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RESEARCH ARTICLE

EFFECT OF YOGA BREATHING EXERCISE ON THE PULMONARY FUNCTION PARAMETER (PEAK EXPIRATORY FLOW RATE) AND SYMPTOM CONTROL OF CHILDREN WITH MODERATE PERSISTENT BRONCHIAL ASTHMA ATTENDING TERTIARY CARE CENTRE-A QUASI EXPERIMENTAL STUDY

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Breathing Exercise, Pulmonary Function Parameter, Symptom Control, Children with Moderate Persistent Bronchial Asthma, Peak Expiratory Flow Rate (PEFR)

Abstract

Objectives: The study was undertaken with the objective of assessing the effect of breathing exercise (Alternate Nostril Breathing Exercise with deep breathing and controlled relaxation, "pranayama" a form of yoga breathing technique) on the pulmonary function parameter as well as symptom control of children with moderate persistent bronchial asthma.

Background: Childhood asthma is a chronic health condition that affects more than 1 million school-aged children and their families. Nonpharmacological therapy includes yoga breathing techniques such as Alternative Nostril Breathing techniques significantly reduces the stress and improves better asthma control in children with bronchial asthma.

Design &Methods: Quasi-Experimental, two group pretest- post-test design were adopted. Sixty children with moderate persistent bronchial asthma attending asthma clinic of tertiary care hospital were selected for the study. Simple random sampling with a comparison group was used for selection of the sample. TREND checklist for quasi-experimental design used as guidelines for the current study.

Results: Breathing exercise significantly changed the Peak Expiratory Flow Rate as evidenced by the significant change in the mean percentage of PEFR value from the predicted value in the experimental group. Comparison of mean percentage PEFR value from age wise predicted value in the experimental group showed that **69.5%/ 82.4% , t= 8.275, p= o.ooo (p< 0.05)** and in the control group was **66.0%/ 66.2% , t= 1.326 , p = 0.195 (p> 0.05).** There was statistically significant change in asthma control parameters in the experimental group. Breathing exercise significantly improved the level of symptom control in the experimental group. No such significant improvement in

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Symptomcontrol was noted in the control group.(McNamer 0.000/ 0.063), ($p< 0.05$).

Conclusion: Based on the above findings, the present study concluded that breathing exercise has an effect on improving the pulmonary functions and symptom control of children with bronchial asthma.**Relevance to clinical practice**:The practice of yogabreathing exercises improves asthma symptoms and helps children to achieve better control over asthma along with pharmacological management.

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Introduction:-

Bronchial asthma has a significant impact on children, their families, and the health care system resulting in reduced quality of life and increased health care costs. There has been an increase in the prevalence of childhood asthma from all over the world and similar trend is observed in India. Wide variation has been reported in the prevalence of asthma from different parts of the world and even from different parts of the same country.The mean prevalence of child hood asthma was 7.24 ± SD 5.42. The median prevalence was 4.75% (with IQR = 2.65 – 12.35%). The overall weighted mean prevalence was found to be 2.74. Childhood asthma among children 13 – 14 years of age was lower than that in younger children (6 – 7 years of age)(Ranabir Pal, Sanjay Dahal, and Shrayan Pal, 2009).

Background of study

Nonpharmacological therapy includes yoga breathing techniques such as alternative nostril breathing technique, a form of pranayama(Pranayama - the basic vitality necessary to life is termed as prana and regulation of prana is pranayama) reduces the stress and improves better asthma control in children with bronchial asthma.One of the best methods of complementary and alternative treatment for bronchial asthma is breathing exercises in the form of Yoga.Because the yoga itself depends on five principals; breathing is one of these five principles and it is called pranayama.Karen B Evaristo, et al (2014) conducted a randomised Control Trial to Compare the effectiveness between breathing and aerobic exercise on clinical control in patients with moderate to severe asthma: The outcome evaluated were clinical control, health related QOL, Levels of anxiety and depression, daily living physical activity, and maximal exercise capacity. The study reported that the practice of breathing exercises have been shown to improve HRQoL, Peak expiratory Flow and asthma symptoms as well as reduce the levels of hyperventilation syndromes, anxiety and depression as well as medication consumption.

