

Nutritional modulation of inflammation in airways disease

A/Professor Lisa Wood

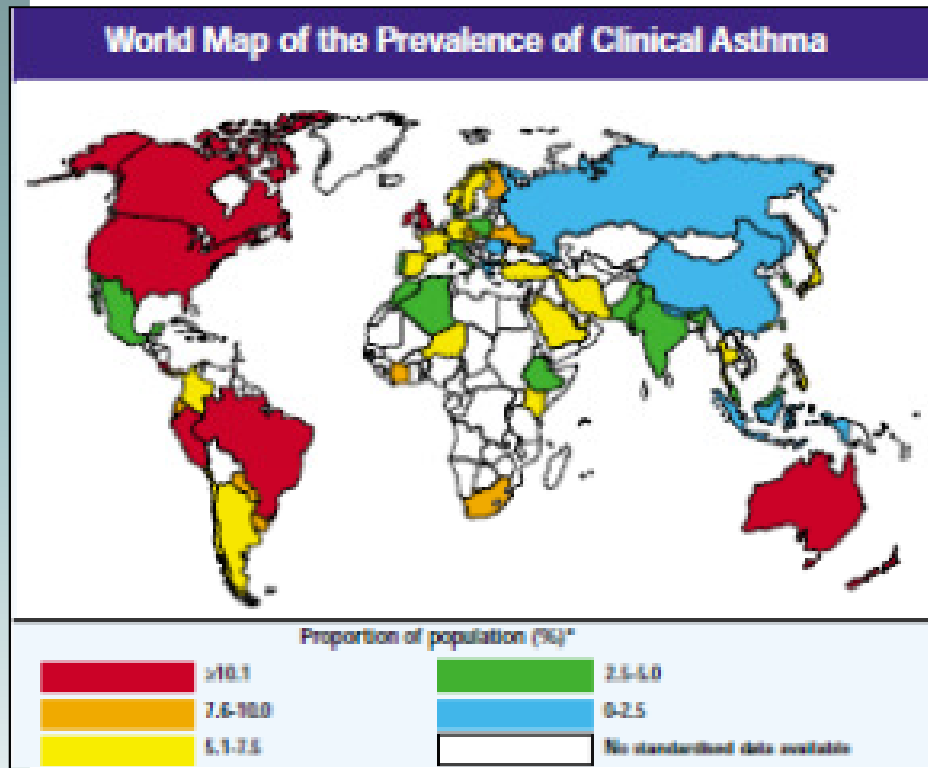
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Outline

- **Asthma, Inflammation & Air Pollution**
- **Asthma and:**
 - **Antioxidants**
 - **Omega-3 fatty acids**
 - **Vitamin D**
- **Summary and Conclusions**

Global Burden of Asthma



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

Host Factors:

genes
gender

Environmental:

allergens
infections (early childhood)
occupational exposure
smoking

air pollution

diet:

- low AO intake
- low omega-3:omega-6
- saturated/ trans fat

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).

