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Diet as a risk factor for atopy and asthma

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It has been hypothesized that decreasing antioxidant (fruit and vegetables), increased n-6 polyunsaturated fatty acid (PUFA; (margarine, vegetable oil), and decreased n-3 PUFA (oily fish) intakes have contributed to the recent increases in asthma and atopic disease. Epidemiologic studies in adults and children have reported beneficial associations between dietary antioxidants and lipids and parameters of asthma and atopic disease. The associations with n-6 and n-3 PUFA appear to be very complex and might differ between asthma and atopic dermatitis. Dietary antioxidants are probably exerting antioxidant and nonantioxidant immunomodulatory effects. Dietary lipids exert numerous complex effects on proinflammatory and immunologic pathways. It has also been suggested that atopic dermatitis is associated with an enzyme defect in lipid metabolism. In spite of this, the results of interventional supplementation studies in established disease have been disappointing, and there is now increasing interest in the possibility that dietary antioxidant and lipid intakes might be important in determining expression of disease during pregnancy and early childhood and that dietary interventions should be targeted at these groups. It also seems likely that there is individual variation in the responses of individuals to lipid, and probably antioxidant, supplementation. Further research to determine whether dietary intervention can reduce the risk of asthma and atopic disease is justified. (J Allergy Clin Immunol 2005;115:1109-17.)

Key words: *Asthma, atopic dermatitis, antioxidants, n-3 polyunsaturated fatty acid, n-6 polyunsaturated fatty acid*

During the latter half of the 20th century, throughout prosperous industrialized countries, there were well-documented increases in the prevalence of asthma and the atopic diseases hay fever, eczema, and food allergy.[1-3]

Abbreviations used

DHA: Docosahexaenoic acid
EPA: Eicosapentaenoic acid
NHANES: National Health and Nutrition Examination Survey
PGE_2: Prostaglandin E_2
PUFA: Polyunsaturated fatty acid

The reasons for the increase in these diseases to important economic and public health concerns have stimulated much speculation and research. Although asthma and atopy have genetic determinants, these alone cannot account for recent time trends. Instead, these rapid increases are most likely to be a result of changes in environmental influences, with consequent changes in gene-environment interactions that increase the expression of genetic susceptibility. An increasingly western lifestyle is associated with complex changes in behavior and the environment, and in this review we discuss studies investigating the possibility that dietary change has contributed to the recent increase in asthma and atopy.

THE ANTIOXIDANT AND LIPID HYPOTHESES

In 1994, we argued that the increases in asthma and atopic diseases were unlikely to be a consequence of the air we breathe becoming increasingly toxic.[4] There had been well-documented decreases in atmospheric pollution and cigarette smoking, and there was little evidence for increased exposure to aeroallergens. Instead, we hypothesized that the increase in asthma and atopy had resulted from increasing population susceptibility. We noted that the increase in asthma and atopy had been preceded and paralleled by changes in the UK diet. There had been a decrease in vegetable consumption, particularly of potatoes and green vegetables (Fig 1).[5] We therefore suggested that a westernized diet increasingly deficient in antioxidants has increased population susceptibility, with consequent large increases in disease prevalence.[4] In support of this, we showed that hay fever had increased in spite of no increase in pollen levels.[6] A proposed mechanism related changes in dietary antioxidant intake to

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