MaheshkumarKuppuswami,K, K Dilara, P Ravishanker, A Julius (2017) conducted a RCT in healthy adolescents with Bronchial asthma were reported that Pranayama (a form of breathing exercise) would produce both physiological and psychological effects. The results of the study showed that there was an improvement in the pulmonary function parameters especially FVC, FEV1,FEV1/FVC ratio, FEF 25%-75% and PEFR was seen in Pranayama group than in control group adolescents.

DemekeMekonnen, Andualem, Mossie (2010) conducted a preliminary clinical trial on the efficacy of yoga on asthmatic patients. They reported that yoga exercise among asthmatic adults resulted in decreased number of day and night attacks and use of drugs. The study highlighted that there was a significant increment (10%) in the PEFR in the yoga group and only 2% increase in the control group.Supervised exercise training might be associated with beneficial effects on disease control and quality of life in Children with bronchial asthma. (Bowler, 1998).

Asthma Control reflects on how well the clinical manifestations of disease are suppressed by the management strategy and is a dynamic phenomenon. Management is aimed at obtaining control. Severity is one of the determinants of control. It is expected that a patient with more severe disease to have greater difficulty in controlling the manifestations of asthma. (Lenoir M, Williamson, 2006**).**

Regular practice of breathing exercises by asthmatics (but not during asthmatic attacks) was shown to reduce the number of attacks and improve respiratory capacity during physical exercise. Other reports showed successful reduction of the usual daily dose of anti-asthmatic drugs (Manocha .et al,2005)**.** Peak Expiratory Flow Rate **(PEFR)** is a good indicator for the lung function capacity. Daily PEFR recorded in 161 patients of bronchial asthma after yoga therapy of one hour daily for 15 days has shown significant trend toward s improvement. Yoga is found to be

an important non pharmacological approach. (Vedanthan. et al, 1995).The most reliable early sign of an asthma episode is a drop in the child's peak expiratory flow rate, or the ability to breathe out quickly which can be measured by a peak flow meter. Almost every asthmatic child over the age of 4 year can and should learn to use a peak flow meter. (National Asthma Council of Australia)

Measurements of PEFR are of value in identifying airflow limitation. Hence PEFR is a simple and reliable way of diagnosing and following patients with bronchial asthma and the use of peak flow meter has been widely adopted for monitoring patients with asthma(Martin R. Miller, 2004).

Objectives:-

1. To assess the effect of breathing exercise on the peak Expiratory Flow Rate of Children with Moderate persistent bronchial asthma

2. To evaluate the effect of breathing exercise on symptom control of children with moderate persistent bronchial asthma

Hypotheses

H_1: Breathing exercise (Alternate Nostril breathing with controlled relaxation) will significantly improve the symptom control of children with moderate persistent bronchial asthma.

H_2: Breathing exercise (Alternate Nostril breathing with controlled relaxation) will significantly increase the peak expiratory Flow Rate of children with Bronchial asthma.

Materials and Methods:-

Research Design:

The present study adopted a Quasi-Experimental-two group pre-test - post -test design with a control group

Setting:

The study was carried out in Asthma clinic of multidisciplinary tertiary care hospital located in southern part of India with a 1500 bed capacity.

Sampling

The sample size for the present study was 60 children (30 each in the experimental & in the control group) between the ages of 7 & 12 years who were able to follow the technique of breathing exercise therapy attending asthma clinic for routine care and follow up.Simple random sampling technique by lottery method was used for selecting the study samples.

Inclusion &Exclusion criteria

Inclusion criteria:

Children with moderate persistent bronchial asthma between the ages of 7-12 years who were able to follow the technique of breathing exercise of asthma

Exclusion criteria:

Children with asthma admitted in medical wards and ICUs, children with acute exacerbations of asthma, children with Co-existing severe heart diseases.

