

Vitamin E and other nutritional solutions for airways disease

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What is Asthma?

Asthma is...

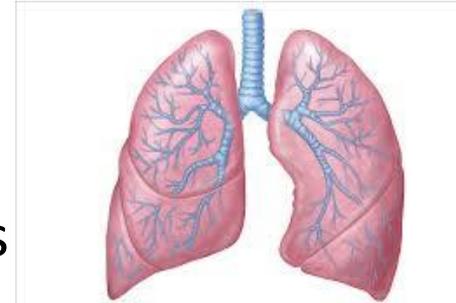
a chronic inflammatory disorder of the airways

Inflammation occurs in asthma because..

asthmatics exhibit an exaggerated immune response to stimuli (e.g. air pollution, allergens, viruses).

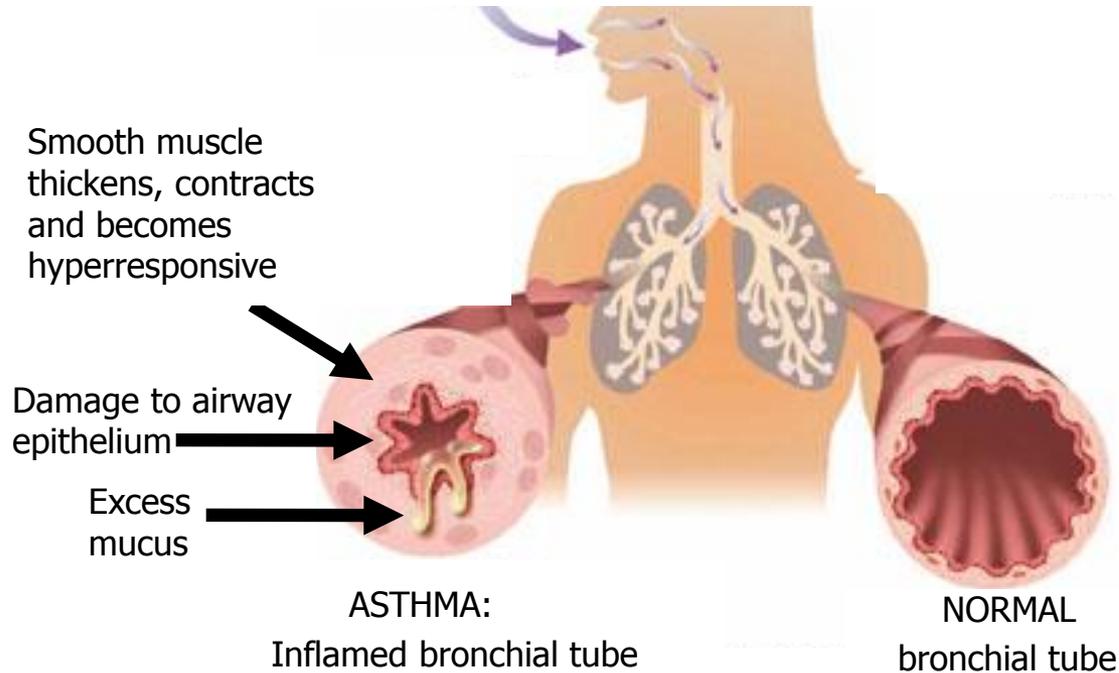
Chronically inflamed airways become hyperresponsive

and have limited airflow, leading to recurrent episodes of wheezing, breathlessness, chest tightness and coughing.



What is Asthma?

