The Relationship between Patient's Duration of Indonesian Asthma Gymnastics in Persahabatan Hospital Asthma Club, Indonesia, with the Post-Exercise Peak Expiratory Flow Rate

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IGH FY ES conceived idea, IGH FY ES FN drafted the study, IGH FY ES collected data, IGH FY ES FN did statistics analysis and interpretation, ES FN critical review manuscript, All approved final version to be published

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The Authors declare that there is no conflict of interest.

Abstract

Background: Indonesian Asthma Gymnastics (IAG) is a modified exercise that is intended for asthmatic patients to improve their breath pattern to become more controlled and healthy.

Objective: This study was conducted to determine whether IAG triggers exercise-induced asthma (EIA), whether the duration of following IAG affect the value of peak expiratory flow rate (PEFR) post-exercise, and the effect of age, gender, smoking history, and BMI on PEFR value post-exercise.

Methodology: A Total of 24 subjects who had performed IAG for at least 1 month, were measured their PEFR values before and after performing IAG using a peak flow meter. Information regarding age, gender, and smoking history was obtained from the interview. While height and weight, to determine body mass index (BMI), were obtained through direct examination.

Results: All subjects were spared from EIA may be because they have performed the IAG for at least one month. However, a longer period of IAG does not make the post-exercise peak expiratory flow rate (PEFR) to be better ($p = 0.447$) but keeps lung function optimally. Furthermore, age and gender have no effect on post-exercise PEFR if their respective roles are assessed individually ($p = 0.698$; 0.721; respectively). In addition, former smokers who have long quit smoking, their previous smoking history no longer affect the value of post-exercisePEFR ($p = 0.310$). Lastly, increased BMI is not associated with decreased the post-exercise PEFR ($p = 0.707$).

Conclusion: IAG does not trigger EIA in asthmatic patient. The addition of duration of joining IAG does not improve the post-exercise PEFR. Age and gender are interrelated in affecting post-exercise PEFR. Smoking history of people who have long quit smoking and increased BMI does not affect post-exercise PEFR.

Key Words: Peak Expiratory Flow Rate; Indonesian Asthma Gymnastics; Exercise-induced Asthma

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Introduction

In 2014 the death rate of Indonesians caused by asthma reaches 1.77% of total deaths. At this point, Indonesia was ranked 19th over the world as the country with the highest number of deaths caused by asthma.[1] Asthma is a condition that involves various cellular and airway alterations which mediated by immunological complex. Inflammation and alteration in the airway are the final common sequences that leads to bronchospasm and airflow limitations. In contrast to healthy people, asthmatic patients will show an excessive response and reactivity in their bronchus as a response to several stimuli including exercise.[2,3] The occurrence of asthma induce by exercise indicates that the patient requires for more intensive therapy due to the fact that it can be a marker of an ongoing inflammation in the airway and poor asthma control.[4]

Pulmonary function tests should be involved in part of monitoring and assessing the degree of airway

obstruction in acute asthmatic patients. One measures can be used is the peak expiratory flow rate (PEFR) in liters per minute.[3] Monitoring the value of peak expiratory flow rate (PEFR) is one alternative per national guidelines as part of asthma action plans.5Nowadays the value of PEFR can be easily identified using a small portable handheld device called a peak flow meter.[6] This portable device can objectively measure the lung capability and the control level of asthma at any given point in time.[6,7]

Therapies and strategies other than medications may be considered if relevant to assist in risk reduction and symptom control. One example with consistent and high-quality evidence is encouraging physical activity.[8] In spite of the fact that exercise can initiate symptoms in asthmatic patients, many studies have demonstrated the anti-inflammatory effects and other benefits of exercise in asthmatic patients who exercise regularly.[9,10,11] Compared to the other interventions, doing physical exercise is admitted to be equal or more important in controlling an asthma.[12]

For this reason, in Indonesia, modified exercise that is intended for people with asthma has been developed. This modified exercise is called Indonesian Asthma Gymnastics (IAG). IAG itself is expected to improve the breath pattern of asthmatic patients to become more controlled and healthy.[13] The IAG is made up of 4 stages of movement that begins with warming up, then A and B core movement, aerobic movements, and the last is cooling down.[13,14]

