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Ganpat Das Vaishnav
Department of Child Health Nursing, Geetanjali College of Nursing, Geetanjali University, Udaipur, Rajasthan, India

Deepak BV
Associate Professor, Department of Child Health Nursing, Geetanjali College of Nursing, Geetanjali University, Udaipur, Rajasthan, India

Effectiveness of buteyko breathing technique on physiological parameters among children with bronchial asthma in selected hospitals, Udaipur, Rajasthan

Ganpat Das Vaishnav and Deepak BV

Abstract
Introduction: Respiratory disease are very often found in children, especially the respiratory infection. A scientific approach and accurate diagnosis will enable proper treatment and outcome. Asthma is one of the leading cause of chronic illness in childhood; this condition commonly appears before adolescence. The word asthma means struggling for breath. It is chronic inflammatory disorder of the lower airway due to temporary narrowing of the bronchi by bronchospasms, manifested as dyspnea, wheezing and excessive cough.

Aims and methods: The methods adopted for the present study was quantitative experimental research approach as the study aimed at development of buteyko breathing technique (BBT) for assessing the physiological parameters of 60 children with bronchial asthma using non probability sampling technique. Data collected by observational check list. Quasi experimental: non randomized control group design, the study was conducted in Geetanjali Hospital, Ananta Hospital & Pacific Hospital at Udaipur.

Result: the effectiveness of buteyko breathing technique on physiological parameters among children with bronchial asthma. The calculated values are greater than table value (13.6, 21.48, 153, 25.01) at 0.001 & 0.01 levels. Hence the research hypothesis (H_1) was accepted that there is a significant difference between pre-test and post test score with respiratory rate, oxygen saturation, PEFR & BHT. There is an association pre-test of physiological parameters with their selected socio-demographic variables; hence the research hypothesis (H_2) was accepted.

Conclusion: This study conducted that there was improvement in the level of quality life of children which indicates that the buteyko breathing technique is effective. The demographic variables of physiological parameters significantly associated with the pre-test level.

Keywords: Effectiveness, buteyko breathing technique, physiological parameters, bronchial asthma

Introduction
The word asthma comes from the Greek verb aazein, meaning to pant, to exhale with the open mouth. Asthma is a lung condition that causes difficulty breathing and it is a common and serious disease in childhood [1].

The word asthma means struggling for breath. It is chronic inflammatory disorder of the lower airway due to temporary narrowing of the bronchi by bronchospasms, manifested as dyspnea, wheezing and excessive cough [2].

Asthma is a chronic inflammatory disorder of the airway that causes recurrent attacks of breathlessness wheezing, chest tightness and cough particularly at night or in the morning. It is mainly due to airway hyper responsiveness to a variety of stimuli resulting in inflammation of the the bronchial wall and increased mucus secretion thereby causing bronchoconstriction and airflow limitation [4].

An estimated 1.9 disability adjusted life year (DALYs) are lost every year due to asthma per thousand children under 15 year of age in India. The increase in the prevalence of asthma in children may have serious implications for adults as 40 % of children with infrequent trivial wheeze and 70-90 % of those with more troublesome asthma continue to have symptoms in mid-adult life [5].

In (2018) 90% of childhood asthma and 50% of adult asthma is caused due to environmental allergens with an estimated 1.5-2 crore asthma patents, at least one in every 10 asthma

Corresponding Author:
Ganpat Das Vaishnav
Department of Child Health Nursing, Geetanjali College of Nursing, Geetanjali University, Udaipur, Rajasthan, India

patient globally lives in India. Globally, the economic costs associated with asthma exceed those of TB and HIV/AIDS combined. Considered te most common chronic disease among children, asthma is prevalent in all countries, whether they are developed or underdeveloped. In fact, over 80% of asthma deaths [15].

Although there is no permanent cure for asthma, the disorder can be managed in many ways. In asthma management, complementary and alternative medicine is enjoying a growing popularity worldwide. Buteyko breathing technique is a form of complimentary or alternative physical therapy that proposes chronic "breathing retraining" as a treatment for asthma as well as other medications. It is a set of simple breathing technique to help control asthma and other breathing disorder. At the core of the buteyko breathing technique is a series of reduced-breathing technique that focus on nasal breathing, breath hold and relaxation [7].

