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F&V to prevent allergy and asthma

Numerous environmental factors can be instrumental in the onset of allergic conditions such as asthma or eczema.

While tobacco and other pollutants are well-identified factors, the role of food is not as well known. The first article is from a recent review conducted by an Australian team detailing literature on the consumption of fruit and vegetables and asthma. Two epidemiological studies are then described.

Research by S. Andrusaityte *et al.* relates to a Lithuanian case-control study among 1,489 children aged 4 to 6. After taking into account many confounding factors, including the level of education, the risk of wheezing (but not asthma) in children who eat fruit dropped significantly (-52%). Those who eat nuts saw the risk of eczema drop by 61%.

Finally, the study by V. Garcia Larsen *et al.* partially addresses a very vast cross-sectional study among 143,967 children aged 6 to 7 from 11 Latin American countries. After taking into account a number of confounding factors, such as physical activity, body mass index or the level of maternal education, the consumption of fruit is inversely correlated with the existence of wheezing (-35%), rhino-conjunctivitis (-28%) or eczema (-36%). The consumption of hamburgers or fast food is positively associated with these symptoms!

The assumptions as to the benefit found in observation studies involve the role of antioxidants, flavonoids and microbiota. Fruit and vegetables are always there, even when you least expect them!

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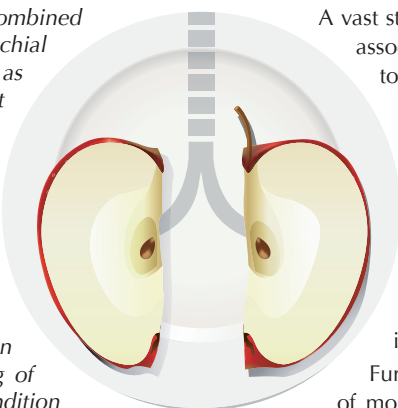
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F&V consumption on asthma, wheezing and immune responses

Asthma is a chronic lung inflammation, combined with a respiratory tract reduction, bronchial hyperresponsiveness and symptoms such as coughing, wheezing, dyspnoea and chest tightness. It is dependent on genetic and environmental factors. In some cases, e.g. exacerbation by viruses, treatments such as glucocorticoids can be ineffective and their prolonged use exposes patients to side effects such as pulmonary superinfection, cataracts and osteoporosis¹. Non-pharmacological measures are therefore necessary to reduce the severity of asthma in adults and children. A better understanding of the role of food in the occurrence of this condition can help manage this chronic inflammatory disease.



A vast study (nearly 70,000 women)⁶ showed inverse associations between asthma and a high intake of tomatoes, carrots and leafy vegetables.

Nagel's international ISAAC study⁷, which includes 50,000 children aged 8 to 12 in 20 countries, showed that the consumption of green vegetables was associated with a reduction in the number of children suffering from wheezing in poor countries only, while fruit consumption was associated with a low wheezing prevalence in rich as well as poor countries.

Furthermore, a one-year prospective study of more than 4,000 children aged 6 to 7 showed that a high intake of tomatoes, fruit and citrus fruits was associated with reduced shortness of breath⁸.

A low F&V consumption can play a key role in the development of asthma and allergies

Numerous studies suggest that under-consumption of F&V can play a pivotal role in the development of asthma and allergies. This recent literature review by an Australian team assesses the link between the consumption of F&V and the risk of asthma, wheezing and immune responses. The studies published until June 2016 were collected from international databases.

58 studies were ultimately listed: 30 cross-sectional studies, 13 cohort studies, 8 case-control studies and 7 intervention studies. Most of them (n=30) found beneficial links between a high intake of F&V and the risk of asthma and/or respiratory function, while 8 found no significant connection. Twenty studies report mixed results, showing a negative link between the consumption of fruit or vegetables alone and asthma.

In addition, meta-analyses in adults and children showed inverse associations between fruit consumption and the risk of wheezing prevalence and asthma severity^{2,3}. Similarly, the consumption of vegetables was negatively associated with the risk of developing asthma. Seven studies examined immune responses in relation to the consumption of F&V in asthma: 6 showed a protective effect against systemic or respiratory inflammation.

