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Study of effect of diet and exercise on pulmonary function test values in adults with mild asthma-An interventional study

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Abstract
Background: Asthma management is a complex process influenced by multiple interacting factors. Among India's 1.31 billion people, about 6% of children and 2% of adults have asthma.
Objectives: To study the effect of diet and exercise, onpulmonary function test values in patients of mild asthma.
Methodology: 80 mild asthma patients in the age group of 20-60 years, including both sexes and taking antiasthma treatment since 5 to 10 years will be recruited for the study.
Observation: Statistically significant values of TV, ERV and FVC was obtained in the exercise group as compared to the diet group.
Conclusion: Regular exercise like walking for 30 minutes at dawn or dusk for 5 days a week for at least twelve weeks can better lung function values and can supplement routine medications in mild asthmatic patients.

Keywords: diet, exercise, mild asthma

Introduction

Among India's 1.31 billion people, about 6% of children and 2% of adults have asthma. Most people do not have health insurance and there is a wide gap in healthcare facilities for rich and poor [1]. Asthma management is a complex process influenced by multiple interacting factors. Most patients with asthma have mild or moderate disease and can be managed in primary care, with currently available medications, most can be treated effectively [2, 3]. The long term goal of asthma treatment is to achieve control of symptoms and maintain normal activity levels [4]. Guidelines for asthma diagnosis and management have previously focused on the assessment and classification of symptom severity, airflow limitationand lung function variability [5]. Revised in 2006, the asthma management guidelines issued by the Global Initiative for Asthma (GINA) proposed a new classification of asthma based on the level of control rather than the severity of the underlying disease process [6].

Several studies have demonstrated the use of healthcare resources, the level of lifestyle impairment and quality of life are all strictly linked to the level of asthma control: the better the control, the less impairment, the lower the use of healthcare resources, and the higher the quality of life [7, 8].

As an essential component of pulmonary rehabilitation, physical exercise demonstrated improvement in cardiovascular function, physical activity levels, and sociological benefits in previous studies [9-11]. However, viewpoints concerning which exercise programs are the most beneficial did not achieve a consensus. Regarding the training modality, aerobic training is exercise that can be performed for at least 20 minutes with mild or moderate fatigue [12, 13]. Spirometry parameters play an essential role in the diagnosis, severity, and prognosis of asthma and are relevant to cardiorespiratory fitness [14, 15]. Due to the medication burden in treating asthma, there has been increasing interest in the role of lifestyle interventions as adjuncts or alternative treatments for people with asthma. The most common lifestyle interventions researched in asthma focus on manipulating diet and/or exercise [16].

Aim: To study the effectof diet and exercise on pulmonary function test values in adults with mild asthma.

Objective

1. To study the effect of diet on pulmonary function test values in patients of mild asthma.
2. To study the effect of exercise on pulmonary function test values in patients of mild asthma.
3. To compare the effects obtained in study with that in controls.

Methodology

Settings: Department of Physiology, Jawaharlal Nehru Medical College, Wardha.
Research design: This will be interventional pre and post study.
Participant: 80 asthma patients in the age group of 20-60 years, including both sexes and taking antiasthma treatment since 5 to 10 years will be recruited for the study. Mild asthma patients will be selected for the study.

Inclusion criteria

1. Symptoms of wheeze.
2. Breathing difficulties in the last 12 months.
3. Diagnosis of mild asthma.

4. Asthma medication occasionally or regularly in the last 12 months.
5. History of allergic asthma and IgE sensitization to inhalant allergen like cat, dog, horse and/or house-dust mite, timothy grass, birch, mugwort and/ or mold.
6. Age group between 20-60 years.

Exclusion criteria

1. Age less than 20 years and more than 60 years.
2. Persistent asthma cases.
3. Severe asthma cases.
4. Major comorbidities like Coronary heart disease Diabetes, Essential and secondary hypertension, Dyslipidemia.
5. Asthma patients on cancer therapy.
6. Patients not consenting to the intervention.