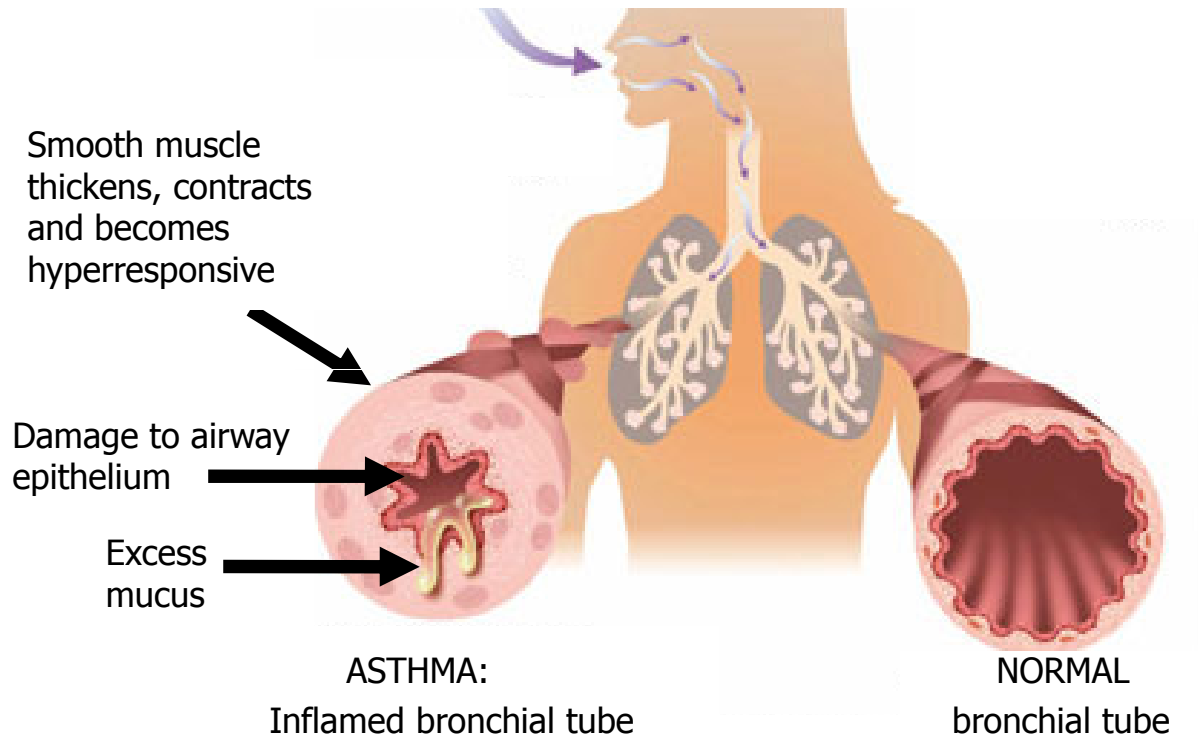
Chronically inflamed airways become hyperresponsive

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



What is Asthma?