Beneficial effects of F&V in asthma

A cohort study carried out in Greece⁴ monitored children from birth to the age of 18. It showed that the daily intake of F&V over the previous 12 months was inversely associated with asthma at the age of 18.

Knekt *et al.*⁵ found a lower incidence of asthma in nearly 400 adults aged 30 to 69 associated with an increased intake of flavonoid-containing food (provided in particular by oranges, apples, grapefruit, onions, cabbage, berries and juices). The strongest associations were observed for apple and orange intakes.

Consumption of F&V during pregnancy and risk of asthma in children

Inverse associations between the incidence of medically diagnosed asthma in children and a higher intake of F&V by the mother during pregnancy were reported by Fitzsimon *et al.*⁹.

According to Willers, the consumption of apples in 1,212 pregnant women reduced wheezing and asthma in children, as confirmed by a physician. No association however was demonstrated with the mother's consumption of vegetables¹⁰. Yet, another study showed that the consumption of vegetables more than 8 times a week was inversely correlated with persistent wheezing, without finding any association with fruit consumption¹¹.

Protective effects of F&V on asthma: role of antioxidants

The protective effects of F&V on asthma and pulmonary function are explained by various mechanisms. More specifically, fresh F&V are rich in a combination of various antioxidants such as vitamins C and E (found in particular in corn, tomatoes, spinach, broccoli, kiwis, mangoes) and carotenoids (including lycopene, a powerful antioxidant, especially concentrated in tomatoes, red fruits, watermelon, apricots and pink grapefruit). Flavonoids (F&V polyphenols with powerful antioxidant and anti-inflammatory properties), isoflavonoids and phenolic compounds are also involved¹².

Asthmatics suffer from high oxidative stress which increases during acute exacerbations. This is why a high intake of antioxidants may be beneficial¹³.

Additional studies are required to improve the identification of the biological mechanisms responsible for the effects of the consumption of F&V on asthma.

Based on: Hosseini B, Berthon BS, Wark P, Wood L. Effects of Fruit and Vegetable Consumption on Risk of Asthma, Wheezing and Immune Responses: A Systematic Review and Meta-Analysis. *Nutrients* 2017. 9, 341.

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How can diet and maternal education impact allergies among preschool children?

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Childhood asthma and allergy: a large public health burden

The prevalence of asthma and allergy has increased among children. Environmental factors, particularly unhealthy nutritional family habits during the prenatal and early life, changes of lifestyle behaviors and dietary patterns might be the cause of this increase. Although evidences are unclear until now, nutrition could be responsible of the development of asthma and allergic disease. Several studies have shown that an increased fruit and vegetable consumption has a beneficial effect on asthma and allergy in children^{1,2}.

The major aim of this case-control study was to investigate the relationship between the consumption of fruit, vegetables, nuts, meat and fish, and the prevalence of wheeze, asthma, and eczema among 1489 preschool children aged 4-6 years. To do so, children's parents have responded to questionnaire to collect information on allergic diseases, dietary pattern, and other variables.

Fruit, vegetables and nuts consumption has a positive effect on allergy diseases

Results have shown that 83.3% of the studied children consume fresh fruit and/or vegetables at least three times per week. Fruit consumption was found to have beneficial effect on wheeze. In addition, children who ate fruit, vegetables, nuts and meat had a lower risk of asthma than those who did not. These results are in accordance with another study, the PIAMA birth cohort study, which found a less asthma risk among school age children

who consumed continuously high amount of fruits since infancy comparing to those who did not³. This could be explained by the fact that vegetables and fruit contain antioxidant vitamins, especially vitamins A, C, and E and carotenoids, as well as other antioxidants like selenium and flavonoids that may have beneficial effects on asthma, wheezing symptoms, and the respiratory function^{4,6}.

Moreover, a lower 61% risk of eczema was found among children who consume nuts. This result is coherent with the finding of another study that showed an association between an increased consumption of vegetables and nuts, and a decreased in the symptoms of wheezing and other allergic diseases⁷.