Warming up is the stage where the movement aims to prepare the joints, muscles, as well as the lungs and heart. The principle at this stage is to move the entire limb without using load and starts from the proximal to distal. The A and B core movement are the steps that aim to improve the function of the respiratory so that the respiratory rhythms are getting better. Respiratory rhythms in asthmatic patients are disrupted due to the fact that they have difficulty in expiration. So, when performing movements at this stage, the patient is asked to inspire through the nose, expire through the mouth, lengthen the expiratory phase in order to make

Table 1. Patient Demographics

Variable	Value	
	n	%
Gender		
Male	6	25
Female	18	75
Age (years old)		
Mean± SD	57 ± 12.5	
Range	37 - 83	
Body Mass Index (kg/m^2)		
Mean± SD	24.7 ± 4.5	
Range	37 - 83	
Smoking History		
Former Smoker	6	25
Non-Smoker	18	75
Duration as an active member (month)		
Median	36	
Range	1 - 360	
PEF pre-exercise (L/min)		
Mean ± SD	303.8 ± 111.8	
Range	110 - 580	
PEF post-exercise(L/min)		
Mean± SD	305.4 ± 112	
Range	90 - 550	

it longer than the inspiration phase, and follow the chest and diaphragm respiration mechanism.

Aerobic movement is a dynamic and rhythmic movement that uses large muscles without causing fatigue in the oxygen transport system. The principle of this movement is to involve many muscles and joints, rest breaks should not be more than three minutes, and the pulse rate increases to 70% of the maximal pulse. Cooling down is the last movement of the IAG that aims to relax the muscles and restore the pulse frequency.[13,14] This stage is done through 3 steps which are increased muscle stretching retained for 6-8 seconds, maximal isometric contraction followed by relaxation, and mental tranquility.[13] This gymnastic has been agreed to be done in 30 minutes.[14]

Table 2. Changes in Peak Expiratory Flow Rate Value Post Exercise

Variable	N	Median (Min - Max)
Changes in Peak Expiratory Flow Rate Value Post Exercise (%)	24	0 (- 18 – 9.4)

Methodology:

A sample of 24 people was selected from Persahabatan Hospital's Asthma Club. The research subjects are asthmatic patients who are member of Persahabatan Hospital's Asthma Club. The study was conducted in Persahabatan Hospital over a period of one year, starting from July 2017 to July 2018. Informed consents were obtained from all subjects and ethical clearance was approved by Faculty of Medicine University of Indonesia.

The subjects were interviewed about their smoking history and duration of joining the asthma club. The smoking history was grouped into 3 categories, namely active smokers, former smokers, and non-smokers. Active smoker refers to a subject that currently is still smoking or has stopped smoking but less than 5 years. Former smokers refer to subjects who have quitted smoking for more than 5 years. Non-smokers refer to subjects who have never smoked in their lives. The duration was calculated in months and starting from the first month of the subject joined the gymnastics, until the month in which the current data retrieval without quitting for a month or more. The information regarding age and gender was confirmed through their id card. The ages of the subjects was counted from subjects's birth year to the year of data retrieval and written in years. The value of BMI was obtained through dividing weight by height squared. The height was recorded in centimeters, while the weight was recorded in kilograms. The values of both variables were obtained from direct measurement.

Table 3.Changes in Peak Expiratory Flow Rate Value Post Exercise and Duration of Indonesian Asthma Gymnastics

Variable	N	p value*
Changes in Peak Expiratory Flow Rate Value Post Exercise (%)	24	0.447
Duration as an active member of Indonesian Asthma Gymnastics	24	

The PEFR of the subjects were measured using a peak flow meter before and after performing Indonesian asthma gymnastics. The peak flow meter was manufactured by vitalograph and the result was recorded in liters per minute. In each measurement, each subject performed 3 PEFR manoeuvres and the highest score of each was recorded.