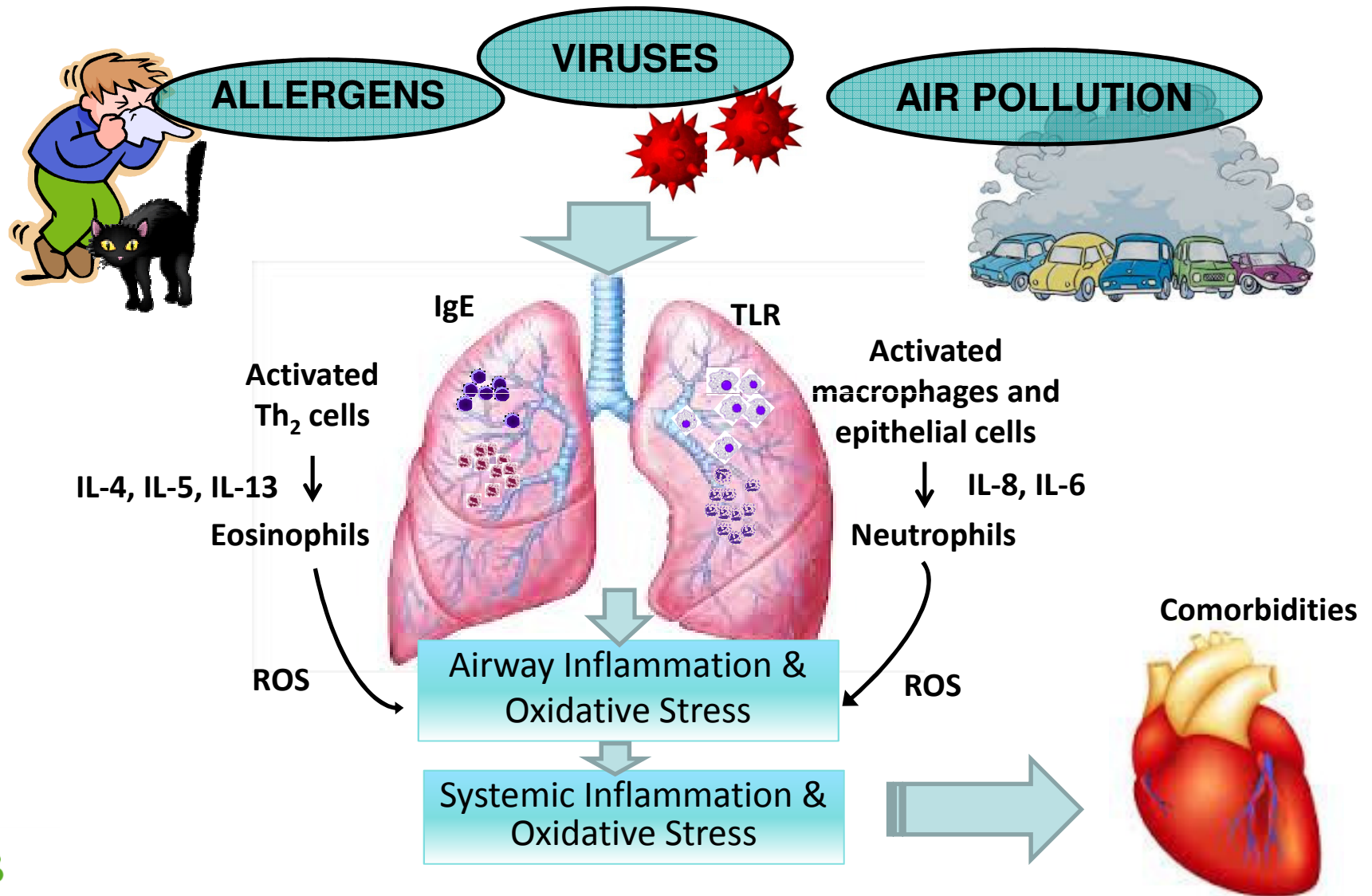
Air enters respiratory tract via mouth and nose and enters bronchial tubes



Key goal of asthma management is...