Tools and Techniques:

The tools used for data collection were structured interview schedule, Clinical records of children with asthma, Asthma Control Score (ACS) checklist and the instrument used for assessing the effectiveness of breathing exercise was Wright's Peak Flow Meter.

Structured interview schedule consists ofselected socio- demographic data & clinical data of the child such as age, gender, place of residence,type of family, Religion & monthly income of family .Clinical data mainly included device used for steroid aerosol therapy, age of onset of asthma &Duration of use of steroid therapy.

Asthma Control Score checklist was a validated tool used for measuring effectiveness of asthma treatment in clinical studies.In the present study ACS checklist was used to assess the extent of symptom control after breathing exercise therapy. The Asthma Control Score checklist consisted of six items :(Day time symptoms, night time symptoms, Exacerbation of asthma symptoms, Ability to do physical activity and Daily use of reliever drugs).The items were summated to give a range of score from 0-12. Score (0-7)indicated that the children were well controlled their asthma symptoms& score 8-12 indicated that the asthma was poorly controlled).The investigator used Wright's Peak Flow Meter for measuring the Peak Expiratory Flow Rate (PEFR) and interpreted the values based on predicted values for South Indian children as per the recommendation of Swaminathan, et al(1992).

The investigator used validated tool for assessing the effectiveness of breathing exercise.The asthma control score checklist was a validated tool used to measure the effectiveness of asthma treatment in clinical studies(www.ginasthma.org).The researcher made the tool on the basis of review of related literature and under the guidance of subject experts.The content validity of the tool was checked by subject experts from different disciplines. It was found that the language used in interview schedule was clear,the parents were able to understand and respond to all items. Reliability of Asthma symptom Control checklist was checked by the split half reliability method. (r> 0.08).Hence, the tool was found to be reliable. The reliability of the instrument was already done in the clinic and found to be good. A pilot study was conducted among 12 children (6 each in the experimental and in the control group) with moderate persistent Bronchial Asthma.The finding from the pilot study revealed the feasibility of the tool and practicability of the study.

Pilot study

The participants of the study were 12 children (6 each in the experimental and in the control group) with moderate persistent bronchial asthma .The duration of the pilot study was 4 weeks.

Data collection Procedure

The duration of Data collection was for three months from May 2018 to July 2018. The children who were having moderate persistent asthma were randomly selected and matched according to age & Sex and 30 children were put under experimental group and 30 were allocated into the control group. Simple Random sampling by lottery method was used for selection of the sample.

After selection of the study group, socio demographic and clinical data were collected using the structured interview schedule and pre- assessment of Peak expiratory flow rate(PEFR) and asthma control (ACS) score were assessed. (Here the investigator was not taken the percentage of personal best value of PEFR due to lack of daily home monitoring of peak Flow Rate by the children as well as the time constraints for the study). After the pre procedure assessment, breathing exercise (Alternate nostril breathing with deep breathing and controlled relaxation) were demonstrated by the investigator to the children belonging to the experimental group for a period of 20 minutes. In this type of breathing exercise, the investigator demonstrated the technique in a step wise manner. The researcher provided an environment free from distractions before starting the exercise. The investigator encouraged the children to practice the technique in the home daily two times (morning and evening) for a time period of 20 minutes for a total duration of 8 weeks. For reinforcing the exercise therapy, the investigator prepared a leaflet which outlines the step wise description of the Alternate Nostril Breathing technique, along with an asthma diary was prepared inorder to reinforce the therapy at home. For assessing the compliance of the exercise therapy, the investigator made regular telephonic follow up with the parent and the child and also encouraged the parents for maintenance of daily record of asthma diary at home. After 8 weeks post assessment of the same variables were measured and compared it with the pretest values.

The researcher evaluated the final PEFR (Peak Expiratory Flow Rate)value by interpreting the mean percentage pretest and post -test PEFR value by comparing the age wise predicted value as per the recommendation of Swaminathan et.al (1992).

