyko (Pre-test and Post-test 1), Significance within Buteyko (Pre-test and Post-test 2) Significance within Buteyko (Post-test 1 and Post-test 2), shows significance (P=<0.001). In contrast, Pranayama showed Significance within Pranayama (Pre-test and Post-test 1) & Significance within Pranayama (Pre-test and Post-test 2) shows significance (P=0.001). The results of ACQ and AQLQ are presented in Table 3.

Table 3: Comparison of control and experimental groups on respiratory parameters by two-way RM ANOVA with Bonferroni 't' test. ACQ and AQLQ

S.No	Groups and comparisons	Tests	ACQ	AQLQ
1	Control	Pre-test	24.0± 0.4	130.0± 6.2
	Buteyko	Pre-test	22.5.0± 1.3	139.3± 17.9
	Pranayama	Pre-test	22.5± 0.6	137.3± 5.4
	Control	Post-test 1	23.2.± 0.3	131.0± 6.2
	Buteyko	Post-test 1	21.0± 1.2	142.0± 17.7
	Pranayama	Post-test 1	21.8± 0.5	138.8± 5.7
	Control	Post-test 2	23.0± 0.4	132.3± 6.3
	Buteyko	Post-test 2	20.0± 1.3	145.3± 17.2
	Pranayama	Post-test 2	21.0± 0.6	141.8± 6.0
2	Significance among groups (Control, Buteyko and Pranayama)		F = 2.079 P = 0.181	F = 0.255 P = 0.780
	Significance among tests (Pre-test, Post-test 1 and Post-test 2)		F = 3.571 P =<0.001	F = 155.605 P =<0.001
	Significance in the interaction (groups X tests)		F = 2.357 P =0.092	F = 10.539 P =<0.001
3	Significance between Pre-test (Control and Buteyko)		t = 1.269 P = 0.698	t = 0.575 P = 1.000
	Significance between Pre-test (Control and Pranayama)		t = 1.269 P =0.698	t = 0.451 P =1.000
	Significance between Pre-test (Buteyko and Pranayama)		t = 0.000 P =1.000	t = 0.124 P =1.000
4	Significance between Post-test 1 (Control and Buteyko)		t = 1.903 P =0.257	t = 0.684 P =1.000
	Significance between Post-test 1 (Control and Pranayama)		t = 1.269 P =0.698	t = 0.482 P =1.000
	Significance between Post-test 1 (Buteyko and Pranayama)		t = 0.634 P =1.000	t = 0.202 P =1.000
5	Significance between Post-test 2 (Control and Buteyko)		t = 2.537 P =0.087	t = 0.808 P =1.000
	Significance between Post-test 2 (Control and Pranayama)		t = 1.691 P =0.063	t = 0.591 P =1.000
	Significance between Post-test 2 (Buteyko and Pranayama)		t = 0.846 P =1.000	t = 0.218 P =1.000
6	Significance within Control (Pre-test and Post-test 1)		t = 2.083 P =0.155	t = 2.384 P =0.085
	Significance within Control (Pre-test and Post-test 2)		t = 2.777 P =0.037	t = 5.364 P =<0.001
	Significance within Control (Post-test 1 and Post-test 2)		t = 0.694 P =1.000	t = 2.980 P =0.024
7	Significance within Buteyko (Pre-test and Post-test 1)		t = 4.166 P =0.002	t = 6.556 P =<0.001
	Significance within Buteyko (Pre-test and Post-test 2)		t = 6.944 P =<0.001	t = 14.305 P =<0.001
	Significance within Buteyko (Post-test 1 and Post-test 2)		t = 2.777 P =0.037	t = 7.749 P =<0.001
8	Significance within Pranayama (Pre-test and Post-test 1)		t = 2.083 P =0.135	t = 10.729 P =<0.001
	Significance within Pranayama (Pre-test and Post-test 2)		t = 4.166 P =0.002	t = 7.152 P =<0.001
	Significance within Pranayama		t = 2.083	t = 3.576

(Post-test 1 and Post-test 2)	P =0.155	P =0.0006

ACQ-Asthma Control Questionnaire, AQLQ-Asthma Quality of Life Questionnaire
Comparison of control and experimental groups using within-group and between-group analysis on respiratory parameters by ANOVA with post Hoc analysis using Bonferroni 't' test on ACQ and AQLQ shows that both experimental groups were better than the control group.