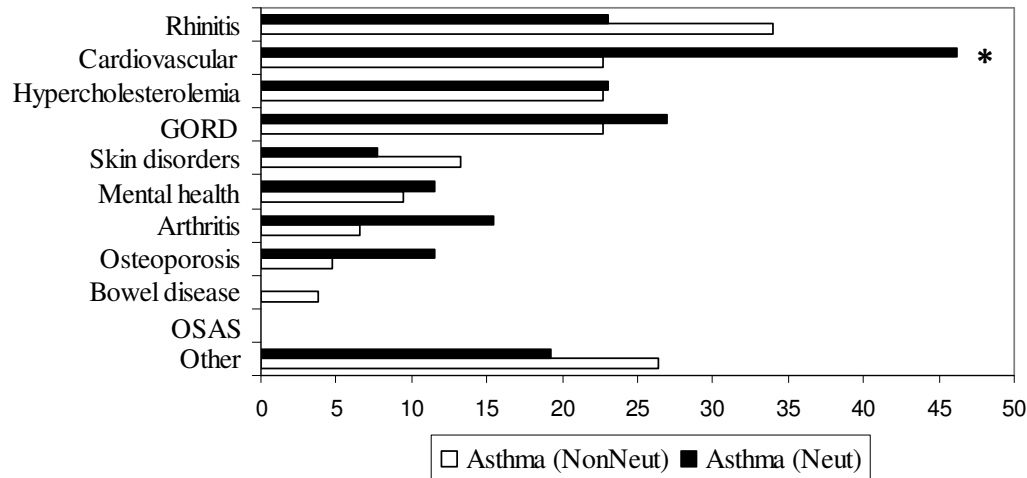
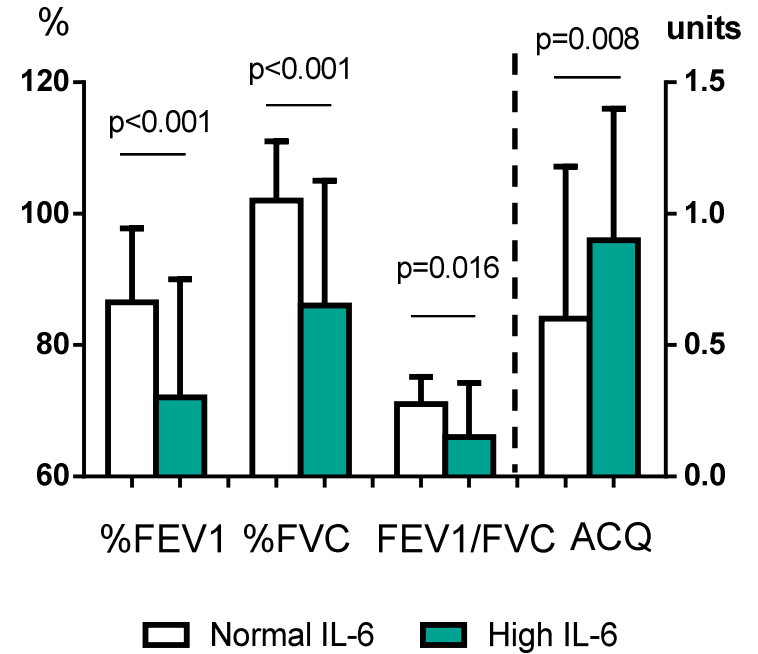
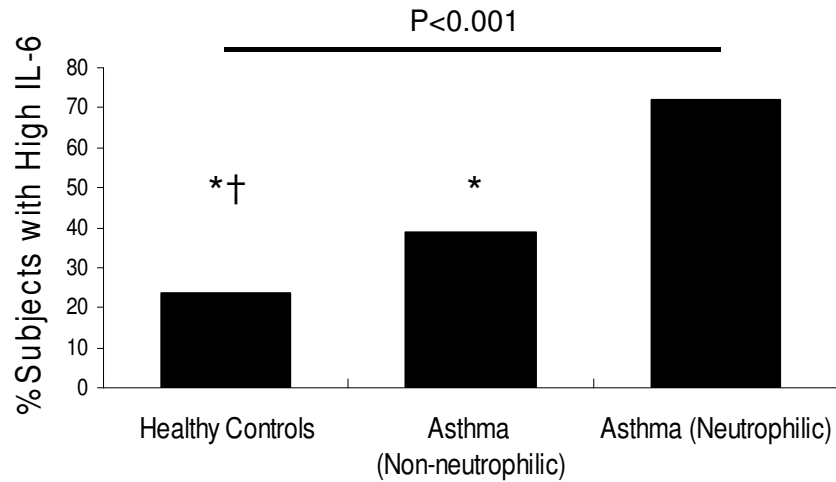
to prevent asthma exacerbations – acute episodes involving deterioration of inflammation, lung function and symptoms.