For the control group, no intervention was given. They received traditional treatments such as routineasthma medications and other supportive care from asthma clinic. The same variables were assessed during pre-assessment and post assessment phase. During the post assessment phase the control group were given health education regarding breathing exercise. After the completion of the study the researchers prepared a poster showing different steps of breathing exercisesand health education provided for all the children and their parents regarding the regular practice of breathing exercises and the therapy subsequently implemented and integrated in the clinic as a non-

pharmacological management for children with asthma. The researchers used the EQUATOR reporting checklist TREND checklist for quasi-experimental as guidelines for the current study.

Data Analysis:-

The findings of the study were discussed under the following headings: The data was analyzed using SPSS software. Various statistical tests were used to evaluate the effectiveness of breathing exercise such as t-test used to compare the pre-post differences between experimental and control group. Chi-square test was used to compare the asthma control parameters between experimental and control group.

Results:-

Description of Sample characteristics

With regard to gender majority of children in the experimental and control group were females (63.3%) and 36.7% of children were males.With regard to age, the mean age of children in the experimental and in the control group was 9.7 & 9.6 respectively. Majority of children in experimental and control group were residing in rural area (56.7% and 43.3% respectively). Regarding mean duration of starting steroid therapy in the experimental group and in the control group were 3.4 and 3.7 respectively.About the device used for steroid aerosol therapy,majority of children in the experimental(56.7%) and the control group (43.3%) were using MDI for steroid aerosol therapy.16.7% of children in the experimental and 33.3% in the control group were using MDI with spacer, 16.7% in the experimental and 13.3% in the control group were using MDI and Rota haler, only 6.7% of children in the experimental group was using MDI with spacer and Rota haler.The groups were comparable with respect to the above characteristics.

Effect of Breathing Exercise on Asthma symptom control and Peak Expiratory Flow Rate (PEFR)

The present study proved that there was a significant reduction in Symptom control Score obtained after Alternate Nostril Breathing exercise in the experimental group as compared with Score obtained in the control group. Also the present study proved that breathing exercise had a significant effect on Peak Expiratory Flow Rate in the experimental group as compared with the control group.

The Comparison of Asthma Control Pre- test- Post test score among the Experimental and Control group showed that there was a significant reduction in symptom control score obtained after breathing exercise therapy in the experimental group 8.8/4.7,t= -8.092, P (<0.05%) as compared with the pretest and post -test symptom control score in the control group 8.4/7.6 ,t=1.361, p=0.184 (p>0.05).**(Table 1)**

The data represented in the **(Table 2),** revealed that there was statistically significant change in asthma control parameters especially in the control of day time symptoms (P=0.00) control of night time symptoms (P=0.000) and ability to do physical activities in the experimental group after breathing exercise (P=0.020). No such change was noted in the control group. Thus investigators accepted the alternate Hypothesis **(H_1).**

The results of the study regarding effects of breathing exercise on Peak Expiratory FlowRate (PEFR) showed that Breathing Exercise significantly changed the pulmonary functions as evidenced by the significant change in the mean percentage of pretest and post -test PEFR value from the age wise predicted value in the experimental group as compared with the mean percentage of pretest and post -test PEFR in the control group after routine care. The mean percentage of pretest& posttest from age wise predicted value in the experimental group shows that 69.5%/ 82.4% , t= 8.275, (p< 0.05) and in the control group showed that 66.0%/ 66.2% , t= 1.326 , (p> 0.05).**(Table 3)**

Data represented in **(Figure 1)** revealed that in the experimentalgroup the mean pretest and posttest PEFR in the age group of 6- 7 years for male and female is 100.0/136.7 (pretest PEFR) & 110/160(posttest PEFR) respectively. Children between the age group of 8-9 years for male and female is 145/155 (pretest)& 174/182 (Post-test), For children between the age group of 10-11 years is 150/ 165 (Pretest) & 171.7/ 194.2(Post -test) and for children between 12-13 years 220/122(pretest) & 250/ 160(post - test).There was observed a significant change in the mean PEFR value after breathing exercise.There was no such significant change in the mean PEFR value was observed in the control group after routine care**.(Figure 2).**Thus accepted the alternative hypotheses stated (**H_2).**

