

Bronchoconstrictor effect of exercise in healthy Libyan children in Tripoli

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تأثير التمرينات الرياضية في إحداث التضيق القصبي لدى الأطفال الليبيين الأصحاء في طرابلس

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خلاصة: من أجل دراسة آثار التمرينات الرياضية في المدى القصير على سرعة النبض ومعدل جريان ذروة هواء الزفير بين التلاميذ الليبيين الأصحاء، تمت دراسة 650 تلميذاً يتمتعون بصحة جيدة (330 من الذكور و320 من الإناث) تتراوح أعمارهم بين أربع سنوات ونصف وبين 14.9 سنة. وقد تم اختيار هذه العينة عشوائياً من المدارس الابتدائية في طرابلس. وتم قياس سرعة النبض ومعدل جريان ذروة هواء الزفير والأطفال وقوف في حالة الراحة ثم بعد تمرينات رياضية لمدة قصيرة. وتبين أن التمرينات زادت سرعة النبض بدرجة كبيرة (وكانت الاختلافات الوسطية أعلى بدرجة ملحوظة بين الإناث عنها بين الذكور)، كما أنها خفضت كثيراً معدل جريان ذروة هواء الزفير (حيث كانت الاختلافات الوسطية أعلى بدرجة ملحوظة بين الذكور عنها بين الإناث). ولقد وجدنا أن 10% من الأطفال كان لديهم انخفاض في معدل جريان ذروة هواء الزفير بنسبة 15% أو أكثر من المستوى الأساسي.

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 \geq 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 \pm standard error of the mean ($s_{\bar{x}}$) or the proportion \pm 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

Table 1 Effect of exercise on pulse rate and PEFR

	Pulse rate (l/min)	PEFR
Pre-exercise	88.7 \pm 0.5	275.9 \pm 2.6
Post-exercise	125.5 \pm 0.8 ^a	263.5 \pm 2.7 ^a

^a $P < 0.001$

Values are presented as mean \pm $s_{\bar{x}}$

PEFR = peak expiratory flow rate

Table 2 Effect of exercise on pulse rate by sex

Sex	Baseline pulse rate	Mean difference between post- and pre-exercise
Boys	87.14 \pm 0.65	35.3 \pm 1.2
Girls	90.43 \pm 0.70 ^a	38.3 \pm 1.2 ^b

^a $P < 0.001$

^b $P < 0.01$

Values are presented as mean \pm $s_{\bar{x}}$

Table 3 Effect of exercise on PEFR by sex

Sex	Baseline PEFR (l/min)	Mean differences between post- and pre-exercise
Boys	295.97 ± 3.5 ^a	13.83 ± 1.6 ^b
Girls	271.42 ± 3.7	9.26 ± 1.5

^aP < 0.001 ^bP < 0.05
 Values are presented as mean \bar{x}
 PEFR = peak expiratory flow rate

Table 4 Reduction in PEFR post-exercise by sex

Sex	% with reduction	% with reduction ≥ 15%
Boys	69.40 ± 2.5 9 ^a	9.09 ± 1.58
Girls	59.25 ± 2.75	10.97 ± 1.75 ^b
Overall mean	64.40 ± 1.89	10.03 ± 1.18

^aP < 0.05 ^bNon-significant
 Values are presented as proportion ± SE of proportion
 PEFR = peak expiratory flow rate

post-exercise) was significantly higher in boys than girls ($P < 0.05$) (Table 3). There was a significantly higher proportion of boys than girls ($P < 0.05$) who responded to exercise by reduction in their baseline PEFR (69.4% and 59.25% respectively). In all, 10.03% of the children had an overall reduction in PEFR $\geq 15\%$ (Table 4); there were no significant differences between the sexes.

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].

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].

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