



Peak expiratory flow estimation following static warm up and dynamic warm up in children having exercise induced asthma-A pilot study

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Abstract

Purpose: Exercise-induced Asthma (EIA) occurs when vigorous exercise induces bronchoconstriction. Pre-exercise warm-up routines are frequently used to elicit a refractory period and thus reduce or prevent EIA. Therefore, this study aimed to compare the effect of static warmup and dynamic warmup exercise training program on pre and post PEFR values after the completion of the test procedure on exercise induced asthma.

Method: A comprehensive literature search was performed. Warmup exercises were classified into static and dynamic exercises. The EIA response was measured with the help of PEFR values after the warmup exercises and p-value and standard deviation (SD) was reported.

Result: Six samples met the inclusion criteria. The result showed that Dynamic warmup (p-value=0.0288, SD=5.29) attenuated the EIA after comparing pre and post PEFR values. However, Static warmup (p-value=0.4226, SD=29.57) failed to result statistically significant in reduction in EIA.

Conclusions: The most consistent and effective attenuation of EIA was observed post PEFR comparison with Dynamic warmup. These findings indicate that an appropriate warm-up strategy that includes dynamic warmup exercise may be a short-term nonpharmacological strategy to reducing EIA.

Keywords: exercise induced asthma, peak expiratory flow rate, static warm UP, dynamic warm UP

Introduction

Asthma

- Asthma is known to be a chronic inflammatory disorder of the airways associated with widespread but variable airflow obstruction that is often reversible spontaneously or with treatment. Increased airway responsiveness and airway inflammation characterized by T-helper-2 lymphocyte infiltration with eosinophils and neutrophils are characteristic of the disorder and Exercise Induced Asthma may be a symptom of asthma or it can be independent of asthma.
- According to American college of Allergy, Asthma and Immunology there are 6 types of asthma.
- Adult-onset asthma
- Allergic asthma
- Asthma-COPD overlap
- Exercise induced asthma/ Exercise induced bronchoconstriction
- Nonallergic asthma
- Occupational asthma

Exercise Induced asthma

Exercise-induced asthma (EIA) is found to be one of the major problems interfering with performance of exercises in general and in particular with participation in sport. Exercise-induced asthma, exercise-induced broncho-constriction and exercise-induced bronchospasm are all the terms used to describe the phenomenon of transient airflow obstruction associated with

physical exercises. It is a distinguished finding in children and young adults because of their greater participation in vigorous activities

In children, the prevalence of EIA is also higher than in the general population, ranging from 3 to 35% (children ≤ 16 years old) in India⁴⁰.

The common symptoms of EIA are shortness of breath, cough, chest tightness and wheezing that normally follow the brief period of bronchodilation present early in the course of exercise. Bronchospasm typically arises within 10 to 15 minutes after a physical exercise is concluded and resolves about 60 minutes later. Exercise-induced asthma may also appear during sustained exertion. Exercise-induced asthma occurs in up to 90% of asthmatics.

There are studies regarding interventions of submaximal exercise which help in reduce EIA, but there is no comparative study about it.

At present, the osmotic theory is widely accepted as the established underlying mechanism of EIA. The osmotic theory proposes that increased ventilation in the airways during periods of exercise leads to water loss from the airway surfaces by evaporation, thus dehydrating the airway surfaces and initiating the episodes that lead to the contraction of bronchial smooth muscle.

PEFR

- Peak expiratory flow rate (PEFR) is an individual's maximum speed of expiration, as estimated with a peak flow meter is a small hand-held device used to monitor a person's ability to breathe out air. It calculates the airflow through the bronchi and so the degree of obstruction in the airways. Peak expiratory flow is usually measured in units of liters per minute (L/min).

Static warm up and dynamic warm up

- Static warm up requires holding a position for 30 seconds or more to elongate the muscle while a dynamic warm up requires stretching through a range of motion. Your body needs to warm up by gradually increasing your heart rate and breathing rate.