The buteyko breathing technique was originally developed in the 1950s by physiologist Konstantin Pavlovich Buteyko in Russia. This technique is based on the assumption that numerous medical conditions including asthma caused by chronically increased respiratory rate (hyperventilation). Normally, when the amount of co_2 in our blood rises, we breathe. This replaces some of the co_2 with oxygen and so lower the co_2 level back to normal. During an asthma attack, people panic and breath too quickly. They actually over breath because they are breathing so rapidly. This over-breathing causes the amount of co_2 in the blood to fall too low, which can subsequently lead to disturbances of the acid-base balance in the blood and lower tissue oxygen level. The body reacts by causing the airway in the lungs to narrow and reduce the amount of air inhaled in each breath, which panics the patient into trying to breath even harder. Buteyko breathing technique will break this "negative feedback" cycle by teaching us breath more shallowly and tolerate a higher concentration of co_2 in our blood [9].

Buteyko uses a measurement to monitor the condition of asthmatics called the control pause (CP) defined as the amount of time that an individual can comfortably hold breath after a normal exhalation. According to buteyko teachers, with buteyko breathing technique, asthmatics are expected to find their CP gradually increases parallel deceased asthma symptoms. By increasing the control pause asthmatics can control the initial over breathing phase and they can prevent a "vicious circle of over breathing" from developing and spiraling into an asthma attack. This means that asthma attacks may be averted simply by breathing less. The first official study into the effectiveness of the buteyko breathing on asthma was undertaken in 1968 at the Leningrad institute of Pulmonology. The second, held at the first Moscow Institute of Pediatric Diseases in April 1980, eventually led to the head of the ministry of health to issue an order (No 591) for the implementation of the buteyko breathing technique in the treatment of bronchial asthma [10].

Problem Statement
"Effectiveness of buteyko breathing technique on physiological parameters among children with bronchial asthma in selected hospitals Udaipur, (Raj.)

Objectives
- To assess the physiological parameters among children with bronchial asthma in both group experimental and control group.
- To evaluate the effectiveness of buteyko breathing technique on physiological parameters of children with bronchial asthma.
- To find out the association between pre-test level of physiological parameters with their selected socio-demographic variables.

Research Hypothesis
H₁. There is a significant difference between the mean pre-test and post-test level of physiological parameters among children with bronchial asthma in both experimental and control group.

H₂.-There is a significant association between the pre-test level of physiological parameters among children with their selected socio demographic variables in both experimental and control group.

Methodology
The methods adopted for the present study was quantitative experimental research approach as the study aimed at development of buteyko breathing technique (BBT) for assessing the physiological parameters of 60 children with bronchial asthma using non probability sampling technique. Data collected by observational check list. Quasi experimental: non randomized control group design, the study was conducted in Geetanjali Hospital, Ananta Hospital & Pacific Hospital at Udaipur.

Criteria for sample selection
Inclusion criteria
The study includes:
- Children who are admitted in the hospital with bronchial asthma.
- Both male and female children between 6-13 years of age.
- Children who can understand English or Hindi.
- Children who are willing to participate in the study.

Exclusion criteria
The study excludes:
- Children who are critically ill.
- Children whose parents are not agreeing to participate their child in the study.
- Children not available at the time of data collection.

Development and description of tool
The tool was developed based on review of literature, opinion from experts in the field of Medical and Nursing. The following steps were undertaken to prepare the final tool
The tool consists of two sections:
Section A: Demographic variable:
It consists of demographic variables of age, gender, religion, type of family, educational status, area of residence, duration of illness, family income, know about BBT, source of information about BBT, Know about bronchial asthma & Source of Information about Bronchial asthma.

Section B: Assessment of respiratory outcome by using
1. Respiratory distress: Modified Becker's scale
2. Oxygen saturation
3. Peak Expiratory Flow Rate (PEFR) and
4. Breath holding time

Respiratory distress: Modified Becker's scale

Table 1: Schematic presentation of Score interpretation

Score	Respiratory rate	Wheezing	Use of accessory muscle
0- Normal	<30	None	None
1-Mild distress	30-40	Terminal expiration	One site
2-Moderate distress	41-50	Entire expiration	Two sites
3- Severe distress	>50	Inspiration and entire expiration	Three sites or neck strap use

- 0 Normal
- 1-3 Mild distress
- 4-6 Moderate distress
- 7-9 Severe distress

1. **Oxygen saturation:** It consist of oxygen saturation ratings to measure oxygen level by using pulse oximeter.
- 96-100% normal oxygen saturation
- 91-95% Mild Desaturation
- 85-90% Moderate Desaturation
- 51-85% Hypoxic

2. **Peak Expiratory Flow Rate (PEFR):** It consists of Peak flow zones namely green, high yellow zone, low yellow zone and red zone.
- 80-100% Normal Peak flow reading
- 50-79% Minimal airway narrowing
- <50% severe airway narrowing.

