Bronchoconstrictor effect of exercise in healthy Libyan children in Tripoli
F. Sagher1 and A. Hweta1

ABSTRACT To study the effects of short-term exercise on pulse rate and peak expiratory flow rate in healthy Libyan schoolchildren, 650 healthy students (330 boys, 320 girls) aged 4.5 years to 14.9 years were selected from four randomly chosen Tripoli primary schools. Pulse rate and peak expiratory flow rate were measured at rest in standing position and immediately after rhythmic short-term exercise. Exercise markedly increased pulse rate (mean differences being significantly higher in girls than boys) and markedly reduced peak expiratory flow rate (mean difference being significantly higher in boys than girls). We found 10% of the children had a reduction in peak expiratory flow rate ≥ 15% from the baseline.

Effet bronchoconstricteur de l'exercice chez des enfants libyens en bonne santé à Tripoli
RESUME Afin d'étudier les effets de l'exercice de courte durée sur la fréquence du pouls et le débit expiratoire de pointe chez des écoliers libyens en bonne santé, 650 écoliers en bonne santé (330 garçons et 320 filles) âgés de 4,5 à 14,9 ans ont été choisis dans quatre écoles primaires de Tripoli sélectionnées au hasard. La fréquence du pouls et le débit expiratoire de pointe ont été mesurés au repos en position debout et immédiatement après un exercice rythmique de courte durée. L'exercice a sensiblement augmenté la fréquence du pouls (la différence moyenne étant beaucoup plus élevée chez les filles que chez les garçons) et sensiblement réduit le débit expiratoire de pointe (la différence moyenne étant beaucoup plus élevée chez les garçons que chez les filles). Nous avons trouvé que 10% de enfants avaient une réduction du débit expiratoire de pointe égale ou supérieure à 15% par rapport à la valeur de référence.

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Introduction

Variability in peak expiratory flow rate (PEFR) has been proposed as a simple method of screening for asthma in epidemiological studies [1,2,3]. Screening for exercise-induced asthma in the community could have advantages at a time when both the prevalence rate and hospital admission rate of asthma are rising.

There are different criteria used to define normal airway response to exercise, according to the parameters of the pulmonary function test used [4]. In this study we present the effect of short-term exercise on PEFR and estimate the incidence of exercise-induced bronchospasm in healthy Libyan schoolchildren living in Tripoli.

Subjects and methods

Of 900 children chosen at random from four Tripoli primary schools, 250 students with a history of asthma, heart problems, skeletal deformity or recurrent admission to hospital were excluded. A total of 650 students (330 boys, 320 girls) aged 4.5–14.9 years fulfilled the criteria and tolerated the exercise.

Pulse rate and PEFR were measured at rest in standing position and immediately after exercise. Pulse rate was counted for 30 seconds on the right radial artery, followed by PEFR using a Mini-Wright peak flow meter without nose-clip. The best of three readings was accepted for each child.

A modified Harvard step test was used throughout with the following modifications: the step height was 35 cm; each child was encouraged to follow a rhythm for 2 minutes for children in first and second year primary school, and for 3 minutes for the others. The project was carried out over a 4-week period in October 1993.

All values are presented as the mean ± standard error of the mean (s_x) or the proportion ± standard error of proportions. Paired and unpaired Student t-tests were used as necessary. A Z-test was applied for comparison of two proportions.

Results

Short-term exercise significantly increased the mean pulse rate and significantly reduced the mean PEFR (P < 0.001) (Table 1). The mean baseline pulse rate was significantly higher in girls than boys. The mean differences in pulse rate (pre- and post-exercise) were significantly higher in girls than boys (P < 0.01) (Table 2).

The mean baseline PEFR was significantly higher in boys than girls (P < 0.001). The mean differences in PEFR (pre- and

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<thead>
<tr>
<th>Table 1 Effect of exercise on pulse rate and PEFR</th>
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<tr>
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<td></td>
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<tr>
<td>Pre-exercise</td>
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<td>Post-exercise</td>
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</tbody>
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*P < 0.001
Values are presented as mean ± s_x
PEFR = peak expiratory flow rate

<table>
<thead>
<tr>
<th>Table 2 Effect of exercise on pulse rate by sex</th>
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<tbody>
<tr>
<td>Sex</td>
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<tr>
<td></td>
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<tr>
<td>Boys</td>
</tr>
<tr>
<td>Girls</td>
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</tbody>
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*P < 0.001
*P < 0.01
Values are presented as mean ± s_x
Table 3 Effect of exercise on PEFR by sex

<table>
<thead>
<tr>
<th>Sex</th>
<th>Baseline PEFR (l/min)</th>
<th>Mean differences between post- and pre-exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>295.97 ± 3.5</td>
<td>13.83 ± 1.6</td>
</tr>
<tr>
<td>Girls</td>
<td>271.42 ± 3.7</td>
<td>9.26 ± 1.5</td>
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</tbody>
</table>

*P < 0.001  **p < 0.05  
Values are presented as mean ± SD  
PEFR = peak expiratory flow rate

Table 4 Reduction in PEFR post-exercise by sex

<table>
<thead>
<tr>
<th>Sex</th>
<th>% with reduction</th>
<th>% with reduction ≥ 15%</th>
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<tbody>
<tr>
<td>Boys</td>
<td>69.40 ± 2.5 9</td>
<td>9.09 ± 1.58</td>
</tr>
<tr>
<td>Girls</td>
<td>59.25 ± 2.75</td>
<td>10.97 ± 1.75</td>
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<tr>
<td>Overall mean</td>
<td>64.40 ± 1.89</td>
<td>10.03 ± 1.18</td>
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</tbody>
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*P < 0.05  **Non-significant  
Values are presented as proportion ± SE of proportion  
PEFR = peak expiratory flow rate

The pattern of bronchospasm occurring soon after exercise in our study was consistent with that found in the known asthmatic population elsewhere [5–7].

A reduction of 15% or greater in PEFR after exercise is used to determine exercise-induced bronchospasm as reported previously [5,8]. Although a slight bronchoconstrictive effect has been reported in healthy athletes after strenuous exercise (attributed to low temperature and strong drying stimulus to the airways) [9], the 10% incidence of exercise-induced bronchospasm in healthy children living in Tripoli is relatively high, especially when compared to the 7% reported in the Zawia area in a similar study carried out in November 1993 (personal communication). The difference is probably a reflection of indoor and outdoor air pollution in Tripoli [10].

Although none of the children in our study was reported to be a smoker, the effect of passive smoking cannot be excluded [7].

The study showed significant differences in the response to exercise between boys and girls, in contrast to other studies [5]. These differences are probably related to the variation in body mass index between boys and girls — girls being heavier than boys. Being overweight is known to produce profound bronchospasm soon after exercise [6].

Discussion

Exercise has been shown to produce bronchospasm [5] which is closely correlated with atopy [3]. Exercise has been proposed as a marker for childhood asthma [3,5].

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References


