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Comparison of the effects of Buteyko and pranayama breathing techniques on quality of life in patients with asthma – a randomized controlled trial

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Abstract

Objective: To compare two breathing exercises (Buteyko and pranayama) with a control group in patients with asthma.

Design: Randomized controlled trial.

Subjects: One hundred and twenty subjects were randomized to three groups through block randomization. Subjects with an Asthma Quality of Life Questionnaire score <5.5 participated in the study.

Setting: Outpatient pulmonary medicine department.

Interventions: Subjects in the Buteyko and pranayama groups were trained for 3–5 days and instructed to practise the exercises for 15 minutes twice daily, and for three months duration. The control group underwent routine pharmacological management during the study period.

Outcome measures: Asthma Quality of Life Questionnaire, Asthma Control Questionnaire and pulmonary function test.

Results: The baseline characteristics were similar in all three groups. Post intervention, the Buteyko group showed better trends of improvement (mean (95% confidence interval), P-value) in total Asthma Quality of Life Questionnaire score than the pranayama (0.47 (–0.008–0.95), P = 0.056) and control groups (0.97 (0.48–1.46), P = 0.0001). In comparison between the pranayama and control groups, pranayama showed significant improvement (0.50 (0.01–0.98), P = 0.042) in total Asthma Quality of Life Questionnaire score.

Conclusion: The Buteyko group showed better trends of improvement in quality of life and asthma control than the group performing the pranayama breathing exercise.

Keywords

Breathing techniques, pranayama, Buteyko

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Introduction

Asthma is a serious public health problem affecting an estimated 300 million people of all ages throughout the world.[1] It is a complex and multifaceted condition causing significant impairment of physical and psychosocial well-being in the affected individual. Thus improving the health-related quality of life of patients is one of the primary goals in asthma treatment. It acquires more significance since traditional parameters such as lung function have weak association with quality of life.[2]

Pharmacological therapies have been shown to reduce symptoms, improve lung function and prevent exacerbations, with an acceptable safety profile.[3] However, it has been stated that some of the failure to control asthma relates to a widespread fear or dislike of medications, notably inhaled corticosteroids.[4] There is a rise in interest in non-pharmacological management of asthma. Breathing techniques have been reported as the most frequently used methods among non-pharmacological approaches to asthma.[5] A Cochrane Review of breathing exercises for asthma concluded that there were trends to improvement in outcomes, but the current evidence is inadequate.[6]

The Buteyko breathing technique aims to reduce hyperventilation,[7] and earlier studies have demonstrated a reduction in symptoms, beta-2 agonist use and inhaled corticosteroid use.[8–16] However, studies evaluating the patients' perspective on asthma quality of life, are limited.[17]

Yoga is an ancient Hindu discipline in which pranayama deals explicitly with control of breathing.[18,19] Earlier studies have indicated that a pranayama type of breathing results in reduction of symptoms, less beta-adrenergic use and reduced airway hyperreactivity.[18,20,21] Nevertheless, studies evaluating the effect on quality of life in patients with asthma are limited. A previous study comparing Buteyko and pranayama concluded no benefit for pranayama,[13] but it was practised with a Pink City Lung Exerciser with no preparatory breathing exercises and nostril breathing,[19] which have been demonstrated to be useful.[22,23]

There is still a need to do further research in this field to provide appropriate treatment for the patients with asthma. The present study, aims to compare two breathing exercises with a control group using the Asthma Quality of Life Questionnaire, Asthma Control Questionnaire (ACQ), and pulmonary function test (forced expiratory volume in one second, FEV_1; FEV_1/FVC, forced expiratory volume in one second/forced vital capacity ratio).

Methods

The randomized controlled trial was conducted at an outpatient department of chest medicine. Ethical clearance was obtained from the institutional ethical committee, and written consent was given by the patients. The inclusion criteria were as follows: subjects aged between 18 and 60 years, Asthma Quality of Life Questionnaire score[24] < 5.5, forced expiratory volume in one second (FEV_1) increase by 12% following bronchodilator administration, usage of bronchodilator for six months and patients without exacerbation in the preceding eight weeks. Patients were excluded if they had medical conditions impairing the performance of breathing techniques, had previous history of breathing retraining, were pregnant and non-compliance with exercise for more than 15% of study period.