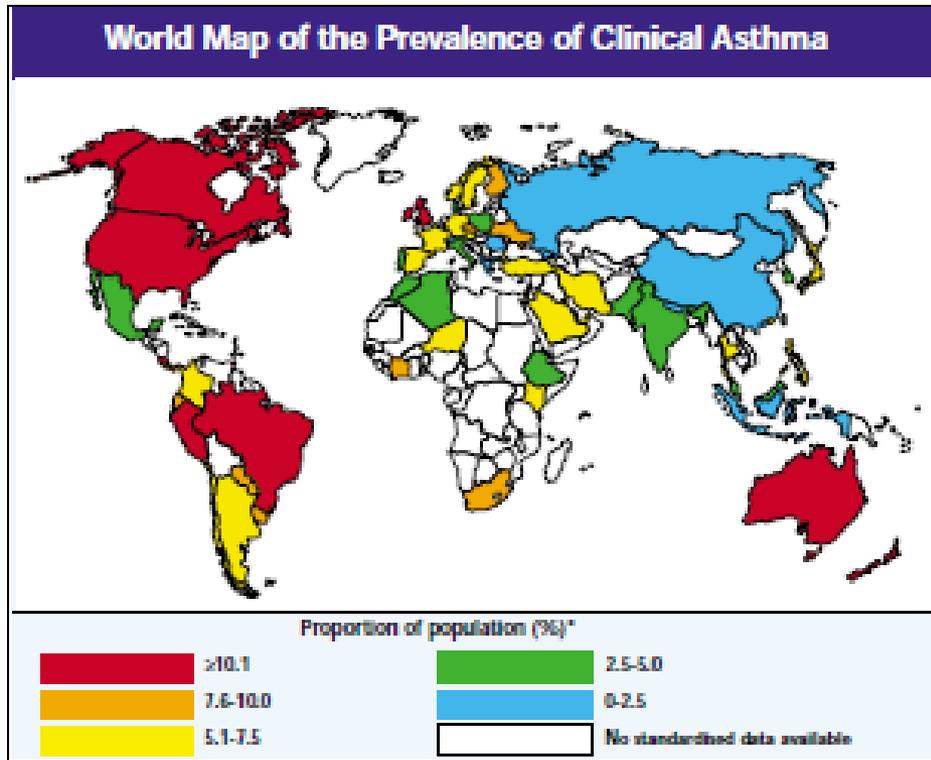
Air enters respiratory tract via mouth and nose and enters bronchial tubes



Key goal of asthma management is...

to prevent asthma exacerbations or asthma 'attacks':
ie acute worsening of inflammation, lung function, symptoms

Global Burden of Asthma



Host Factors:

genes
gender

Environmental:

allergens
infections (early childhood)
occupational exposure
smoking

air pollution

diet

- Affects 300m people worldwide
- Prevalence: increased over time, higher in westernised countries
- Migration to western countries can lead to asthma

Westernised Diets

- High in fast or 'processed' foods
- Low in fruit and vegetables
- Low in wholegrains
- Low in fish

Diet
Quality

DIETARY SATURATED FAT
REFINED CARBS
(SUGARS)

ANTIOXIDANTS
FIBRE
OMEGA-3 FATS

Types of Antioxidants

Dietary

- Vitamin C
- Vitamin E
- Carotenoids/ Flavonoids



Endogenous

- GSHPx
- SOD
- Catalase
- Glutathione

Antioxidant/ oxidant imbalance → oxidative stress

Vitamin E Sources

Vitamin E = a group of lipid soluble compounds including tocopherols and tocotrienols; α -tocopherol is the most biologically active form



