

Is physical activity anti-inflammatory on the airways?

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Further evidence that physical activity may prevent or modify airway inflammation

In this issue of *Thorax* (see p 403), Shaaban and colleagues¹ report an inverse relationship between weekly exercise and bronchial hyperresponsiveness (BHR) in 5518 adults. Participants answered questionnaires on whether “they usually exercised so much that they got out of breath or sweaty” in order to estimate weekly frequency and duration of physical activity. Although this methodology may be difficult to validate, self-report questionnaires are used routinely to obtain information in epidemiological studies. These findings are consistent with the results of two previous studies: Rasmussen and coworkers² found that decreased physical fitness in childhood was significantly correlated with the development of adolescent asthma over a 10 year period, and Huovinen *et al*³ showed in a 17 year study of 262 twins that the twin who participated in exercise conditioning had a decreased risk of asthma.

An interesting question to arise from the findings of this study is “What is the cause-effect relationship?” The authors propose that “even modest physical activity can have a beneficial effect on BHR”. One mechanism that Shaaban *et al* considered was that deep inspirations with physical activities may be bronchoprotective.⁴ However, Skloot and colleagues⁵ showed that deep inspirations had no effect on methacholine-induced bronchoconstriction in asthmatic subjects. In addition, Fish *et al*⁶ reported that induced bronchoconstriction was transiently reduced or abolished with a deep inspiration in non-asthmatic subjects, but this effect was minimal in those with asthma. Despite increased tidal volumes (ie, deeper inspirations) that occur with physical activity, exercise may cause acute bronchoconstriction in those with BHR and with asthma.^{6,7}

I therefore believe that their alternative explanation is more plausible. As BHR is characterised by the presence of airway inflammation, Shaaban and colleagues suggest that physical activity may exert

an anti-inflammatory effect on the airways. This hypothesis is based on two associations: (1) regular physical activity reduces systemic inflammation, as measured by various markers of inflammation including C-reactive protein (CRP);^{8,9} and (2) increased CRP levels are independently associated with more frequent BHR.¹⁰ Further support is provided by Aronson and colleagues¹¹ who found a strong inverse relationship between CRP levels and quartiles of forced expiratory volume in 1 s in 1131 subjects without pulmonary disease. Aronson *et al*¹¹ proposed that systemic inflammation may be linked to early perturbations of pulmonary function.

Another possibility is that individuals with BHR are inactive in order to minimise or avoid respiratory symptoms, particularly breathlessness, cough and/or wheezing. The prevalence of exercise-induced symptoms in individuals with asthma, a disease characterised by BHR, ranges from 40% to 90%.⁶ Certainly, many patients with airway disease (asthma or chronic obstructive pulmonary disease) acknowledge, upon questioning, that their sedentary lifestyle is due in large part to the desire to prevent the unpleasant experience of breathing difficulty. It is possible that some individuals with BHR share this same attitude or concern. Shaaban and colleagues considered this possibility and found similar results after excluding 127 subjects who reported that they avoided exercise because of wheezing or asthma. However, elimination of only 4.6% of the population would probably have a very small impact on the overall results.

Whether physical activity provides an anti-inflammatory effect on inflamed airways and alters BHR is an intriguing proposition. The results of the study by Shaaban and colleagues add to the indirect evidence that physical activity may prevent or modify airway inflammation. However, the magnitude of this effect may be modest and may only be detected in individuals with BHR and/or

mild asthma. Certainly, anti-inflammatory treatment is standard care for persistent asthma.⁷ In addition, fish oil supplementation has been shown to suppress exercise-induced bronchoconstriction; Mickleborough and colleagues^{12,13} proposed that this bronchoprotective effect may be attributed to the anti-inflammatory properties of fish oil. Although additional studies are needed, a randomised controlled trial with physical activity as the intervention and markers of airway inflammation together with prevention or modification of BHR as outcomes is probably not feasible or realistic.

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