The self-administered version of Asthma Quality of Life Questionnaire was the primary outcome measure in this study since it measures the best experience of asthma symptoms by patients.[24]

The Asthma Control Questionnaire has strong measurement properties and has been validated for use in both clinical practice and clinical trials.[25] The pulmonary function test was performed according to the standards outlined by the ATS/ERS Task Force.[26] It was measured with a flow meter (Ferraris Respiratory, Hertford, UK). Measures such as FEV_1 and FEV_1/FVC were recorded.

Intervention

Patients were assigned to three groups through block randomization. The method of allocation was concealed in sequentially numbered, sealed, opaque envelopes. An independent observer who performed the randomization procedure was not involved in

conducting intervention and collecting the outcome measures. The patient's baseline parameters such as Asthma Quality of Life Questionnaire, Asthma Control Questionnaire and pulmonary function test was recorded pre and post training for three months by a person blinded to the allocation of groups.

Buteyko group

Patients were taught the Buteyko technique for 3–5 days with a session of 60 minutes each day. They were then followed up for three months and were instructed to practise the exercise for 15 minutes twice daily. The aim of the Buteyko method was to correct the patient's breathing pattern by reducing hyperventilation and thereby resetting CO_2 levels. This technique involves periods of breath holding, known as 'control-pause', interspersed with periods of shallow breathing, and is accompanied by physical activities to increase the build up of CO_2 further.[7]

Pranayama group

Patients were trained to perform diaphragmatic breathing, thoracic breathing, upper lobe breathing and full yogic breathing progressing to right nostril breathing, left nostril breathing and alternate nostril breathing[19] for 3–5 days with a session of 60 minutes each day. They were followed up for three months and were instructed to practise the exercise for 15 minutes twice daily.

Patients in both groups were contacted every two weeks by telephone regarding performance of the exercise. They were taking medications in accordance with the physician's instructions. Diary cards to record daily performance of exercise were given. Compliance to exercise was assessed at the end of the study period. Patients who recorded non-compliance with the exercise for more than 15% of the study period were excluded from the analysis.

Control group

Patients in the control group followed routine physician care involving pharmacological management. They were contacted every two weeks by telephone enquiring about their medication usage. Exacerbations and adverse events were recorded for all the groups. Moderate exacerbations were defined as ≥2 consecutive days of increased reliever use by >2 occasions/day and/or increase in symptoms (≥1 episode of nocturnal asthma/night and/or early waking requiring reliever) over baseline, and/or in the investigator's opinion the subject was experiencing an exacerbation. Severe exacerbations were defined by requirement for oral corticosteroids.[9]

Data analysis

Data analysis was performed using SPSS version 14.0 (SPSS Inc., Chicago, IL, USA). Descriptive analysis was performed for age, gender, height, weight, duration of disease, duration of medications, duration of exercise, FEV_1, FEV_1/FVC, Asthma Quality of Life Questionnaire and Asthma Control Questionnaire. To examine the effect of the randomization procedure, the demographic variables and preintervention outcome measures between the groups were evaluated with analysis of variance for normally distributed data. Kruskal–Wallis test was performed to analyse between-group differences for non-normally distributed data. Further multiple paired comparisons were performed with post-hoc Bonferroni test to determine the effective intervention group.

The chi-square test was used to test the association between categorical variables if the numbers were sufficient or Fisher's exact test if not. Pre–post analyses in each of the three groups were done using paired *t*-test (normally distributed data) and Wilcoxon signed rank test (non-normally distributed data).

Data are expressed as number (percentage) for categorical variable and mean ± standard deviation, median (range) for continuous variable.