Sampling procedure: Purposive sampling.
Sample size: 60 with 20 in each group.
Data collection tools: Respiratory parameters namely TV, ERV, IRV, FVC and FEV1/FVC.

Method

This research study had 2 groups namely study and control. 40 patients with asthma was allocated to the intervention/ study group and 20 patients with asthma was in control group. Study group was further divided into 2 groups namely Study 1&Study 2. Study group 1 was on specific diet. Study 2 group practiced only simple exercise i.e walking. Control group had no intervention. Patients of all the groups were on their routine antiasthma medication.

Subjects were subjected to intervention for 3 days with 1 hour duration of work out. The workout was done in 3 steps.

Step 1- One week prior to the intervention all pretest namely TV, ERV, IRV, FVC, FEV1/FVC.

Step 2- Intervention given.

Step 3- 3 months later[after intervention is given] the post test namely TV, ERV, IRV, FVC, FEV1/FVC was done.

Study 1 group- This group of 20 asthma patients as subjected to intervention for 3 days with 1 hour duration of work out. The schedule was as follows-

1st day- orientation to the disease through video programme and lectures.

2nd day- explanation of diet chart. Advocated diet for the subjects in was Indian staple diet with lot of fresh fruits and green vegetables daily.

3rd day- Preparation of log book and instructions for writing the log book.

Study 2 group- This group of 20 asthma patients was subjected to intervention for 3 days with 1 hour duration of work out. The schedule was as follows-

1st day- orientation to the disease through video programme and lectures.

2nd day- explanation of the exercise schedule.

3rd day- performance of exercise namely walking for 30 minutes at dawn or dusk for 5 days a week.

Control group: They are sex and age matched group who will be on their regular anti asthma medication only.

Data collection process was recorders and Medicare system which was used for recording and analyzing lung function values. All subjects performed 3 repeated maximal expiratory flow volume measurements. The highest values of forced vital capacity (FVC) and FEV1/FVC was extracted and used for analysis in accordance with the standard criteria.

Study duration: 2 years.

Variables: This information was obtained from the baseline questionnaire namely sex, mothers age at birth, parental allergic disease and parental smoking.

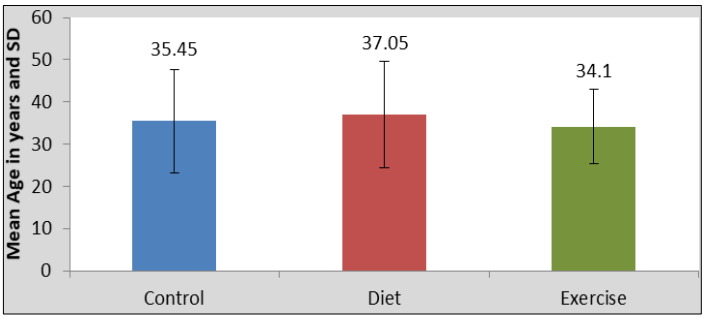
Scope: This study explored non pharmacological interventions in case of mild asthma. The beneficial effects if any, of these interventions, can be used as an adjunct with routine asthma treatment in improving health outcomes.

Statistical analysis was done by using descriptive and inferential statistics using student's paired t test, one way ANOVA and multiple comparison: Tukey Test and software used in the analysis were SPSS 27.0 version and GraphPad Prism 7.0 version and $p<0.05$ is considered as level of significance.

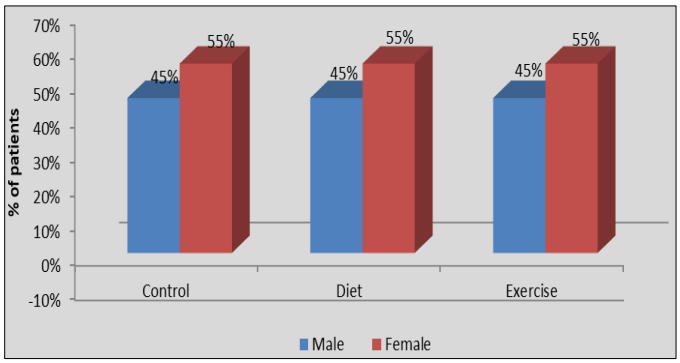
Observation

Table 1: Distribution of patients in three groups according to demographic characteristics