Wheat Germ



Sunflower Seeds



Almonds



Hazelnuts



Peanuts



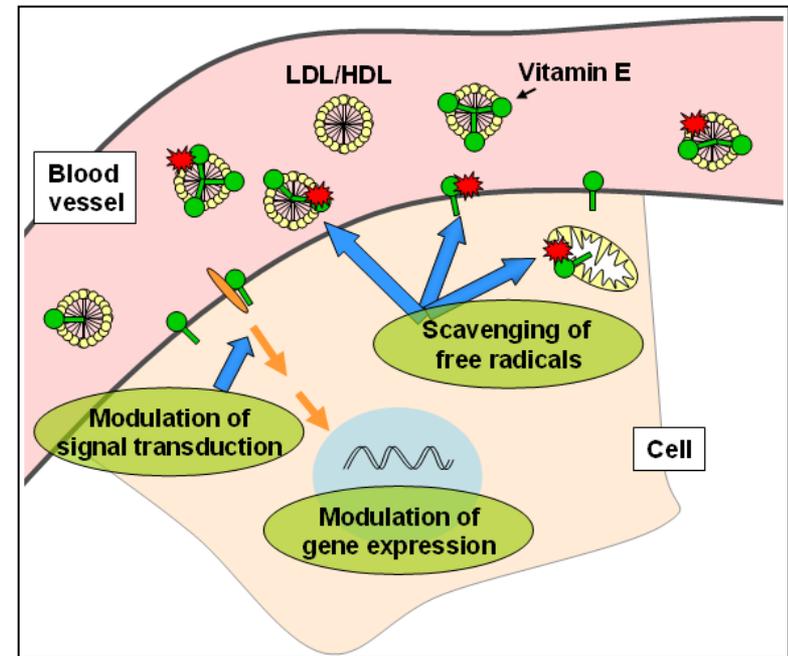
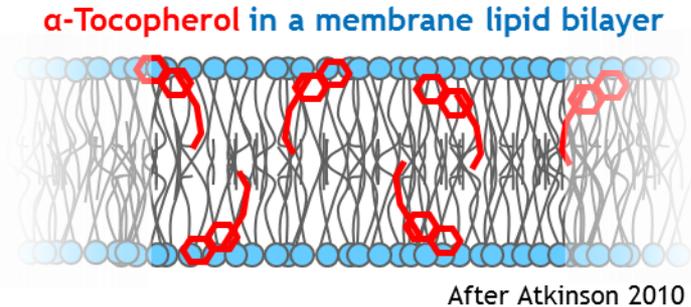
Olive oil