Need of study

- Exercise is one of the most common triggers of asthma symptoms.
- Exercise induced asthma is a phenomenon of transient airflow obstruction associated with physical exertion. The transient airflow obstruction is accompanied by coughing, wheezing and chest pain and chest tightness. It is more commonly found in children and young adults because of their greater participation in vigorous activities. Bronchospasm typically arises within 10 to 15 minutes during exercise and takes an hour or longer to subside.
- There are studies showing that warm up exercises increase the refractory period which helps in delaying Exercise Induced Asthma.
- Potential physiological mechanisms have been proposed as to why exercise would cause a refractory period of EIA. Exercise is believed to result in dehydration of the airway surface, which increases airway osmolarity, releasing inflammatory mediators (prostaglandins, leukotrienes, and histamine) from the mast cell, and it is the release of these mediators that causes bronchoconstriction.
- The cause of this refractory period is not fully understood but may be due to depletion of catecholamines, increased circulation of prostaglandin, or degranulation of mast cell mediators. Depletion of mast cell mediator stores is a popular theory to explain refractory period after exercise. It has been hypothesized that warm-up causes a gradual discharge of mast cell mediators, and a time would be required for replenishment. If exercise is resumed within this period, then mediator stores would not be replenished, and therefore, EIA would not occur.
- Therefore the purpose of this study is to compare the effect of static warmup and dynamic warmup exercise training program on pre and post PEFR values after the completion of the test procedure.

Subjects

Included

- Participants willing to participate.
- Children with exercise induced asthma.
- Children suffering from asthma
- Pre-diagnosed cases of exercise induced asthma.
- Age group 6 to 17 years

Excluded

- Children having restrictive lung diseases.
- Children who are under bronchodilators.
- Children having recent surgeries.
- Children suffering from obesity and spinal deformity.

Materials

- pen
- paper
- consent form
- peak expiratory flow meter
- cones

Method

Various clinics, hospitals and societies were visited in and around city.

Participants were selected on the basis of inclusion and exclusion criteria.

The participants were explained about the study and consent form was taken from participant's parents.

PEFR was assessed using peak expiratory flow meter.

Participants were divided into two groups using ODD-EVEN method.

One group was given static warm up and other was given dynamic warm up protocol.

Pre and Post PEFR was assessed of each group after the 4-week training program and data analysis was done.

Protocol

The protocol will start with Static exercises for Group A and Dynamic exercises for Group B.

Static exercises will be done for 6 minutes with 15 seconds hold, 5 seconds rest and in total of 3 repetitions for each exercise.

Static exercises include



Fig 1: Adductor Stretch



Fig 2: Modified hurdler stretch



Fig 3: Hip rotator stretch



Fig 4: Bend-over toe raise



Fig 5: Quadricep stretch



Fig 6: Calf stretch

Dynamic exercises will be done for 6 minutes in total with 1 minute 2 repetitions and with 10 second's rest for each exercise.

Dynamic exercises include



Fig 7: High knee walk



Fig 8: Straight leg march



Fig 9: Lunge walk



Fig 10: Backward lunge



Fig 11: Lateral shuffle

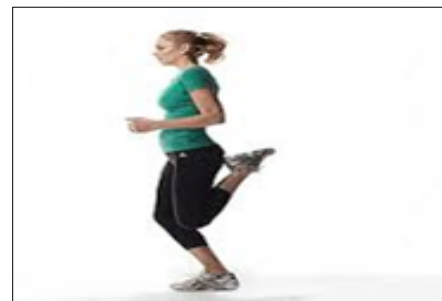


Fig 12: Heel ups

Outcome measure

- Peak Expiratory Flow Rate (PEFR)
- In upright sitting position, participants are given cartoon mouthpiece that is adjusted to mouthpiece of expiratory flow meter.
- Pointer is switched to zero.
- Instruction is given to subjects to hold peak flow meter level (horizontally) and to keep their fingers away from pointer.
- Subjects are asked to take deep breath and close lips firmly around cartoon mouthpiece and blow as hard as they can.
- Reading over peak flow meter is measured and pointer is switched back to zero.
- Procedure is repeated 3 times and highest reading is recorded.