Results

Figure 1 shows patient allocation and enrolment to the Buteyko, pranayama and control groups. Baseline characteristics demonstrate no significant difference between the groups, suggesting homogeneity between the groups (Table 1). Fourteen moderate

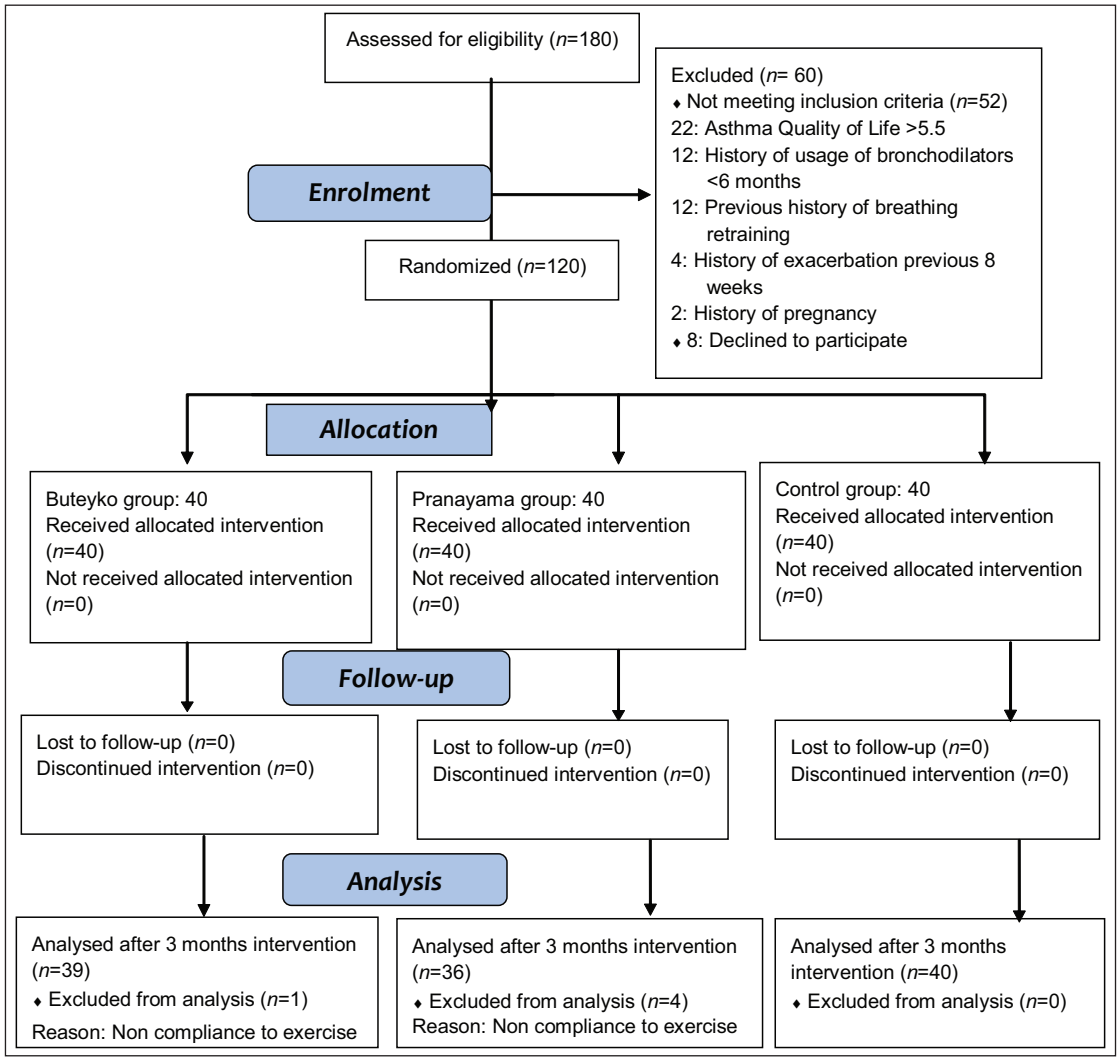

Figure 1. Study flowchart.

exacerbations (4 in the Buteyko group, 4 in the pranayama group and 6 in the control group; *P*-value > 0.05) and 5 severe exacerbations (1 in Buteyko, 2 in pranayama and 2 in the control group; *P*-value > 0.05) were reported during the study.

The Buteyko and pranayama groups showed significant improvement in total score and four subdomains (symptoms, activity, emotion and environment) of asthma quality of life, whereas the control group did not show significant improvement. With a change of 0.5 signifying a clinically relevant patient threshold, the Buteyko group and the pranayama group demonstrated clinically significant change.