Discussion:-

The present study was conducted to assess the effect of breathing exercise therapy (alternate nostril breathing, a form of yoga breathing technique) on Peak Expiratory Flow Rate and symptom control of asthmatic children.The findings of the present study were consistent with the study, conducted by H. R. Nagendra (2008) reported an integrated set of yoga exercises, including breathing exercises will significantly improve the weekly number of attacks of asthma symptoms for drug treatment, and peak flow rate. A systematic review on "Breathing Exercises for children with asthma conducted by Macedo TMF, et, al (2016) reported that breathing exercise techniques used by the included studies mainly consisted of lateral costal breathing, diaphragmatic breathing, inspiratory pattern and pursed lips. Yoga breathing exercise involved all these patterns of breathing techniques. The findings of the present study was supported by the study findings by (Srivastava R.D; Jain Nidhi; Singhal; 2005) who evaluated the effect of yoga training in 46 young asthmatics (aged 11–18 years) with a history of childhood asthma. Yoga training resulted in a significant increase in pulmonary function and exercise capacity as well as subjective measures like improved Symptom Control. A follow-up study spanning 2 years showed a good response with reduced symptom score and drug requirements. There are more recent evidences supporting the role of yoga practices for asthmatic patients. A study done by (ShruthiAgnihotri et al ,2015) on "efficacy of yoga in mild to moderate persistent bronchial asthma" reported that significant change in FEV_1 and PEFR noted in yoga group after 8weeks of regular practice and the frequency of using the medications significantly decreased in yoga group as compared to control group.

The results of current study were supported by the findings of a randomized control trial conducted byYoos H,L, Kitzman, H, McMullen, A (2002).They reported that children who used Peak Flow meters when symptomatic had a lower asthma severity score, fewer symptom days and less health care utilization. The present study also revealed that a reduction in asthma symptom score in the experimental group indirectly reflecting a change in Peak Flow Rate and fewer symptom days as result of breathing exercise.

Limitations

The current study has been carried out on a small group of children with moderate persistent bronchial asthma and we couldn't generalize the findings based on the reports .Hence we consider this study as a reference to future randomized controlled trials.Moreover further large population based studies are required for breathing exercises as recommendations for children with asthma to formulate a clinical practice guideline.Also the duration of the study is limited (only 3 months). For better outcomes the study duration could be increased to more than 3 months. It is recommended that well controlled clinical trials with strong methodology is needed for generalization.

Ethical Considerations

Human ethical committee clearance obtained from the institution before the study had undertaken. (IEC NO: 416210MCT). Children and their parents were well explained about the study and informed consent taken prior to conduct of the study and confidentiality was maintained throughout the study period.Participants were given information about the study objective, voluntary participation and told to their treatment. They were also told about the activities that are going to be practiced and were also informed as they can withdraw from participation at any stage. Those who signed the consent form participated in the study

Relevance to Clinical Practice and Future Recommendations

Bronchial asthma is the most common chronic disease in childhood. Breathing exercises are most preferred non pharmacological management of people with asthma. The practice of breathing exercises improves asthma symptoms and helps children to achieve better control over asthma along with pharmacological management. Yoga breathing exercises could be practiced daily by children to reduce asthma exacerbations and to reduce the stress and anxiety associated with the disease burden and improve the quality of life of children with Bronchial asthma. Yoga breathing exercises are one of the recommended adjunct management of children with persistent symptoms of asthma .Various breathing exercises could be modified as age appropriate play therapy and can be implemented for regular practice at home

Conclusion:-

The present study concluded that Breathing Exercise like alternate nostril breathing technique ('pranayama')have an immense effect on the pulmonary function parameter such as the Peak Expiratory Flow Rate and improved symptom control of children with Bronchial asthma. The patients whose asthma continues to cause symptoms and quality-of-

life impairment, despite adequate pharmacological treatment, or who have high bronchodilator use, should be offered access to an effective breathing training programme as a part of holistic, integrated asthma care.