Sundried Tomatoes

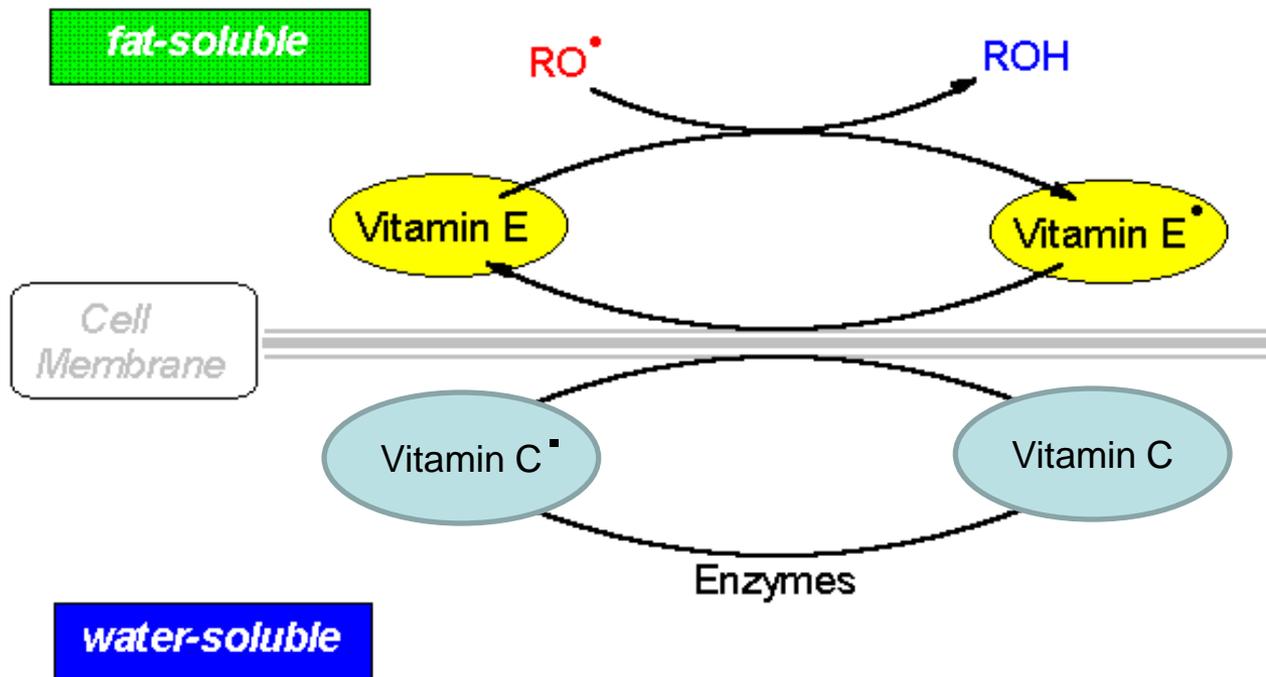
Vitamin E Functions

- Due to its lipophilic nature, vitamin E localizes to lipid compartments, such as cell membranes (prevention of peroxidation of lipids and oxidation of proteins).
- Furthermore, vitamin E depletion and repletion affects gene expression in vitro in cells and in vivo in animal models, indicating broader effects than just protection from oxidation.
- Incorporation of vitamin E into cellular membranes can alter the activity of membrane-associated proteins and thereby changes signal transduction pathways.



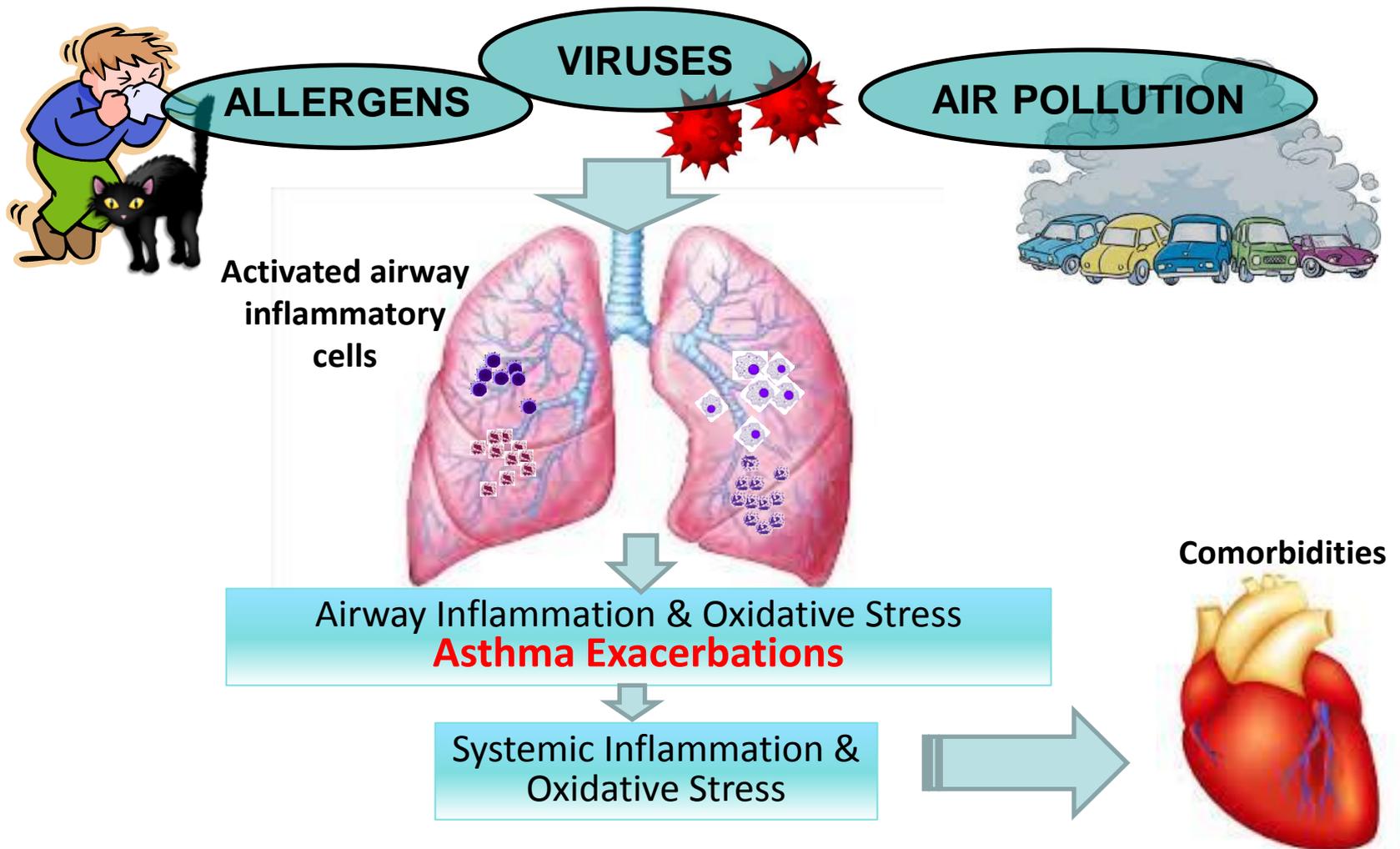
Vitamin E Functions

- Vitamin E/ Vitamin C interaction:



(Dept of Chemistry, University of York)

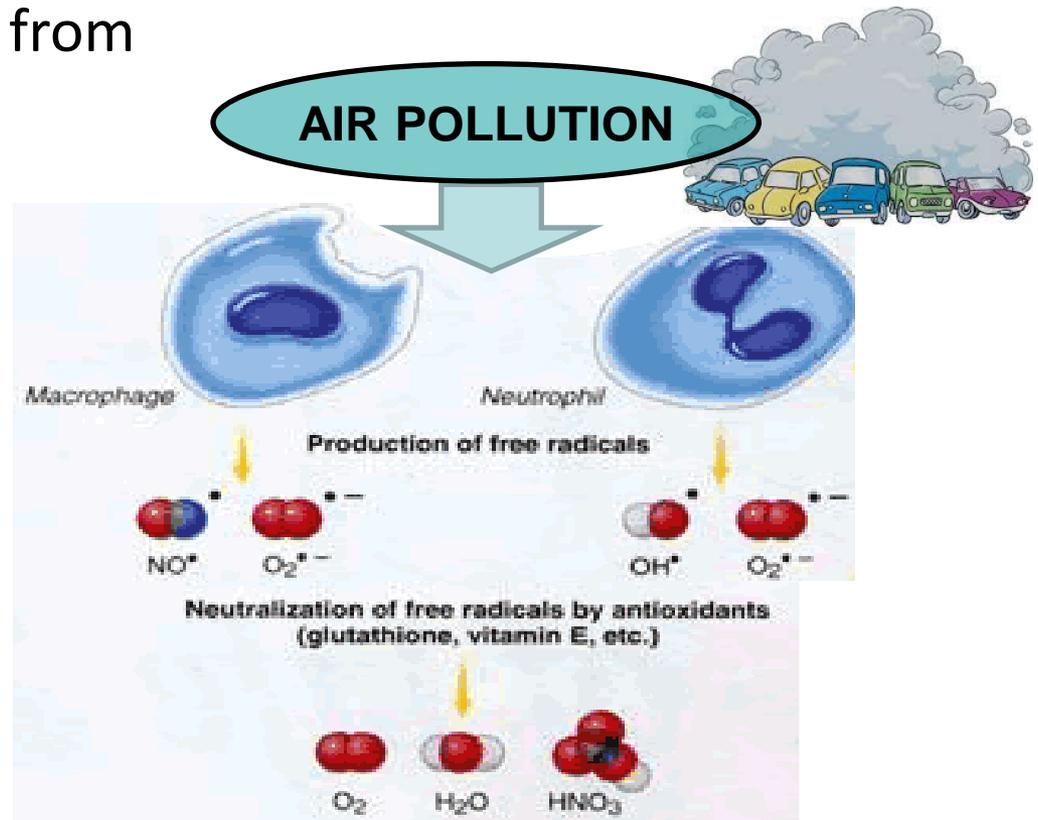
Asthma, Inflammation and Oxidative Stress



(Wood Lipids 2000; Wood Am J Resp Crit Care Med 2005; Wood Chest 2011)

Why are Antioxidants Important in Asthma?