To determine the degree of exercise-induced asthma (EIA) control in subject, the increase or decrease in PEFR value post exercise was divided by PEFR value before exercise and the results were made in percent. A decrease in PEFR of more than 20% was considered as an exercise-induced asthma.[6,15] The relationship between duration, gender, age, BMI, and smoking history with value of PEFR post exercise was analysed using Statistical Package for Social Sciences (SPSS) version 24 software. Bivariate analysis was used for analyzing the numerical data and Independent Test analysis was used for analyzing nominal data. A p-

Table 4.Changes in Peak Expiratory Flow Rate Value Post Exercise and Age

Variable	N	p value*
Changes in Peak Expiratory Flow Rate Value Post Exercise (%)	24	0.698
Age	24	

Table 5. Changes in Peak Expiratory Flow Rate Value Post Exercise and Body Mass Index

Variable	N	p value*
Changes in Peak Expiratory Flow Rate Value Post Exercise (%)	24	0.707
Body mass index	24	

value of less than or equal to 0.05 was considered as statistically significant.

Results

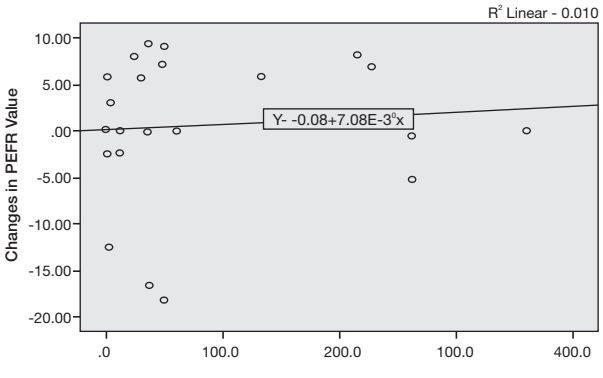
545patientspresented during above time period. The mean age in our study was 38.80+ 17.05 years. Most of the patients were in age range of 15-24 years 22.9% (N= 125), followed by 25-34 years 21.5% (N= 117). There were 52.1% (N= 284) male and 47.9% (N= 261) female. Majority of patients were non-smoker non addict 95.4% (N= 520). Only 2.6% (N= 14) of patients were smoker. The prevalence of various diseases was diabetes mellitus 22.4% (N= 122), Hepatitis C 4.6% (N= 25), diabetes with other complications 3.9% (N=21) and HIV 0.6% (N=3). Eight patients in our study refused for HIV testing. DM is the predicator and significantly associated with the final outcome as compared to other medical conditions.

Discussion

Histamine, which is mainly released by mast cells, is thought to mediate the initial event of asthma exacerbation in asthmatics patients in response to exercise stimulus.[16] On the other hand, many studies have also demonstrated lung benefits of regular exercising in patients with asthma.[9,11,12] These findings include a decreased in allergen-specific and total IgE levels in the body. IgE is an antibody molecule that can activate mast cells to produce histamine. Thus, a decreased in IgE levels in the body may suppress histamine production by mast cells and asthmatic patients could be spared from EIA.[12] In this study, changes in the value of peak expiratory flow rate (PEFR) post exercise was observed. The lowest decrease of PEFR value post-exercise recorded was 18%. This decrease, however, is still considered normal since EIA refers to a decrease in PEFR above 20 percent.[6,15] This suggests that all subjects in this study were controlled from exercise-induced asthma. All subjects may be spared from exercise-induced asthma because they have practiced Indonesian Asthma Gymnastics (IAG) for at least one month.