'What does this paper contribute to the wider global clinical community?

1. Breathing exercises are most preferred non pharmacological management of people with asthma.
2. The practice of breathing exercises improves asthma symptoms and helps children to achieve better control over asthma along with pharmacological management.
3. Yoga breathing exercises could be practiced daily by children to reduce asthma exacerbations and to reduce the stress and anxiety associated with the disease burden and improve the quality of life of children with Bronchial asthma.
4. Yoga breathing exercises are one of the recommended adjunct management of children with persistent symptoms of asthma

Figure 1:- Distribution of mean PEFR pretest& post-test value in the experimental group.

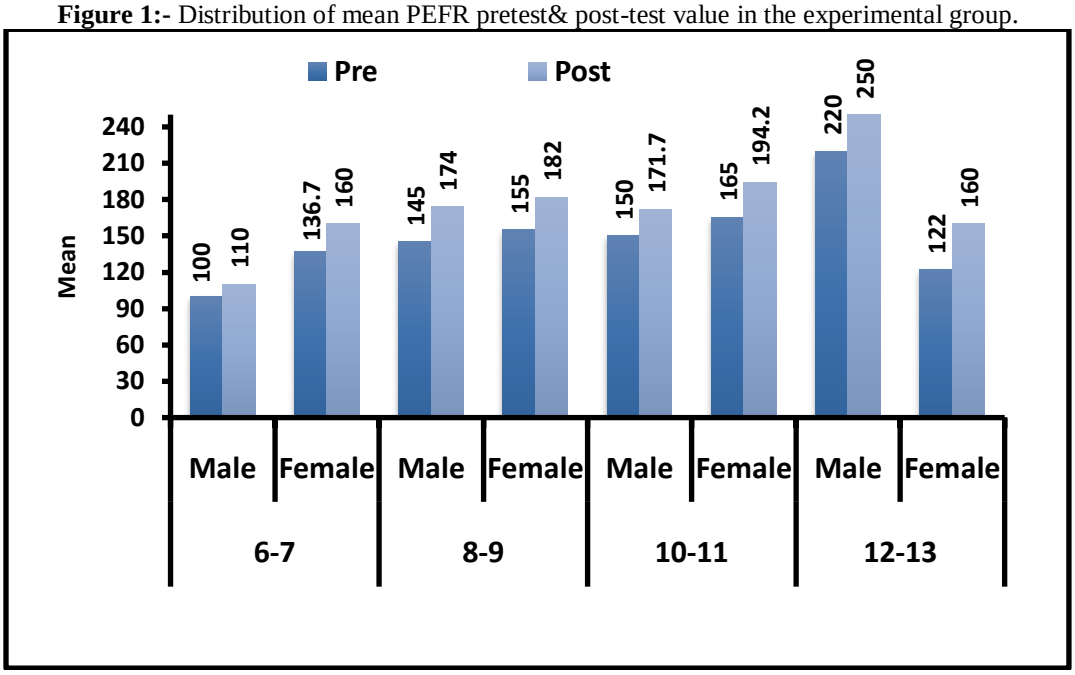

Figure 2:- Distribution of mean PEFR pretest& post -test value in the control group.