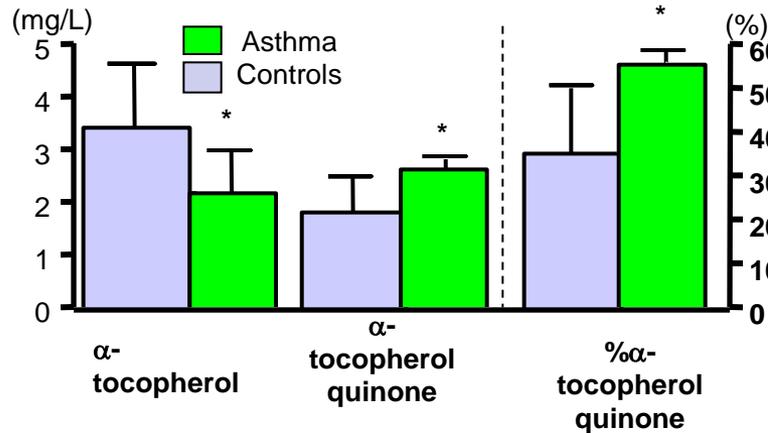
- Activated inflammatory cells release free radicals in asthma
- AO can protect cells from free radical damage



Asthma and Antioxidants

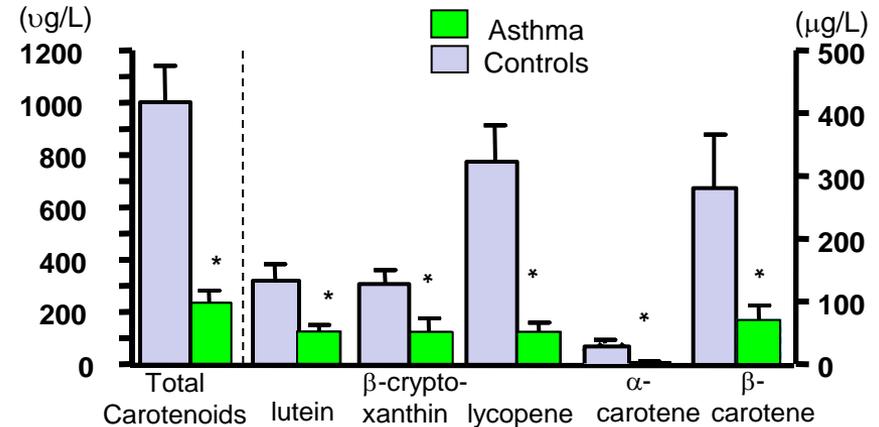
α -tocopherol (whole blood)

(Wood, Clin Nutr, 2005)



Carotenoids (plasma)

(Wood, JACN, 2005)



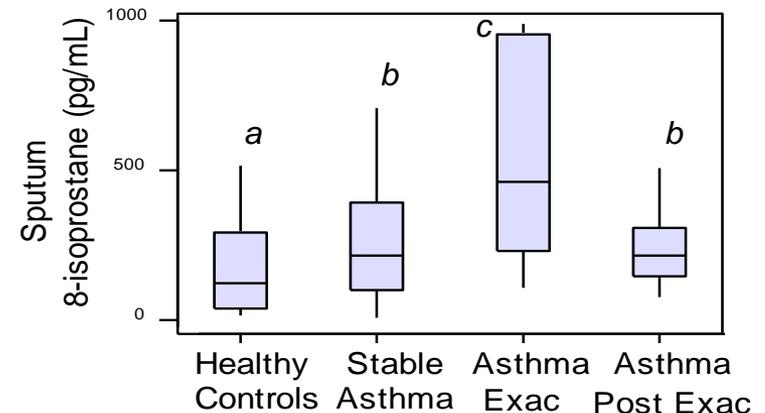
Many observational studies link reduced dietary AO levels to asthma: eg vit C, E, carotenoids, selenium

(Hu 2000; Huang 2001; Troisi 1995; Hijazi 2000; Shaheen 2001, Wood 2005, Wood 2008)

- antioxidant therapy?

Airway oxidative stress

(Wood, Am J Resp Crit Care Med, 2005)



Asthma and Antioxidants

Vit E & C intervention:

RCT in children with asthma (n=158) in Mexico City, for 12 weeks
50 mg/day of vitamin E and 250 mg/day of vitamin C or placebo
(Romieu, *Am J Resp Crit Care Med*, 2002)

Results:

Placebo: Ozone levels were inversely correlated with lung function.