3. **Breath Holding Time:** It is the time duration that a child can comfortably hold breath after a normal exhalation measured with stop watch in seconds. (>25 sec/min is considered to be normal)
- 1-10 Sec/min
- 11-20 Sec/min
- 21-30 Sec/min

Reliability of the tool
The researcher used standard tool so reliability of the tool is r =0.87. Priyalatha G *et al*. (2018) [9].

Ethical consideration
Ethical considerations are vital to any research study because of the influence on the researcher's ability to acquire and retain participants.
The researcher has done Buteyko Breathing technique (BBT) on children with Bronchial asthma at selected Hospitals, Udaipur. The proposed study was conducted after the approval from Geetanjali College of nursing Ethical Committee. Permission were obtained from the concerned authorities. Informed consent were obtained from the parents of children participating in study. Respondents had given the right to withdraw from the study at any time they want and assurance was given to the study subjects and parents that, the privacy and anonymity of the individual will be maintained confidentially.

Method of data collection
After obtaining the required permission from the concerned authorities and informed consent from the parents, the investigator introduce himself, explain the purpose of the study and collect the data pertaining the demographic variables. The study will be conducted in the following phases.

Phase 1: The investigator will assess the physiological parameters which includes, respiratory distress, oxygen saturation, PEFR and breath holding time by using pulse oxymeter, observation, peak flow meter and stop watch in both experimental and control group.
Phase 2: Buteyko breathing technique will be demonstrated by researcher to the experimental group. This will be performed for about 20 min., 2 times a day for 5 days. There will be no intervention for the control group.
Phase 3: After the end of the intervention (5th day), post test score of physiological parameters will be assessed by using pulse oxymeter, observation, peak flow meter and stop watch in both experimental group and control group.

Plan for data analysis
The Researcher used Descriptive statistics which include frequency, percentage and mean, medium and standard deviation to assess the demographic variables of children with Bronchial asthma. Inferential statistics such as 't' test and Wilcoxon Signed Rank test was used to compare the effectiveness of pre and post-test assessment. Chi-square test was done to find out the association between the physiological parameters and demographic variables.

Projected outcome
After the study, the researcher will know whether Buteyko breathing technique has much effect on the selected physiological parameters of respiratory distress, oxygen saturation PEFR & BHT among children admitted with bronchial asthma in experimental group.

Study result
Section A: socio-demographic data
- **Among 30 children with bronchial asthma in experimental group:** 12 (40 %) belongs to the age group 10-11 years, were 22 (73.3 %) belongs to boy, were 19 (63.3 %) belongs to Hindu, were 21 (70 %) belongs to nuclear family, were 22 (73.3 %) belongs to primary education, 18 (60 %) belongs to rural area, were 14 (46.6 %) belongs to Rs.5001-10000, were 12 (40 %) belongs to 4-5 years, were 28 (93.3%) belongs to no, were 28 (93.2 %) belongs to no information, were 27 (90%) belongs to yes, 12 (40 %) belongs to mass media.
- **Among 30 children with bronchial asthma in control group:** 16 (53.3 %) belongs to the age group 6-7 years, were 20 (66.7 %) belongs to boy, were 15 (50 %) belongs to Hindu, were 18 (60 %) belongs to nuclear family, were 20 (66.7 %) belongs to primary education, were 16 (53.3 %) belongs to rural area, were 12 (40 %) belongs to Rs.5001-10000, were 13 (43.3 %) belongs to 4-5 years, were 27 (90%) belonged to no, were 27 (90 %) belongs to no information, were 28 (93.3 %) belongs to yes, were 13 (43.3 %) belongs to mass media.