Demographic characteristics	Control	Diet	Exercise
Mean Age	35.45±12.26	37.05±12.57	34.10±8.80
Age Range	22-58 yrs	20-60 yrs	20-51 yrs
Gender			
Male	9(45%)	9(45%)	9(45%)
Female	11(55%)	11(55%)	11(55%)



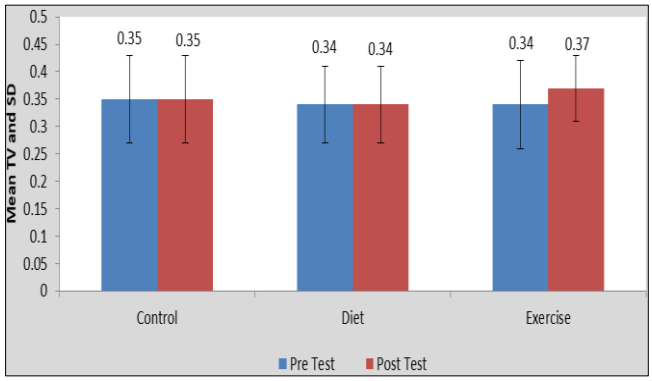
Graph 1: Comparison of mean age in three groups



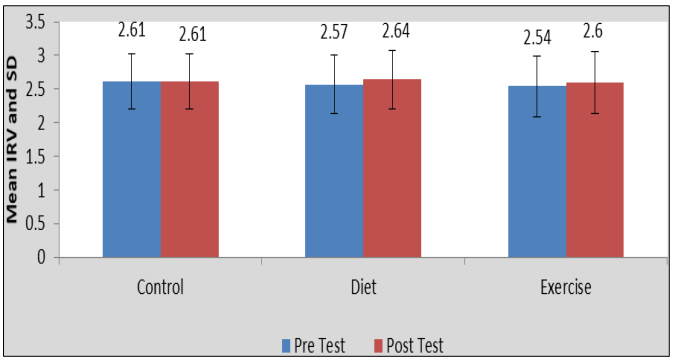
Graph 2: Distribution of patients according to gender in three groups

Table 2: Comparison of PFT values in three groups at pre and post test Student's paired t test

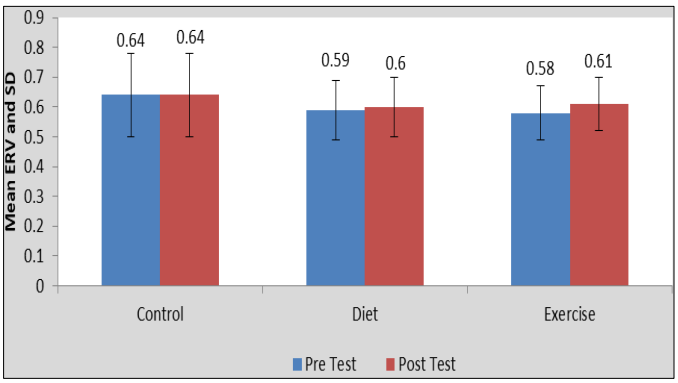
Parameters	Group	Pre test	Post test	Mean difference	T-value	P-value
TV	Control	0.35±0.08	0.35±0.08	-	-	-
	Diet	0.34±0.07	0.34±0.07	0.001±0.01	0.37	0.71,NS
	Exercise	0.34±0.08	0.37±0.06	0.02±0.05	2.12	0.047,S
IRV	Control	2.61±0.41	2.61±0.41	-	-	-
	Diet	2.57±0.44	2.64±0.43	0.07±0.22	1.37	0.18,NS
	Exercise	2.54±0.45	2.60±0.46	0.06±0.18	1.45	0.16,NS
ERV	Control	0.64±0.14	0.64±0.14	-	-	-
	Diet	0.59±0.10	0.60±0.10	0.01±0.02	1.73	0.09,NS
	Exercise	0.58±0.09	0.61±0.09	0.03±0.04	2.85	0.010,S
FVC	Control	3.60±0.68	3.60±0.68	-	-	-
	Diet	3.39±0.61	3.39±0.61	0.00±0.19	0.00	1.00,NS
	Exercise	3.35±0.55	3.72±0.53	0.37±0.26	6.13	0.0001,S
FEV1/FVC	Control	0.58±0.07	0.58±0.07	-	-	-
	Diet	0.56±0.06	0.57±0.06	0.01±0.02	2.03	0.056,NS
	Exercise	0.56±0.06	0.57±0.05	0.009±0.02	1.44	0.16,NS