5. DISCUSSION

The primary objective of this pilot study was to compare and contrast the effects of the Buteyko breathing method with Pranayama (Yoga breathing) on biochemical and physiological markers. Several breathing exercises can be used to control asthma, but many different approaches and mechanisms have been proposed.[23] Both the Buteyko method and Pranayama are good at treating respiratory problems, but their approaches and methods are different.[24] While Pranayama focuses on improving lung function and increasing oxygen levels, the Buteyko method reduces hyperventilation and increases carbon dioxide levels. Pranayama and the Buteyko method are specific breathing exercises that help manage respiratory conditions like asthma. Heart rate (beats per minute), systolic and diastolic blood pressures, respiration rate, and oxygen saturation were all found to be the same in the current study's Control Pre-test, Buteyko Pre-test, Pranayama Pre-test, Control Post-test 1, Buteyko Post-test 1, Pranayama Post-test 1, Control Post-test 2, and Buteyko Post-test 2, respectively. A two-way RM ANOVA Previous studies have shown that Pranayama has significantly improved with Forced Vital Capacity (FVC), Forced Expiratory Volume (FEV1), and FEC/FEV1.[25] In Bio-chemical markers. Two-way RM ANOVA uncovered no huge contrast in the gatherings (Control, Buteyko, and Pranayama) (P = 0.821). P 0.001 indicated that the tests (Pre-test, Post-test 1, and Post-test 2) were statistically significant. Buteyko and Pranayama showed a significant decrease in the Asthma Control Questionnaire Post-test 2 but remained within the clinical limits. The tests (Pre-test, Post-test 1, and Post-test 2) showed statistical significance (P=0.001). The Asthma Quality of Life Questionnaire The tests (Pre-test, Post-test 1, and Post-test 2) in both groups showed statistical significance (P=0.0001). This study was supported by another early reported study on the effects of Buteyko breathing exercises on newly diagnosed asthmatics[20]. Overall, the results showed a decrease in asthma symptoms and an increase in peak expiratory flow rate. The ongoing review proves that the Buteyko breathing method and Pranayama showed a critical lessening in Asthma Control and improvement in Personal Satisfaction Post-test 2. This study results also contradict the previous two studies comparing the Pranayama and Buteyko breathing techniques, which reported a significant advantage of using the latter. [21,22]

6. FUTURE RECOMMENDATION

As many systematic reviews in the past state that breathing exercises can only be an additive tool in treating asthma, much research is still needed to justify breathing techniques as a definite intervention tool. [26] Future studies can concentrate on using stress biomarkers (Hemoglobin, blood glucose, etc.) as both interventions also act at the level of conscious breathing and psychological betterment. The study should be repeated using an adequate sample size estimated through previous effect sizes. The study can also involve comparing these two techniques with activity-based breathing techniques. The adherence to these two interventions can also be tested using an appropriate research design.

7. CONCLUSION

The current study demonstrates that, while within the clinical limits, the Buteyko breathing technique and Pranayama significantly decreased asthma and improved quality of life. Pranayama practice has an edge over the Buteyko breathing technique regarding allergic response through immune mediation (IgE). Hence, this study suggests future studies with more samples to prove the advantage of Pranayama over other breathing interventions.

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9. AUTHORS CONTRIBUTION STATEMENT

K. Karpagam- Designed and devised the research thesis, performed the experiment and prepared the manuscript. Dr. Ramasamy- Guided and supported the research work throughout the study with conceptual ideas and manuscript preparation. Dr. Vijayaraghavan. R- Guided and Performed analytic calculations and guided in manuscript preparation.

10. CONFLICT OF INTEREST

Conflict of interest declared none.

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