Section B: assessment of physiological parameters outcome by
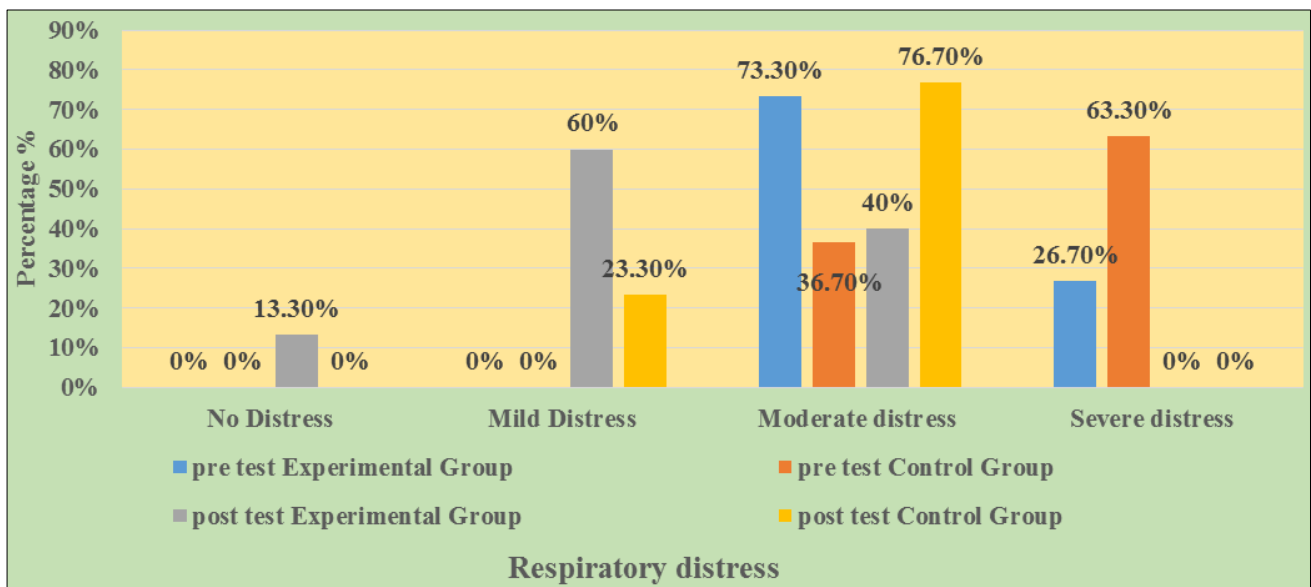1) Respiratory distress
2) Oxygen saturation
3) Peak Expiratory Flow Rate (PEFR) and
4) Breath holding time

Table 2: Pre and Post- test level of respiratory distress among children with Bronchial asthma.

Modified Becker's Scale	Pre-test				Post test			
	Experimental Group		Control group		Experimental Group		Control group	
	f	%	f	%	f	%	f	%
No distress	0	0	0	0	4	13.3	0	0
Mild Distress	0	0	0	0	18	60	7	23.3
Moderate distress	22	73.3	11	36.7	8	26.7	23	76.7
Severe distress	8	26.7	19	63.3	0	0	0	0

Fig 1: Respiratory distress among children with Bronchial asthma

Figure 1 & Table 2: Experimental group: Depicts that majority of respondents in pre-test level of respiratory distress with Bronchial asthma 22 (73. 3 %) had moderate distress, 8 (26. 7 %) had severe distress and none of them had no distress and mild distress, in post-test with bronchial asthma 18 (60 %) had mild distress, 8 (26.7 %) had moderate distress, 4 (13.3 %) had no distress and none of them severe distress.

Control group: Depicts that majority of respondents in pre-test level of respiratory distress with Bronchial asthma 19 (63.3 %) had severe distress, 11 (36. 7 %) had moderate distress and none of them had no distress and mild distress, in post-test with bronchial asthma 23 (76.7 %) had moderate distress, 7 (23.7 %) had moderate distress and none of them no distress and severe distress.

Table 3: Pre and post-test level of Oxygen saturation among children with Bronchial asthma.