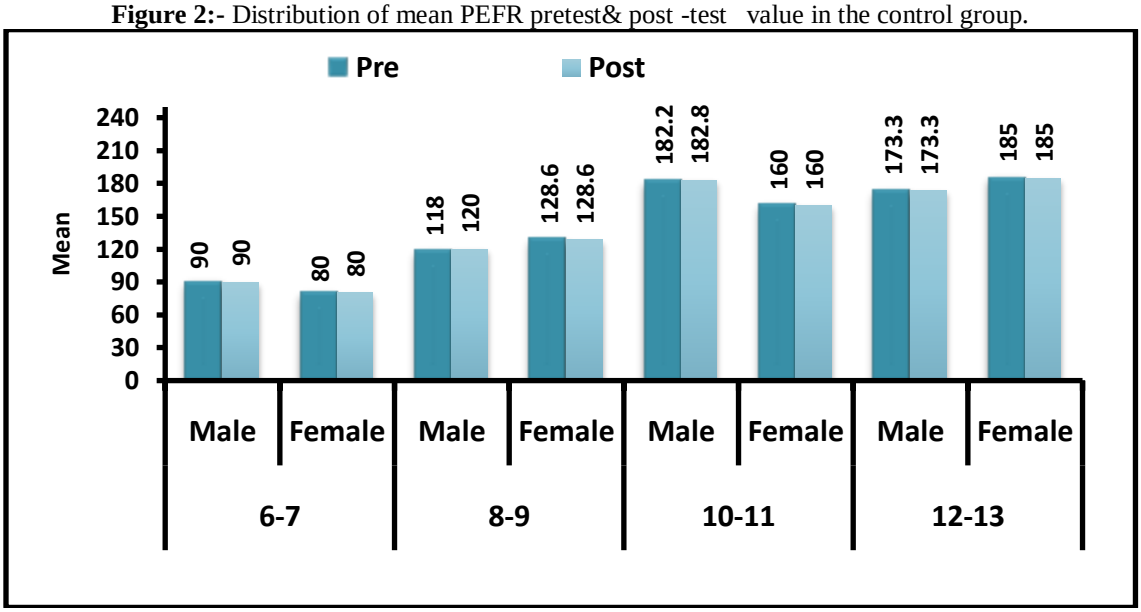

Table 1:- Comparison of Asthma Control Pre- test- Post test score among the Experimental and Control group (n= 60).

ACS		Mean	N	SD	t	p
Experimental	**Pre**	**8.8**	**30**	**2.0**	**-8.092**	**0.000**
	Post	**4.7**	**30**	**2.1**		
Control	**Pre**	**8.4**	**30**	**1.7**	**-1.361**	**0.184**
	Post	**7.6**	**30**	**1.8**		

*__ACS__ (Asthma Control Score)

Table 2:- Comparison of Asthma Control Parameters among the experimental and control group (n=60).

Asthma control parameters	Category	ASTHMA SYMPTOM CONTROL				χ^2	P value
		Poor		Good			
		f	%	f	%		
Day time symptoms	**Experimental**	4	13.3	26	86.7	12.381	**0.000**
	Control	17	56.7	13	43.3		
	Total	21	35	39	65		
Night time symptoms	**Experimental**	4	13.3	26	86.7	12.381	**0.000**
	Control	17	56.7	13	43.3		
	Total	21	35	39	65		
Exacerbation of asthma symptoms	**Experimental**	1	3.3	29	96.7	6.405	**0.011**
	Control	8	26.7	22	73.3		
	Total	9	15	51	85		
Ability to do physical activity	**Experimental**	2	6.7	28	93.3	5.455	
	Control	9	30	21	70		**0.020**
	Total	11	18.3	49	81.7		
		No change		**Decreased**			
Daily use of reliever drugs	**Experimental**	15	50	15	50	2.500	0.114
	Control	21	70	9	30		
	Total	36	60	24	40		
Total effect	**Experimental**	4	13.3	26	86.7	**15.864**	**0.000**
	Control	19	63.3	11	36.7		

Table 3:- Comparison of Mean Percentage of Pre- test& Post -test PEFR from age wise predicted value in Experimental & Control Group (n=60).

Group		N	Mean (%)	SD	t	P	Paired Differences		t	P
Experimental	Pre	30	69.5	16.6	8.28	0.00	**Mean**	**SD**		
	Post	30	82.4	19.5			-12.9	8.6	8.0	**0.00**
Control	Pre	30	66.0	13.5	1.33	0.2	-0.2	1.00		
	Post	30	66.2	13.4						

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