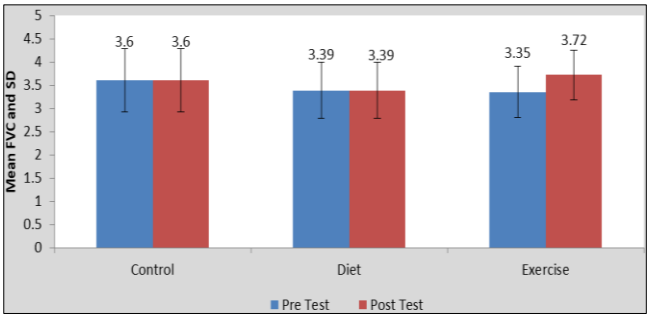
Graph 3: Comparison of TV in three groups at pre and post test



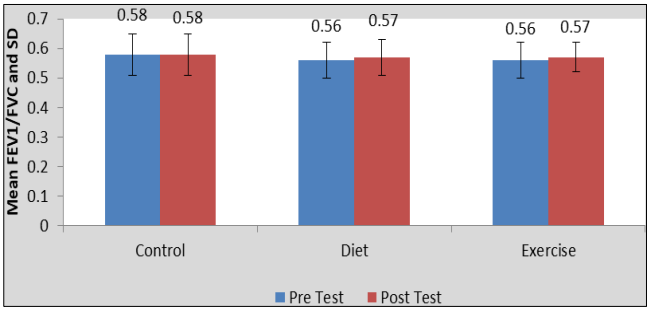
Graph 4: Comparison of IRV in three groups at pre and post test



Graph 5: Comparison of ERV in three groups at pre and post test



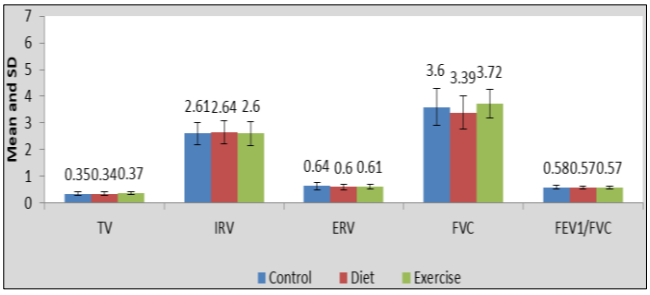
Graph 6: Comparison of FVC in three groups at pre and post test



Graph 7: Comparison of FEV1/FVC in three groups at pre and post test

Table 3: Comparison of parameters in three groups at posttest Multiple Comparison: Tukey Test

Group	Control	Diet	Exercise	F-value
TV	0.35±0.08	0.34±0.07	0.37±0.06	0.58 P=0.56,NS
IRV	2.61±0.41	2.64±0.43	2.60±0.46	0.04 P=0.95,NS
ERV	0.64±0.14	0.60±0.10	0.61±0.09	0.56 P=0.57,NS
FVC	3.60±0.68	3.39±0.61	3.72±0.53	1.48 P=0.23,NS
FEV1/FVC	0.58±0.07	0.57±0.06	0.57±0.05	0.08 P=0.92,NS



Graph 8: Comparison of PFT values in three groups at post test

Discussion

In our study we found statistically significant values of TV, ERV and FVC in the exercise group as compared to the diet group.