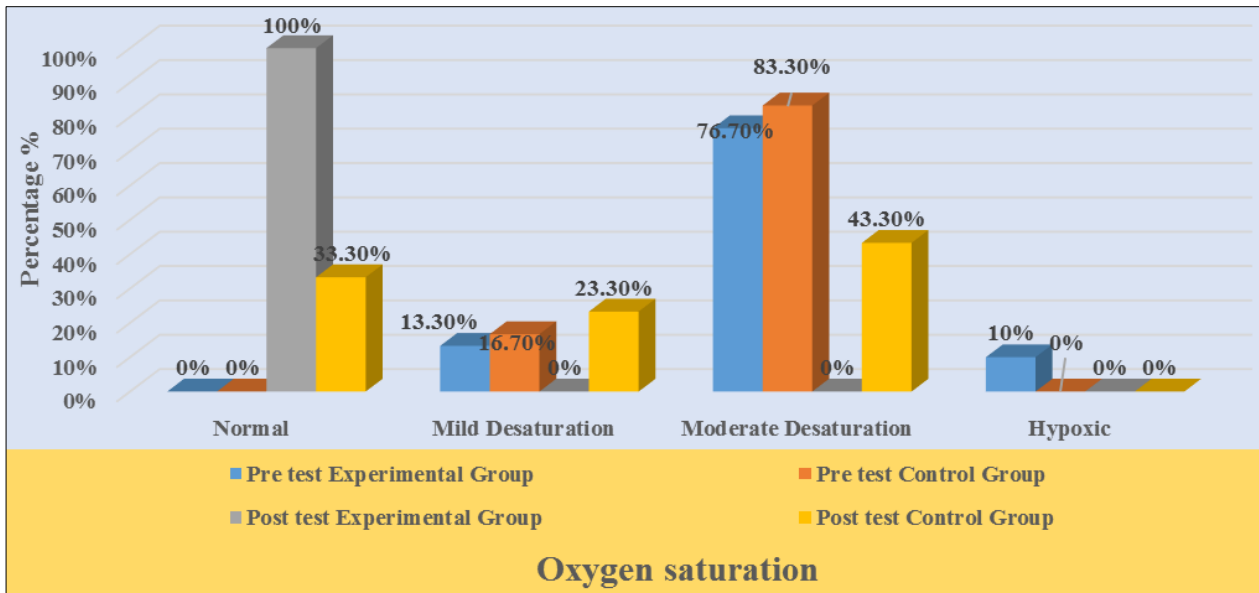| Oxygen saturation	Pre test				Post test			
	Experimental Group		Control group		Experimental Group		Control group	
	f	%	f	%	f	%	f	%
Normal	0	0	0	0	30	100	10	33.3
Mild Desaturation	4	13.3	5	16.7	0	0	7	23.3
Moderate Desaturation	23	76.7	25	83.3	0	0	13	43.3
Hypoxic	3	10	0	0	0	0	0	0

Fig 2: Oxygen saturation among children with Bronchial asthma

Figure 2 & Table 3: Experimental group: Depicts that majority of respondents in pre-test level of oxygen saturation with Bronchial asthma 23 (76.7 %) had moderate desaturation, 4 (13.3 %) had mild desaturation, 3 (10 %) had hypoxic and none of them had normal, in post-test with bronchial asthma 30 (100 %) had normal and none of them mild desaturation, moderate desaturation and hypoxic.

Control group: Depicts that majority of respondents in pre-test level of oxygen saturation with Bronchial asthma 25 (83.3 %) had moderate desaturation, 5 (16.7 %) and none of them had normal and hypoxia, in post-test with bronchial asthma 13 (43.3 %) had moderate desaturation, 10 (33.3 %) had normal, 7 (23.3 %) had mild desaturation and none of them hypoxic.

Table 4: Pre and post-test level of Peak Expiratory Flow Rate (PEFR) among children with Bronchial asthma.

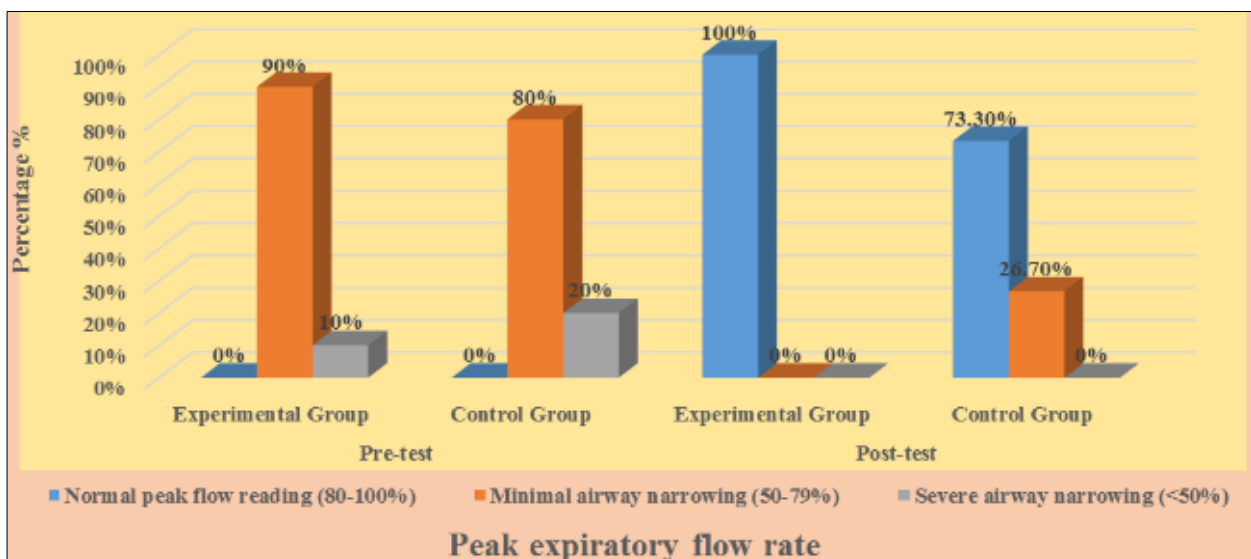| Peak Expiratory Flow Rate (PEFR)	Pre test				Post test			
	Experimental Group		Control group		Experimental Group		Control group	
	f	%	f	%	f	%	f	%
Normal peak flow reading	0	0	0	0	30	100	22	73.3
Minimal airway narrowing	27	90	24	80	0	0	8	26.7
Severe airway narrowing	3	10	6	20	0	0	0	0