Active: No association between ozone and lung function

Asthma and Antioxidants

Whole food intervention (High vs Low AO diet):

(Wood, *Am J Clin Nutr*, 2011)

RCT, n=136 asthmatics for 3 months

High AO diet (≥ 5 veg & ≥ 2 fruit serves/day + increase AO-rich foods) vs
Low AO diet (≤ 2 veg & ≤ 1 fruit serve/day + avoid AO-rich foods)

Results:

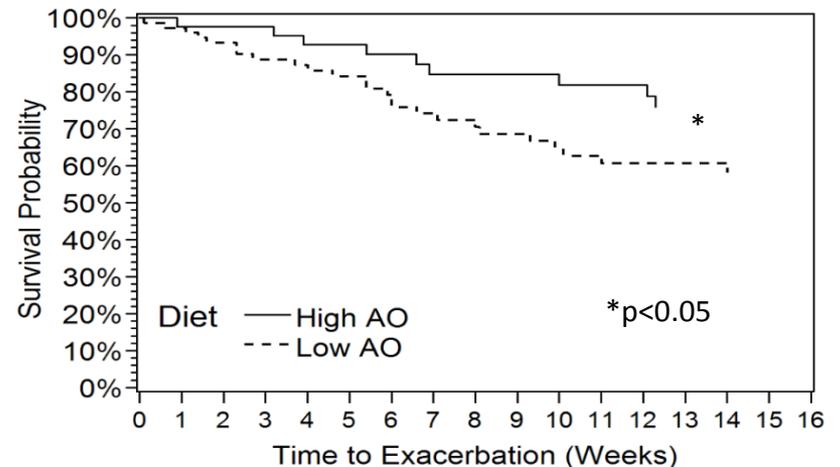
High vs Low AO diet:

↑ B grp vit, vit C, β -carotene intake

↑ plasma vitamin E levels

↓ exacerbation risk

→ AO combinations important



Other Nutrients Linked to Asthma

Omega-3 FA

Observational studies:

- Omega-3 intake is associated with improved lung function, decreased asthma risk and wheeze in some studies (*eg Schwartz, 94, 2000; Yu, 1996*)

Supplementation studies:

- No studies have examined the effect of omega-3s on asthma exacerbation risk (*Cochrane, 2011*)



Vitamin D

Observational studies:

- Some studies show an association between asthma risk or reduced lung function and low vitamin D levels (*Black 2005; Brehm 2009*)

Supplementation studies:

- Only one study to date: rate of first exacerbation reduced in vitamin D3 responders *only* (25-hydroxyvitamin D >30ng/mL) (*Castro, 2014*)



Systemic effects of air pollution: nutritional approaches

- **Vitamin E** (800mg/day) and **vitamin C** (500mg/day) reduced systemic oxidative stress (SOD, GSHPx enzyme activity restored)
(Possamai 2010)
- **Omega-3** polyunsaturated fat (2 g/day) improved HRV and antioxidant defences (SOD and GSHPx enzyme activity)
(Romieu 2005, Romieu, 2008)
- **Vitamin B6 and B12** intake associated with improved HRV
(Baccarelli 2008)

Summary & Conclusions

Exposure to air pollution, causes airway and systemic inflammation, oxidative stress and asthma exacerbations

Antioxidants:

- *Observational studies:*
Dietary AO deficiencies occur in asthma (vit C, E, Se, carotenoids)
- *Supplementation studies:*
 - Vitamin E and C combination attenuated ozone-associated lung function decline in asthma
 - Whole food antioxidant intervention was effective in:
 - increasing levels of micronutrients (vit C, E, B grp, β -carotene)
 - reducing asthma exacerbation risk

Other nutrients linked to asthma:

- omega-3 FA, vitamin D – more work needed

Systemic effects of air pollution:

- Omega-3 FA, B group vitamins, vitamin E and C, some evidence for benefit – more work needed

Conclusions

- Health effects of air pollution an increasing global problem
- Nutrient *combinations* likely to be important in protecting against air pollution;
in particular Vitamin E, C and omega-3 show promise
- High AO dietary pattern adopted during asthma intervention routinely consumed by only ~5% population
- Role for supplementation?