Fig 13

Data analysis

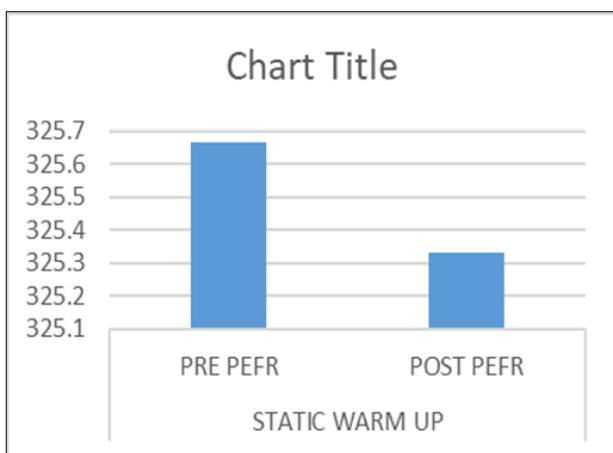


Fig 14: Mean of Static warm up (PEFR)

Table 1

Mean	STD deviation	P-value
325.66	29.54	0.4226 Not Significant
325.33	29.57	0.4226 Not Significant

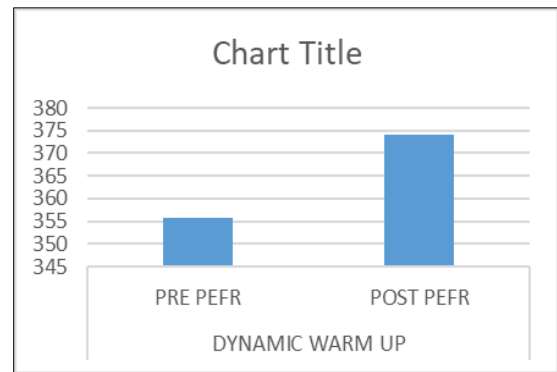


Fig 15: Mean of dynamic warm up (PEFR)

Table 2

Mean	STD deviation	P-value
355.66	10.69	0.0288 Significant
374	5.29	0.0288 Significant

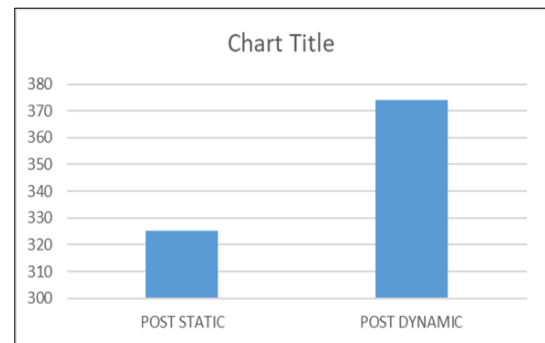


Fig 16: Comparison of post static warm up and post dynamic warm up (PEFR)

Table 3

Mean	STD deviation	P-value
	29.57	0.0485 Significant
374	5.29	0.0485 Significant

Results

- The comparative technique is used in the study in between Static warm up (Group A) and Dynamic warm up (Group B)
- Pre and post mean value of PEFR in static warm up is 325.66 and 325.33 respectively.
- Pre and post mean value of PEFR in dynamic warm up is 355.66 and 374 respectively.
- Pre and post of both static and dynamic warm up was compared and analyzed using paired t-test.
- Post of both static and dynamic warm up was compared and analyzed using unpaired t-test.
- Group A with static warm up shows p-value 0.4226 which is statistically not significant.
- Group B with dynamic warm up shows p-value of 0.0288 which is statistically significant.
- Comparing post value of Group A and Group B shows p-value of 0.0485 which is significant.

Discussion

- Current study was conducted to find out the effect of static warm up vs dynamic warm up on PEFR in children having exercise induced asthma.
- A total of 6 individuals with exercise induced asthma participated in the study. The result of the study showed that dynamic warm up is more effective than static warm up. Mean value of pre PEFR in static warm up is 325.66, post PEFR is 325.33 and in dynamic warm up pre PEFR is 355.66, post PEFR is 374 and shows P value of 0.0288 which is considered to be significant.
- The study included participants with exercise induced asthma were both male and female.
- In the study dynamic warm up was proved better than static warm up in children having exercise induced asthma, dynamic warm up includes stretching through a range of motion which targets the potential physiological mechanism which caused refractory period in EIA which improved the PEFR.
- Static warm up includes holding a position for 30 seconds therefore there is no such effect which would cause refractory period in EIA and will have no change in PEFR value.
- In conclusion the current study proves that dynamic warm up is better than static warm up to improve the PEFR value in children having exercise induced asthma.

Conclusion

The present study concluded that dynamic warm up is more effective than static warm up in children having exercise induced asthma.

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