Fig 3: Peak expiratory flow rate among children with Bronchial asthma

Figure 3 & Table 4: Experimental group: Depicts that majority of respondents in pre-test level of peak expiratory flow rate with Bronchial asthma 27 (90 %) had minimal airway narrowing, 3 (10 %) had severe airway narrowing and none of them had normal peak flow reading, in post-test with bronchial asthma 30 (100 %) had normal peak flow

reading and none of them minimal airway narrowing and severe airway narrowing.

Control group: Depicts that majority of respondents in pre-test level of peak expiratory flow rate with Bronchial asthma 24 (80 %) had minimal airway narrowing, 6 (20 %) had
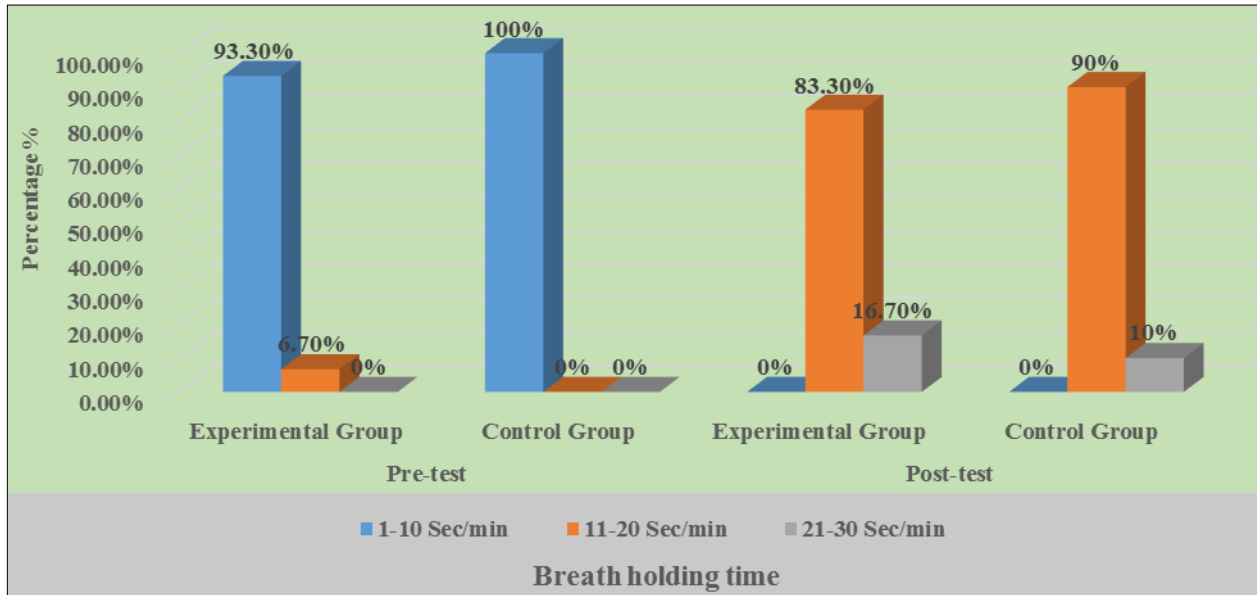
severe airway narrowing and none of them had normal peak flow reading, in post-test with bronchial asthma 22 (73.3 %) had normal peak flow reading, 8 (26.7%) had minimal

airway narrowing and none of them severe airway narrowing.