The Global Initiative for Asthma Guidelines (GINA) includes amongst its recommendations, the practice of ahealthy diet for the primary prevention of asthma [17]. However,there are still important gaps in the interpretation of the type of foods or diets that the population should in corporate to improve their health [18-20].

A study on systematic reviews on dietary intake and asthma showed evidence of a negative association between asthma or wheeze and dietary intake of vitamins C, E and D, as well as

intake of fruits and adherence to a Mediterranean diet.[21].In a study titled "Manipulating antioxidant intake in asthma: a randomized controlled trial" by Lisa G Wood *et al* it was found that after 14 days, subjects consuming the low-antioxidant diet had a lower percentage predicted forced expiratory volume in 1 s and percentage predicted forced vital capacity than did those consuming the high-antioxidant diet. They had in their study 137 asthmatic adults who were randomly assigned to a high-antioxidant diet (5 servings of vegetables and 2 servings of fruit daily; n = 46) or a low-antioxidant diet (≤2 servings of vegetables and 1 serving of fruit daily; n = 91) for 14 d and then commenced a parallel, randomized, controlled supplementation trial. Improvements were evident only after increased fruit and vegetable intake, which suggests that whole-food interventions are most effective [22].

Another study by S.O. Shaheen *et al* showed that after controlling for confounders and Using regression analysis, a "prudent" pattern (high consumption of fruit, vegetables, oily fish and whole meal cereals) was positively associated with forced expiratory volume in 1 s (FEV_1) [trend p-value <0.001 in males, 0.008 in females) [difference in FEV_1 between top and bottom quintiles of pattern score, 0.18 L (95% CI 0.08–0.28 L) in males, 0.08 L (95% CI 0.00–0.16 L) in females]. This pattern was also positively associated with forced vital capacity (FVC) in both sexes. Males with a higher "prudent" pattern score had a higher FEV_1/FVC [trend p-value 0.002) [23].

Regarding exercise effects on pulmonary functions in asthma a study by Xing gui Wu *et al* showed that their meta-analysis on 22 trials proved that regular continuous aerobic exercise benefits asthma patients on FEV1, PEF, FVC, FVC% pred, while there were no improvements in FEV1%pred and FEV1/FVC%.[24]. The details of this study is as follows-

VC

Ten trials [25-27, 28, 29, 30, 31, 32-34] in volving 373 subjects provided data on the forced vital capacity index that could be pooled with a fixed model (I^2=0.0%, P=0.817). The meta-analysis demonstrated a significant difference in favor of aerobic exercise compared with the controls (WMD: 0.18, 95% CI: 0.09–0.27, P=0.0001)

FEV1/FVC%

FEV1/FVC% was included in 7 articles [35,36,37,36,37,38,39] at the end of training programs, and a fixed-effects model revealed no effectiveness of aerobic exercise (I^2=0.0%, WMD: 0.27, 95% CI: −0.43 to 0.98, P=0.443)

This meta-analysis confirmed the effectiveness of aerobic exercise training for ameliorating partial spirometry parameters (PEF, FEV1, FVC, FVC% pred, and $FEF_{25–75\%}$) and quality of life associated with asthma.

The current mechanisms pertaining to improving lung function of asthmatic patients participating in aerobic exercise remain unclear. According to those mechanism studies, aerobic exercise ameliorates airway inflammation, airflow obstruction, airway hyperresponsiveness, and remodeling in asthma [40-43].

Conclusion

From this study it can be concluded that regular exercise like walking for 30 minutes at dawn or dusk for 5 days a week for at least twelve weeks can better lung function values and can supplement routine medications in mild asthmatic patients.

Limitations

Individual studies are necessarily, constrained by the need to focus on specific concepts and simple studies which can be observed with en the boundaries of a single study. Our study was limited as effects was not be seen in other grades of severity of asthma but this limit does not hamper appropriate care.

Consent

A written informed consent will be taken from all the subjects after screening through the inclusion and exclusion criteria.

Ethical approval

As per international standard or university standard written ethical was taken by the author.

Competing interests

Author did not have any competing interests.

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