Comparison of the Buteyko and pranayama groups did not show a significant difference in total score and the four subdomains of the Asthma Quality of Life Questionnaire. The Buteyko group compared to control group showed a significant improvement in total score, symptoms, activity and environment domains, whereas the emotional domain did not show significant difference. The pranayama group showed significant improvement

Table 1. Baseline characteristics of study subjects

Characteristics	Buteyko (n = 39)	Pranayama (n = 36)	Control (n = 40)	P-value
Age (years), mean ± SD	38 ± 13	35 ± 13	41 ± 14	0.067
Male/female, n (%)	16 (41%)/23 (59%)	17 (47%)/19 (53%)	14 (35%)/26 (65%)	0.815
Height (cm), mean ± SD	159 ± 12	157 ± 8	158 ± 9	0.740
Weight (kg), mean ± SD	59 ± 10	58 ± 9	59 ± 11	0.724
Duration of disease (years), mean ± SD	10 ± 10	11 ± 12	11 ± 10	0.924
Duration of medications (months), mean ± SD	41 ± 28	32 ± 31	45 ± 43	0.164
Duration of exercise (days), mean ± SD	82 ± 3	80 ± 3		0.911
FEV_1 (1/s), mean ± SD	2.28 ± 0.75	2.33 ± 0.81	2.00 ± 0.61	0.113
FEV_1/FVC, mean ± SD	96.20 ± 13.25	98.56 ± 10.05	93.42 ± 13.85	0.190
Baseline AQLQ, mean ± SD	4.29 ± 0.90	4.49 ± 1.02	4.19 ± 0.95	0.391
Baseline ACQ, mean ± SD	1.47 ± 0.84	1.31 ± 0.74	1.36 ± 0.72	0.644
No. of puffs, median (interquartile range)	2 (2–3)	2 (2–3)	2 (2–3)	0.473
Medications				
ICS, n (%)	2 (5%)	5 (14%)	2 (5.3%)	P > 0.05
LABA + ICS, n (%)	37 (95%)	36 (100%)	34 (84.2%)	
SABA, n (%)	3 (8%)	0 (0%)	6 (15.8%)	
LTRA, n (%)	5 (13%)	7 (19%)	6 (15.8%)	
Theophylline, n (%)	5 (13%)	3 (8%)	6 (15.8%)	

FVC, forced vital capacity; FEV_1, forced expiratory volume in one second; ICS, inhaled corticosteroid; LABA, long-acting beta agonist; SABA, short-acting beta agonist; LTRA, leukotriene antagonist; AQLQ, Asthma Quality of Life Questionnaire; ACQ, Asthma Control Questionnaire.

Table 2. Mean (95% confidence interval) change in Asthma Quality of Life Questionnaire between group difference of Buteyko, pranayama and control groups

	Buteyko vs. pranayama	P-value	Buteyko vs. control	P-value	Pranayama vs. control	P-value
Total	0.47 (–0.008–0.95)	0.056	0.97 (0.48–1.46)	0.0001*	0.50 (0.01–0.98)	0.042*
Symptoms	0.32 (–0.24–0.88)	0.50	1.01 (0.44–1.59)	0.0001*	0.69 (0.13–1.26)	0.01*
Activities	0.52 (0.20–1.03)	0.36	1.32 (0.81–1.83)	0.0001*	0.79 (0.28–1.30)	0.001*
Emotion	0.47 (–0.17–1.13)	0.23	0.65 (–0.01–1.31)	0.059	0.17 (-0.48–0.83)	1.00
Environment	0.57 (–0.18–1.33)	0.21	0.91 (0.13–1.69)	0.016*	0.33 (–0.43- 1.10)	0.86

*$P < 0.05$.

in total score and in symptoms and the activity subdomain, while the emotional and environment domains did not show significant difference compared to the control group (Table 2).

The Buteyko group demonstrated significant improvement in asthma control, whereas the pranayama and control groups did not show improvement in Asthma Control Questionnaire scores (Table 3).