Table 5: Pre and post-test level of Breath Holding Time (BHT) among children with Bronchial asthma.

Breath Holding Time (BHT)	Pre test				Post test			
	Experimental Group		Control group		Experimental Group		Control group	
	f	%	f	%	f	%	f	%
1-10 Sec/min	28	93.3	30	100	0	0	0	0
11-20 Sec/min	2	6.7	0	00	25	83.3	27	90
21-30 Sec/min	0	0	0	0	5	16.7	3	10

Fig 4: Breath holding time among children with Bronchial asthma

Figure 4 & Table 5: Experimental group: Depicts that majority of respondents in pre-test level of breath holding time with Bronchial asthma 28 (93.3 %) had 1-10 Sec/min, 2 (6.7 %) had 11-20 Sec/min and none of them had 21-30Sec/min, in post-test with bronchial asthma 25 (83.3 %) had 11-20 Sec/min, 5 (16.7 %) had 21-30 Sec/min and none of them had 1-10Sec/min.

Control group: Depicts that majority of respondents in pre-test level of breath holding time with Bronchial asthma 30 (100 %) had 1-10 Sec/min had and none of them had 11-20 Sec/min and 21-30Sec/min, in post-test with bronchial asthma 27 (90 %) had 11-20 Sec/min, 3 (10 %) had 21-30 Sec/min and none of them had 1-10Sec/min.

Section C: Analysis of effectiveness of buteyko breathing technique on physiological parameters:
- Findings related to effectiveness of Buteyko Breathing Technique (BBT) on respiratory distress. The obtained 't' test value in experimental group was 13.67 and control group was 3.61 and indicate that buteyko breathing technique was significant at $p<0.001\%$ in experimental group and not significant in control group.
- Findings related to effectiveness of Buteyko Breathing Technique (BBT) on Oxygen saturation. The obtained 't' test value for experimental group was 21.48 and control group was 3.61 and indicates that Buteyko Breathing Technique (BBT) was significantly effective in improving oxygen saturation at p-value <0.001 in experimental group and not significant in control group.

- Findings related to effectiveness of Buteyko Breathing Technique (BBT) on Peak Expiratory Flow Rate (PEFR). The obtained Wilcoxon Signed rank test for experimental group was 153 and control group was 37 and indicates that Buteyko Breathing Technique (BBT) was significantly effective in improving Peak Expiratory Flow rate at $p<0.01$ in experimental group and not significant in control group.
- Findings related to effectiveness of Buteyko Breathing Technique (BBT) on Breath Holding Time (BHT). The obtained 't' test for experimental group was 25.01 and control group was 3.52 and indicates that Buteyko breathing Technique (BBT) was significantly effective in improving Breath Holding time at $p<0.001$ in experimental group and not significant in control group.

H_1: There is a significant difference between the mean pre-test and post-test level of physiological parameters among children with bronchial asthma in both experimental and control group hypothesis was tested at 0.001 & 0.01 levels. This indicates that there was significant difference in physiological parameters of experimental group hence research hypothesis H_1 was accepted.

Section D: findings related to association between selected demographic Variables in experimental and control group
- Findings related to association of Buteyko Breathing Technique (BBT) on respiratory distress. In experimental group significant association between pre-

test level of respiratory distress with their selected socio-demographic variables such as religion (χ^2=14.42), educational status (χ^2=7.19), area of residence (χ^2=9.88) monthly income (χ^2=13.18), know about buteyko breathing technique (χ^2=8.57), were found to be significant at 0.05 level whereas In control group significant association between pre-test level of respiratory distress with their selected socio-demographic variables such as age in years (χ^2=3.40), gender (χ^2=0.37), religion (χ^2=8.14), types of family (χ^2=.69), educational status (χ^2=1.37) were not found to be significant at 0.05 level.

- Findings related to association of Buteyko Breathing Technique (BBT) on oxygen saturation. In experimental group significant association between pre-test level of oxygen saturation with their selected socio-demographic variables such as religion (χ^2=14.33), educational status (χ^2=8.75), area of residence (χ^2=10.97), duration of illness (χ^2=10.72), know about buteyko breathing technique (χ^2=6.53), were found to be significant at 0.05 level whereas In control group significant association between pre-test level of oxygen saturation with their selected socio-demographic variables such as age in years (χ^2=3.02), gender (χ^2=0.68), religion (χ^2=5.60), educational status (χ^2=2.32 were not found to be significant at 0.05.