Asthma and Inflammation



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

Asthma and Inflammation

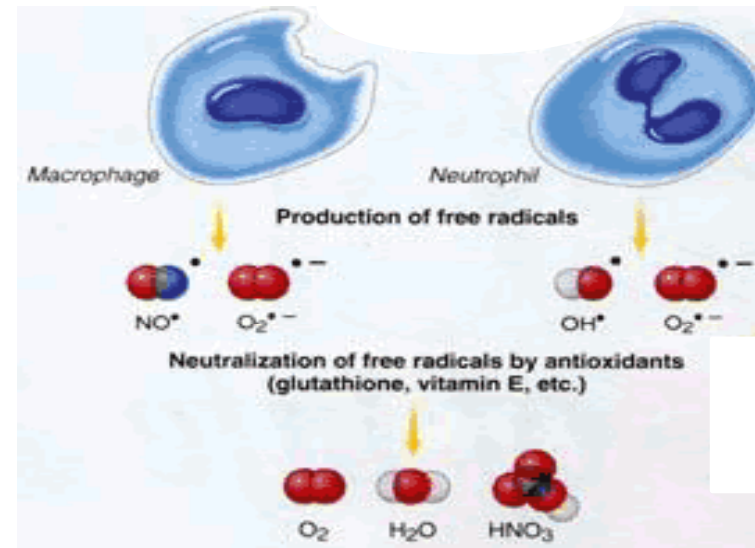
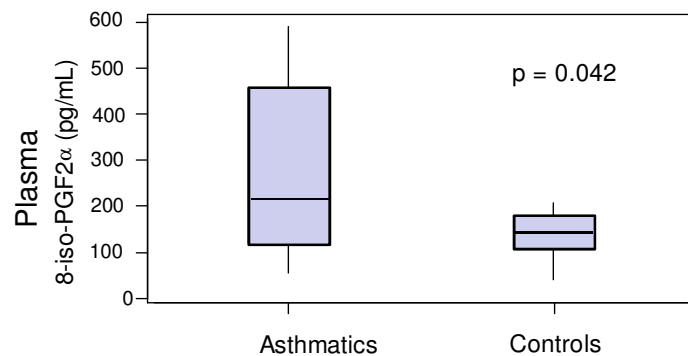


(Wood Chest 2011)

Asthma and Antioxidants

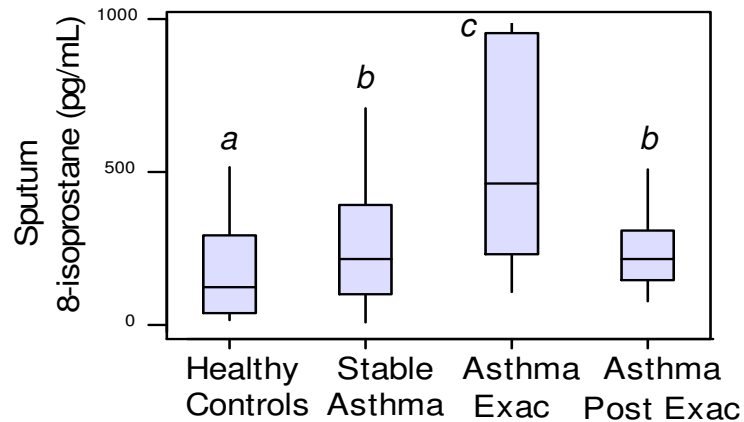
Systemic oxidative stress in asthma

(Wood, Lipids, 2000)



Airway oxidative stress in asthma

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



Activated inflammatory cells in asthma

- host AO defences overwhelmed
- antioxidant therapy?

Asthma and Antioxidants

Many observational studies link reduced levels of dietary AO to asthma:

- Vitamin C, E
- Carotenoids
- Selenium

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

BUT....

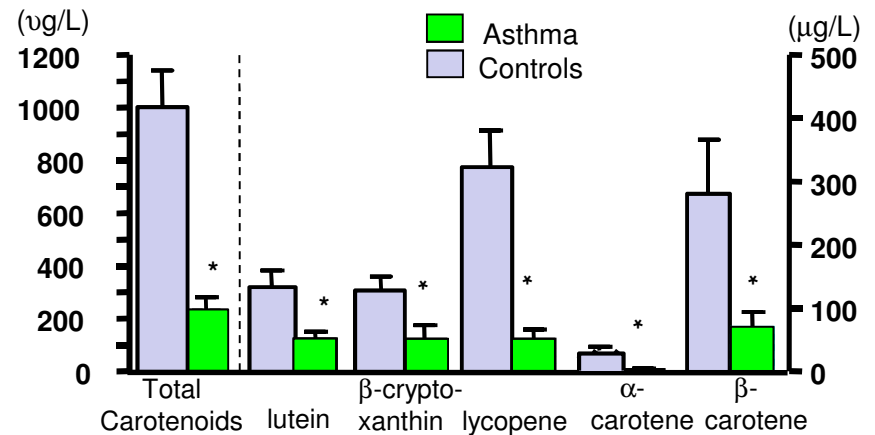
AO supplementation studies limited or no efficacy:

Vitamin C and E, Se

(Kaur, 2009; Shaheen, 2007; Pearson, 2004)

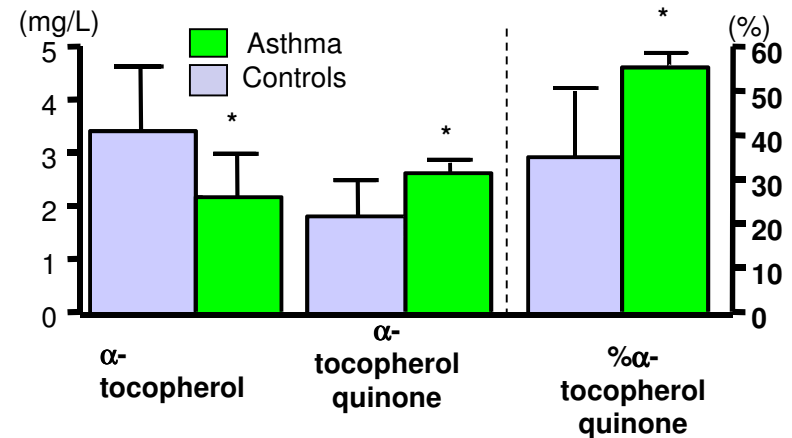
Carotenoids (plasma)

(Wood, JACN, 2005)



α -tocopherol (whole blood)

(Wood, Clin Nutr, 2005)



Asthma and Antioxidants

Whole food intervention effective (*Wood, Am J Clin Nutr, 2011*)

n=136 asthmatics

RCT: High vs Low AO diet for 14 wk

High vs Low AO diet:

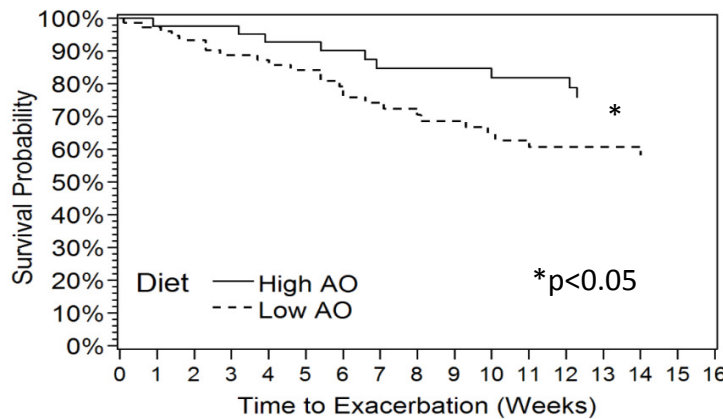
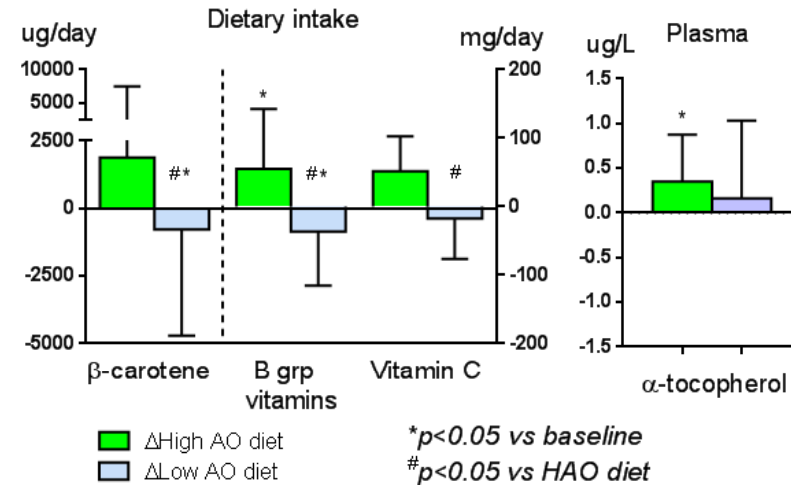
↑ B grp vit, vit C, β-carotene intake