Children with high-educated mother consume more F&V

Sixty-one percent of women who participated in this study were highly educated. Asthma was physician-diagnosed in 10.7% of families in the group having a low education level, while in high educational level group the prevalence of physician-diagnosed asthma was 5.7%. Furthermore, the study revealed that children of higher-educated mothers have a weekly consumption of fruit and vegetables more important than those of medium and low educated mothers. These findings confirm the results of a cross-sectional Norwegian study that found a lower fruit and vegetables consumption in families with a lower socioeconomic status⁸.

Promote diet intervention for allergy prevention

The study's findings support the idea to have future interventions for allergy preventions by focusing on specific early-life diets.



Based on: Andrusaityte S, Grazuleviciene R, Petravičienė I. Effect of diet and maternal education on allergies among preschool children: A case-control study. *Environmental Research* 2017. 159: 374-380

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Fruit and vegetable intake and asthma - evidence from Europe and Latin America

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Asthma is a chronic disease of the airways, characterised by recurrent attacks of breathlessness and wheezing. The disease affects a growing number of children and adults from affluent nations and from low- and middle- income countries, causing a burden on quality of life and a health cost. Fruit and vegetable (F&V) intake is widely recommended to preserve health and reduce the risk of diseases. There is increasing evidence suggesting that specific components found in F&V preserve lung function, thus reducing the risk of chronic respiratory diseases later in life. Due to their rich content of nutrients and bio-compounds with antioxidant and anti-inflammatory, it is possible that F&V might also help reduce the risk of asthma or attenuate its related symptoms. Asthma, however, is a complex, multi-factorial disease, often presented with allergic conditions (eczema, food allergies), which are difficult to manage and prevent. This article summarises the evidence from two multi-national studies that examined the association of F&V intake in European adults, and in Latin American children.

Association of F&V intake and asthma in European adults – The GA2LEN Study¹

In the European Global Asthma and Allergy Network of Excellence (GA2LEN) Study¹, investigating risk factors for allergic diseases, 3,206 adults answered a questionnaire on respiratory symptoms and general health. An asthma score was built based on their answers on self-reported asthma symptoms (increasing from 0 to 5). Chronic rhino-sinusitis (CRS) was also studied. Using an internationally validated food frequency questionnaire (FFQ), usual intake of a list of 68 F&V was enquired. Using statistical models of regression, the association of F&V intake (≥ 5 times/week vs. less often) and asthma score and CRS was investigated, taking into account the potential confounding effect of variables such as body mass index, total energy intake from diet, and socio-economic status, amongst other factors.

In this sample, 22.8% of participants reported having at least 1 asthma symptom (asthma score ≥ 1), whilst 19.5% had CRS. After adjustment for potential confounders, the study reported

that having a higher asthma score (i.e. more asthma symptoms) was negatively associated with intake of total fruits. Similarly, participants were less likely to have CRS if they consumed dried fruits more often. After taking into account multiple testing, these associations were no longer statistically significant.

Association of F&V intake and asthma-related symptoms Latin American children – the ISAAC Phase III Study

In the Latin American arm of the worldwide International Study of Allergy and Asthma in Children (ISAAC) Phase III², the association of F&V intake and asthma-related symptoms was investigated in a sample of younger (6-7y) and older (14-15y) children from eleven countries. Information on dietary habits and current wheeze, chronic rhino-conjunctivitis, and eczema, was collected through standardised questionnaires.

The study reported findings from over 140,000 children. The risk of having current wheeze was lower in younger, and in older children (15% and 11%, respectively) who reported eating fruits ≥ 3 times/week, compared to those who ate fruits less often. In children aged 6-7y, a regular intake of vegetables (≥ 3 times/week) was also associated with a lower prevalence of current wheeze. A more frequent intake of fruits in this group was also associated with a 36% lower prevalence of eczema. Conversely, intake of fast-food was positively associated with a higher prevalence of wheeze in adolescents.

This study showed that a higher intake of F&V was associated with a lower prevalence of allergic symptoms in Latin American children.

F&V consumption might reduce asthma and allergic symptoms

A higher intake of F&V might contribute to reduce the burden of asthma and some allergic symptoms. The findings from these population-based studies in children and adults suggest that a diet generous in F&V should be encouraged from childhood.



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