- Findings related to association of Buteyko Breathing Technique (BBT) on peak expiratory flow rate. In experimental group significant association between pre-test level of peak expiratory flow rate with their selected socio-demographic variables such as educational status (χ^2=10.33), area of residence (χ^2=12.43), duration of illness (χ^2=13.63), were found to be significant at 0.05 level whereas In control group significant association between pre-test level of peak expiratory flow rate with their selected socio-demographic variables such as age in years (χ^2=2.38), gender (χ^2=0.37) were not found to be significant at 0.05 level.

- Findings related to association of Buteyko Breathing Technique (BBT) on Breath holding time. In experimental group significant association between pre-test level of breath holding time with their selected socio-demographic variables such as educational status (χ^2=6.26), area of residence (χ^2=9.67), duration of illness (χ^2=13.72), were found to be significant at 0.05 level whereas In control group significant association between pre-test level of breath holding time with their selected socio-demographic variables such as age in years (χ^2=3.40), gender (χ^2=0.37), religion (χ^2=8.16) were not found to be significant at 0.05 level.

H₂: There is a significant association between the pre-test level of physiological parameters among children with their selected socio demographic variables in both experimental and control group.
Hypothesis was tested at 0.05 levels. This indicates there is significant association in experimental group and not significant association in control group. Hence research hypothesis was accepted.

Discussion
In this study, majority of children with bronchial asthma in experimental and control group, 22 (73. 3 %) had moderate

distress, 8 (26. 7 %) had severe distress and none of them had no distress and mild distress, in post-test with bronchial asthma 18 (60 %) had mild distress, 8 (26.7 %) had moderate distress, 4 (13.3 %) had no distress and none of them severe distress in experimental group. In control group, 19 (63.3 %) had severe distress, 11 (36. 7 %) had moderate distress and none of them had no distress and mild distress, in post-test with bronchial asthma 23 (76.7 %) had moderate distress, 7 (23.7 %) had moderate distress and none of them no distress and severe distress.

The above result supported by, Priyalatha G *et al*. (2018) [9] conducted a study to assess the effectiveness of buteyko breathing exercise (BBE) on respiratory outcome among children with bronchial asthma admitted in pediatric Unit of MGMCRI, Puducherry. Totally, 70 children (6-12 years) with Bronchial asthma were selected by using non-probability purposive sampling technique. During pre-test majority of subjects were 71. 4% (25) had moderate distress, 28. 6% (10) had mild distress and none of them had no distress and severe. During post-test majority of subjects were 57.1% (20) had no distress, 42.9% (15) had mild distress and none of them had moderate and severe distress. The study showed that buteyko breathing exercise was effective in improving the respiratory outcome among children with bronchial asthma and there is significant difference between experimental and control group 3.025 and 0.365. The result show the buteyko breathing exercise was effective in reduction of bronchial asthma symptoms assessed by modified Becker's score, oxygen saturation, peak expiratory flow rate and breath holding time. It was significant at $p<0.05\%$.

The above results were supported by, Kimita Huidrom *et al*. (2016) [10] conducted a study to assess the effectiveness of Buteyko Breathing exercise (BBE) on respiratory parameters among 60 children (6-12 years) with Bronchial asthma, Pune. Modified observational tool such as Becker's score, Peak Expiratory Flow Rate, was used to assess the respiratory physiological parameters. During pre-test, majority of the subjects, 52(86.6%) in experimental group, 42 (70%) in control group had moderate distress. In post-test, 36 (60%) had mild distress 24(40%) had moderate distress in experimental group, and 58(96.7%) had moderate distress and 2 (3.3%) had severe respiratory distress in control group. The study showed that Buteyko Breathing Exercise (BBE) was effective in improving the respiratory physiological parameters among children with Bronchial asthma and there is significant difference between experimental pre-test and post-test (t29=16.6, $p<0.05$) and there is significant difference between experimental and control group (t58= 17.4, $p<0.05$). The study results show that Buteyko Breathing Exercise (BBE) was effective in reduction of Bronchial asthma symptoms assessed by Modified Becker's Score and in improving oxygen saturation, Peak Expiratory Flow Rate, Breath Holding Time (BHT). The obtained test value was significant at $p<0.001$ level.

Conclusion
This study conducted that there was improvement in the level of quality life of children which indicates that the buteyko breathing technique is effective. The demographic variables of physiological parameters significantly associated with the pre-test level.

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