With regard to mean changes in pulmonary function after three months of intervention in the Buteyko, pranayama and control groups, analysis of FEV_1 showed a significant increase in the Buteyko group by 0.06 L/s and the control group by 0.17 L/s; FEV_1 in the pranayama group decreased by 0.11 L/s. FEV_1/FVC showed a significant decrease of 4% in the Buteyko and pranayama groups, but an increase of 2% in the control group. Overall, the

Table 3. Mean (95% confidence interval) change in Asthma Control Questionnaire from baseline to three months within-group difference of Buteyko, pranayama and control groups

	Pre ACQ	Post ACQ	Mean change (95% CI)	*P*-value
Buteyko	1.44	1.00	0.44 (0.23–0.64)	0.001*
Pranayama	1.30	1.17	0.13 (–0.15–0.41)	0.356
Control	1.33	1.21	0.11 (–0.14–0.37)	0.383

*$P < 0.05$.
ACQ, Asthma Control Questionnaire; 95% CI, 95% confidence interval.

Table 4. Mean change in forced expiratory volume in one second (FEV_1) and FEV_1/FVC

	FEV_1 (L/s)	FEV1/FVC
	Mean change ± SD	Mean change ± SD
Buteyko	–0.06 (0.41)	3.70 (9.90)
Pranayama	0.11 (0.50)	4 (9.44)
Control	–0.17 (0.38)	–2.38 (9.58)
P-value	0.021*	0.007*

*$P < 0.05$.

magnitude of change in FEV_1 and FEV_1/FVC was statistically significant, however they were not clinically important changes (Table 4).

Discussion

The aim of the study was to compare the effect of Buteyko and pranayama breathing exercises with a control group on asthma quality of life and asthma control. The study results demonstrated better trends of improvement in the Buteyko group on quality of life and asthma control than in the pranayama group. Both the breathing training groups showed significant improvement in quality of life compared to the control group. The baseline characteristics such as age, gender, height, weight, duration of disease, duration of medications, duration of exercise, medications, asthma quality of life, asthma control and lung function were similar in the three groups following randomization. This demonstrates homogeneity and that all three groups were comparable.

The improvement of quality of life in the Buteyko group could be a result of improvement in 'hidden hyperventilation' as claimed by Buteyko. There is evidence of hyperventilation causing decreased CO_2 levels, resulting in asthma symptoms and also linked to a lower perceived general health.[27] The reasons for the improvement in total score of quality of life are due to the Buteyko breathing technique involving a period of breath holding interspersed with periods of shallow breathing, accompanied by physical activities to increase the build up of CO_2. The increase in CO_2 leads to dilatation of smooth muscles in the walls of the bronchi, bronchioles and alveolar ducts, and therefore optimizes ventilation perfusion matching. Similar improvements in asthma symptoms and activity have been reported by earlier studies investigating Buteyko breathing.[8,10,13–15]

Within-group differences in Asthma Quality of Life Questionnaire scores in the Buteyko and pranayama groups were 1.12 and 0.64, which is well beyond the 0.5 clinically important threshold,[28] for change in an individual patient. The present study showed a mean change of 1.12 and 0.64 after three months of intervention, which is in agreement with the findings of Cooper et al.,[13] who compared Buteyko and pranayama breathing, demonstrating

within-group differences of 1.03 and 0.61 following six months of intervention. The reason for the higher magnitude of change in the shorter duration of study period could be lower baseline values of Asthma Quality of Life Questionnaire, around 4.2 in the present study, compared to a score of 5 in the earlier study.

Earlier studies in asthma have been performed with a combination of breathing and yoga postures.[20,21] Some studies have used the Pink City Lung Exerciser for the purpose of reducing the respiratory rate.[13,18] The present study was conducted only with breathing practices, to understand its effects on patients with asthma. Pranayama showed an improvement of 0.64 units in the Asthma Quality of Life Questionnaire in the present study compared with the study by Cooper et al.,[13] which showed a difference of 0.61 units with a study duration of six months. The reason for the larger improvement in the shorter study could be the progressive set of breathing practices used, compared with the breathing retraining used in the earlier study, performed through a cylinder with an expiratory resistance (the Pink City Lung Exerciser), which was designed to reduce breathing frequency and increase the duration of expiration. Nostril breathing, which was not investigated in the earlier studies, was included in the present study. The effects of uni-nostril breathing have been described in ancient Indian yoga texts[29] and scientific evidence is available of the therapeutic effect on the autonomic nervous system.[22,30,31]