↑ plasma vitamin E levels

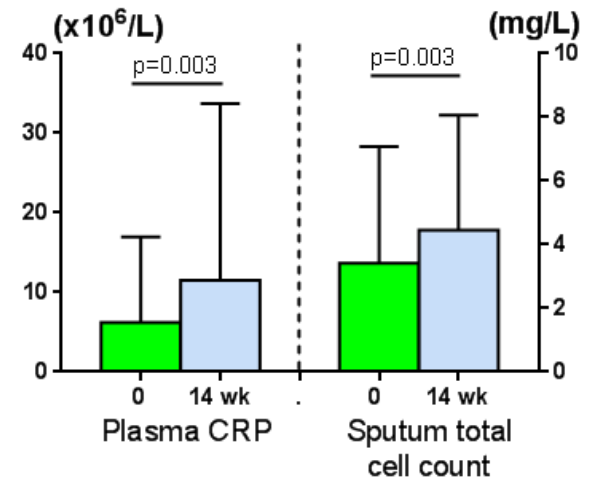
Low AO diet: ↑ exacerbation risk

↑ inflammation

→ AO combinations important



Low AO diet group:



Asthma and Antioxidants

Summary

Observational studies:

- Dietary AO deficiencies occur in asthma (vit C, E, Se, carotenoids)

Supplementation studies:

- To date have focused on single nutrients (vitamin C, E and Se) and results are disappointing
- Whole food antioxidant intervention was effective in:
 - increasing levels of micronutrients (vit C, E, B grp, β -carotene)
 - protecting against inflammation
 - reducing asthma exacerbation risk

→ Multiple antioxidants likely to be important *in combination*
- Dietary pattern adopted during intervention routinely consumed by only 5% population
→ Role for supplementation?



Asthma and Omega-3 FA

Summary

Preclinical studies:

- Omega-3 FA suppress inflammatory response to asthma triggers: allergens (*Wood et al, 2010, Clin Exp Allergy*); viruses (*Saedisomeolia, Wood et al, Brit J Nutr, 2009*)

Observational studies:

- Omega-3 fatty acid or fish intake is associated with improved lung function, decreased asthma risk, AHR, wheeze in many (not all) studies (*eg Schwartz, 94, 2000; Yu, 1996*)

Clinical supplementation studies:

- Few available and data inconclusive, however no studies have examined the effect of omega-3s on exacerbation risk (*Cochrane, 2011*)
- Omega-3 to reduce asthma exacerbation risk ??



Asthma and Vitamin D

Summary

Observational studies:

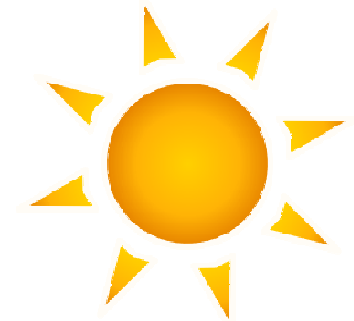
- Some studies show an association between asthma risk or reduced lung function and low vitamin D levels

(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)



Summary & Conclusions

- Nutritional deficiencies linked to asthma include: vitamin C, vitamin E, Se, carotenoids, omega-3 FA, vitamin D
- Supplementation studies using individual nutrients show limited or no efficacy, while whole food intervention (leading to increased vitamin C and E, β -carotene and B group vitamin levels) reduced asthma exacerbation risk \rightarrow *nutrient combinations* important
- Key outcomes for future nutritional interventions in asthma: reduction in inflammatory biomarkers (airway and systemic) and reduction in exacerbation risk

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