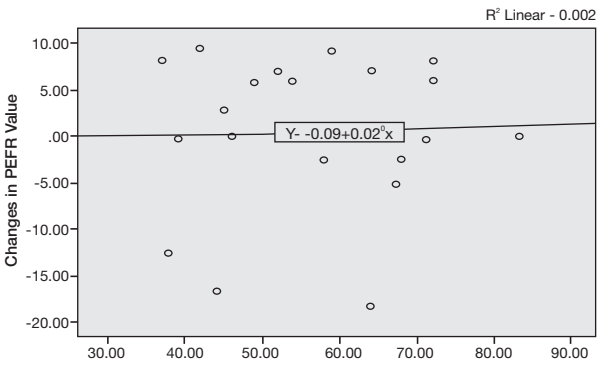
This study showed that the relationship between duration of participation in IAG and changes in PEF values post-exercise is not significant. In contrast, Yunus F, et al. (2002) found a significant improvement in lung function after undergoing gymnastics within a certain period of time. This certain period of time may be the basis why the results of this study are insignificant. Previous study found that within 4.5 months following the gymnastics, lung function of subjects had become very good.[14] While in this study, the majority of subjects (75%) have been practicing IAG for more than 4.5 months. As the result, the lung function of the subjects should have been in very good condition and the addition of duration of following the IAG did not give significant result to the change of PEFR value.

It has been confirmed that lung function is influenced by many factors such as age, gender, and smoking status.17 Lung structure that change with age affects the ventilatory response during exercise.[18] Wilkie S, et al. (2011) had observed lung function of female with different age during exercise. The results showed that



Himantoko IG, et al. Figure 1

Figure 1. The Correlation Graph between Duration of IAG and Changes in PEFR Value



Himantoko IG, et al. Figure 2

Figure 2. The Correlation Graph between Age and Changes in PEFR Value

older female tend to have expiratory flow limitation compared to younger female.[19]

In contrast to previous studies, this study showed that the relationship between age and changes in PEFR values post-exercise was not significant. This result was different because it turns out sex has a significant role in lung aging.[18] Moreover, female have ovarian hormones such as progesterone and estrogen that can affect airway responsiveness, ventilation, and respiratory muscle work during exercise. This modification makes female have a tendency to experience hyperresponsiveness and expiratory flow limitation while exercising.[20] While in this study, the analysis was not limited by one gender alone. Age and gender are the factors that influence each other in the assessment of lung function post-exercise. The same reason also makes the relationship between gender and PEFR values post-exercise become insignificant since this study did not compare gender across the same range of age.

As for smoking history, no subject in this study is an active smoker. So, this study only compares the non-smoker and former smoker. Former smokers who have serious inflammatory problems generally experience decreased lung function during physical activity. However, García-Aymerich J, et al. (2007) found that quitting smoking for more than 5 years made the association between physical activity and pulmonary function decline insignificant.[21] Similar to previous study, former smokers in this study also have quitted smoking for more than 5 years. This may be the reason why the results in this study also become insignificant.

Another recent study suggests that increased BMI has a significant effect on pulmonary function decline during light exercise. This result contradicts the findings of this study. Wang S, et al. (2017) and Soundariya K, et al. (2015) explained that further the increased body fat percentage, limiting the movement of the abdomen and thorax thus increasing airway resistance.[17,22] However, apparently BMI takes no account of fat distribution in the body. Race is the one that has an important influence in the distribution of fat. For example, fat in Americans generally accumulates in the hip, whereas Chinese people in the abdomen.[22] Fat that accumulates on chest wall was the one that makes airway resistance as explained in the previous study.[17] The relationship between increased BMI and changes in PEFR value post-exercise in this study was found insignificant. This may be because the fat distribution of Indonesians does not accumulate in the chest wall so the airways are not disturbed.

Conclusion

No subject experienced exercised-induced asthma (EIA) after performing Indonesian Asthma Gymnastics (IAG). All subjects were spared from EIA may be because they have performed the IAG for at least one month. However, a longer period of IAG does not make peak expiratory flow rate (PEFR) value post-exercise to be better but keeps lung function optimally. Furthermore, gender or age has no effect on PEFR value post-exercise if their respective roles are assessed individually. Gender and age are interconnected in influencing PEFR value post-exercise.[17,18] Former smokers who quit smoking for more than 5 years, their smoking history no longer significantly affects PEFR value post-exercise.[21] Increased BMI is not associated with decreased PEFR value post-exercise. This is because an increase in BMI does not necessarily lead to an increase in the body fat percentage in the thorax or chest wall, but perhaps on other parts that does not associated with limiting the movement of abdomen and thorax.[22]

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