The threshold of clinical relevance for between-group mean differences in Asthma Quality of Life Questionnaire scores has not been established, but for comparison recently conducted study between diaphragmatic and control group for six months with similar baseline values of Asthma Quality of Life Questionnaire showed between-group difference as 0.4.[32] The magnitude of mean difference in the present study is 0.97 between the Buteyko and control groups, 0.50 between the pranayama and control groups; the mean difference is much higher in the present study. The higher difference could be because breathing practices were combined with physical activity in the Buteyko group and a series of breathing practices in the pranayama group compared to diaphragmatic breathing alone. Hence the Buteyko and the pranayama groups show significant improvement compared to the control group in total score.

The present study did not demonstrate a significant difference between the Buteyko and pranayama groups on total Asthma Quality of Life Questionnaire scores and four subdomains (symptoms, activity, emotional and environmental). Comparison of the Buteyko and pranayama groups showed mean difference of 0.47 compared to a similar study by Cooper et al.[13] with a mean difference of 0.42. Both were statistically insignificant. Thus the study is unable to conclude that the Buteyko technique is more effective than pranayama, although it is showing better trends of improvement in Asthma Quality of Life Questionnaire compared to pranayama. The insignificant difference between the two types of breathing techniques could be due to a similar aim of reducing respiratory rate and using a nasal route of breathing. The Buteyko and pranayama techniques both advise nasal breathing over oral breathing as part of the breathing technique. The advantages of nasal breathing include the filtration of air for allergens and polluting dust, humidification and production of nitric oxide, which results in brochodilatation of airways.[33] Thus nose breathing could have played a role in reducing the symptoms of asthma and thereby improving the quality of life for the asthmatic patients.

International guidelines indicate that the primary goal of asthma treatment is to achieve optimum control (minimization of day and night time symptoms, broncho-constriction and short-acting beta-agonist use) and thus reduce the risk of life-threatening exacerbations and long-term morbidity.[1,3,34] The Asthma Control Questionnaire measures the adequacy of asthma treatment as identified by international guidelines. The baseline values for the Buteyko, pranayama and control groups in the present study were 1.44, 1.30 and 1.33, respectively. It indicates that the subjects were symptomatic with values >0.5 at baseline. Following intervention the magnitude of change was less than 0.5 units, which is not a clinically important change for Asthma Control Questionnaire in all three groups.[35] However, the Buteyko group showed a change of 0.44 units compared to the pranayama (0.13) and control (0.11) groups, thus the Buteyko group shows a greater

improvement compared to the improvement registered by other groups. The present study did not intend to address components such as inhaled bronchodilators and lung function in the Asthma Control Questionnaire. Hence future studies are required to address the above-mentioned components to demonstrate changes in the Asthma Control Questionnaire.

FEV_1 is a sensitive indicator of airway obstruction. The present study demonstrated no significant difference between the breathing training groups and the control group. This might be due to optimal FEV_1 at the baseline of three groups. Thus there is minimal scope for further improvement following breathing retraining. It also requires a long duration of breathing practice to bring about a change in pulmonary physiology. Hence the study could not demonstrate the effect of breathing training on pulmonary function. The clinical benefit attained by breathing training is through the specific effect of intervention and also could be due to professional attention resulting in beneficial nonspecific 'placebo-like' effects.[36] This study warrants caution while generalizing and interpreting the results. The study had a limited number of patients with asthma recruited from a single geographical location. Hence, a multicentric study is required to confirm the study results. Studies investigating the effect of Buteyko and pranayama breathing on airway hyperresponsiveness are required. Studies with long-term effects of breathing training are required to investigate absenteeism from work or school, number of acute exacerbations and inpatient hospitalizations.

Clinical messages

- The Buteyko group showed better trends of improvement in quality of life and asthma control than the group performing the pranayama breathing exercise.
- The Buteyko and pranayama groups demonstrated significant improvement in quality of life compared to the control group.

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