Effect of physical training on lung function and respiratory muscles strength in policewomen trainees

Kamal M. Awad¹, Aamir Magzoub²*, Omer Elbedri³, Omer A. Musa¹

¹Faculty of Medicine, Sudan International University, Khartoum, Sudan
²Faculty of Medicine, National Ribat University, Khartoum, Sudan
³Faculty of Medicine, ElSheikh Abdallah Elbadri University, River Nile, Sudan

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*Correspondence:
Dr. Aamir Magzoub,
E-mail: aamirmagzoub70@hotmail.com

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ABSTRACT

Background: Measurement of respiratory muscles strength has not been widely investigated in the context of physical training.

Methods: This cross-sectional study has assessed pulmonary function and strength of respiratory muscles in two women groups: group I includes healthy policewomen (n=28) exposed to physical training 3 hours daily for at least 2 years and group II is a matched control group (n=31) of untrained apparently healthy second year medical students. Lung function tests including forced vital capacity (FVC), forced expiratory volume in the first second (FEV1) and peak expiratory flow rate (PEF) were performed using a digital spirometer and maximum inspiratory and expiratory pressures (MIP and MEP) as indicators for respiratory muscle strength were measured using a digital respiratory pressure meter.

Results: The mean FVC (L), FEV1 (L), PEF (L/min) values were significantly higher in the police-trained group (p=0.000, 0.000 and 0.003 respectively). Similarly, the mean MIP and MEP (cm/H₂O) values were significantly higher among trained group (p=0.000 and 0.003 respectively).

Conclusions: Long-term regular physical exercise improves lung function as well as respiratory muscle power and may delay the age-related decline in lung function.

Keywords: Exercise, Lung function, Physical training, Respiratory muscle power

INTRODUCTION

Exercise is a stressful situation that produces marked changes in body functions including the respiratory system. Physical inactivity is directly related to morbidity and mortality from many diseases.¹ Therefore, physical training is one of the major bases for good health and wellbeing and currently globally recommended.² During exercise the body's demand for oxygen increases as the breathing must also rise. This requires numerous muscles surrounding the lungs to contract in a highly coordinated manner. As the intensity of exercise increases, the respiratory muscles contract more forcefully and quickly to keep pace with the increase in oxygen demand. Maximal inspiratory pressure (MIP) and maximal expiratory pressure (MEP) are useful indices for assessment of respiratory muscles performance in adults as well as in children.³ Training of the respiratory muscles increases their strength and improves lung function and was found to reduce the severity of obstructive sleep apnoea in cervical spinal cord injury and improves breathing pattern in patients with COPD.⁴,⁵
Several cross-sectional and cohort studies have shown significant improvement of lung function as a result of exercise in both children and adolescents.6-9 However, measurement of respiratory muscles strength has not been widely investigated in relation to physical training. In this context, the present study aimed at assessing pulmonary function as well as respiratory muscles strength among policewomen trainees compared to healthy untrained sedentary group of medical students.

RESULTS

Fifty-nine subjects were included in the two matched groups. The mean age (year), height (cm), weight (Kg) and BMI (Kg/m²) of the policed-trained group were 20.96±0.88, 162.54±5.73, 58.04±8.27 and 21.96±2.89 respectively while in the untrained medical students were group were 19.45±1.52, 163.88±8.00, 57.19±11.37 and 21.25±3.58 respectively (Table 1).

Table 1: Mean age, height, weight and BMI in police-trained group (trainee) and the control group (sedentary medical students).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Trainee group (n=28)</th>
<th>Control group (n=31)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>20.96±0.88</td>
<td>19.54±1.52</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>162.54±5073</td>
<td>163.88±8.00</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>58.04±8.27</td>
<td>57.19±11.37</td>
</tr>
<tr>
<td>Body mass index (BMI) (Kg/m²)</td>
<td>21.96±2.96</td>
<td>21.25±3.58</td>
</tr>
</tbody>
</table>

Mean values of FVC (L), FEV1 (L), PEF (L/min), MIP and MEP (cm/H₂O) for trainees were: 2.70±0.55, 2.41±0.46, 286.11±66.49, 56.89±15.40 and 76.53±14.82 respectively while in untrained were: 2.03±0.47, 1.93±0.45, 249.45±87.61, 44.03±17.55 and 47.48±19.43 respectively. Comparing the two groups showed FVC, FEV1, PEFR, MEP and MIP were significantly higher (p<0.05 for all parameters) in police-trained group, (Table 2).

Table 2: Mean values of ventilatory and respiratory muscle strength indices in police-trained group (trainee) and the control group (sedentary medical students).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Trainee group (n=28)</th>
<th>Control group (n=31)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>FVC (L)</td>
<td>2.70±0.55</td>
<td>2.03±0.47</td>
<td>0.000</td>
</tr>
<tr>
<td>FEV1 (L)</td>
<td>2.41±0.46</td>
<td>1.93±0.45</td>
<td>0.000</td>
</tr>
<tr>
<td>PEF (L/min)</td>
<td>286.11±66.49</td>
<td>249.45±87.61</td>
<td>0.003</td>
</tr>
<tr>
<td>MIP (cm/H₂O)</td>
<td>56.89±15.40</td>
<td>44.03±17.55</td>
<td>0.004</td>
</tr>
<tr>
<td>MEP (cm/H₂O)</td>
<td>76.53±14.82</td>
<td>47.48±19.43</td>
<td>0.000</td>
</tr>
</tbody>
</table>

DISCUSSION

To the best of our knowledge, this is the first study to be focused on MEP and MIP variation in Sudanese women athletes. The results of the present study were measured and compared among the two groups and also with the studies carried out previously. The values of lung volumes (FVC, FEV1 and PEF) as well as respiratory muscle strength indicators (MEP and MIP) were found to be significantly higher (p<0.05 for all) in policewomen trainee group when compared with results obtained for...
sédentary medical students’ group. The higher values in lung function parameters could be attributed to the improved strength of respiratory muscles proved by higher values of MEP and MIP in trained subjects (Table 2). Present results are in consistency with the literature regarding the association between physical activity and lung function. Different types of exercise can improve lung function. A review article, pulmonary function appears to improve with a minimum of 10 weeks of regular yoga practice. Swimming exercise can also improve lung function; a study conducted among adolescent swimmers revealed higher spirometric values (FVC, FEV1 and PEF) above percentage of their predicted values. Another supportive study comparing active versus inactive groups was conducted by António B who included 52 women: 27 were engaged in a gymnastics program for 3 hour a week, for at least 2 years and 25 were age matched control group. MEP was significantly higher in the active group. Nevertheless, the MIP was also higher in the active women group but statistically insignificant. In a study conducted in healthy subjects, it was observed that high intensity inspiratory muscle training increases the diaphragm thickness, lung volumes and exercise capacity in trained people, a result consistent with our study findings and supports the fact that training of respiratory muscles improves lung function. Moreover, a high level of physical activity was found to overcome the disadvantages of a decline in lung function with increasing age a result that supports the benefits of regular and long term physical activity.

CONCLUSION

Regular long term physical exercise improves lung function which is likely due to improved respiratory muscles power that aids a better chest expansion. Regular physical activity should be encouraged as it may delay the age-related decline in lung function and respiratory muscle power. MEP and MIP are suggested being used as sensitive tools for athletes’ performance.

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