

## Healthy eating; healthy people; healthy eyes...

Healthy nutrition is promoted on TV and in magazines. Healthy nutrition reduces risk of cancer, obesity, heart disease, diabetes and so on. However the notion that healthy eating may be beneficial to eye health is still not commonly recognised.

Good diet is essential to eye health and to the health of the visual system. There are many vitamins, minerals and phytochemicals that are essential to good vision. These nutrients can be either synthesised by the body or obtained from dietary sources. Often the body cannot synthesise the appropriate nutrients or cannot do so in sufficient quantities for the body's needs.

If the quantity of nutrient is insufficient then function is impaired, either temporarily or permanently. This can have catastrophic consequences with regards to eyes and vision.

In this issue we take a look at minerals, phytochemicals and free radicals.

### Minerals

Minerals are trace elements that are required in much smaller quantities than vitamins. Minerals are mostly involved in physiologic functions such as carrying electrical impulses or

serving as part of enzyme systems. These minerals must be supplied from external (i.e. dietary) sources and include:

### Zinc Sulphate

Zinc is an essential trace element and is found in dietary sources such as seafood, liver and eggs. It is an essential part of two antioxidant enzymes and is necessary for proper wound healing.

Zinc has been postulated from some studies to be an effective treatment for cataracts, however other studies have shown that elevated ocular zinc concentrations may cause cataract.

Studies appear to strongly suggest that zinc from dietary sources and/or supplementation reduces the visual deterioration in some types of ARMD.

Zinc deficiency leads to symptoms similar to those of vitamin A deficiency. This is linked to the role zinc plays in the regeneration of photopigments (the conversion of retinol to retinal requires the action of a zinc-dependent enzyme). Deficiency may result in

- Night blindness
- Reduced colour perception
- Hyperkeratinisation (thickening) of the lid margins with stenosis (narrowing) of the puncta

- Blepharitis
- Conjunctivitis
- Photophobia

### Selenium

Selenium is important in the functioning of the antioxidant enzyme glutathione peroxidase. This enzyme is particularly important in catalysing the breakdown of peroxide, which can produce ocular tissue damage.

Selenium may also have a role to play in the prevention of ARMD.

### Copper

Copper is an important part of many metalloenzymes and therefore plays an important antioxidant role.

Dietary sources for copper include liver, seeds and nuts.

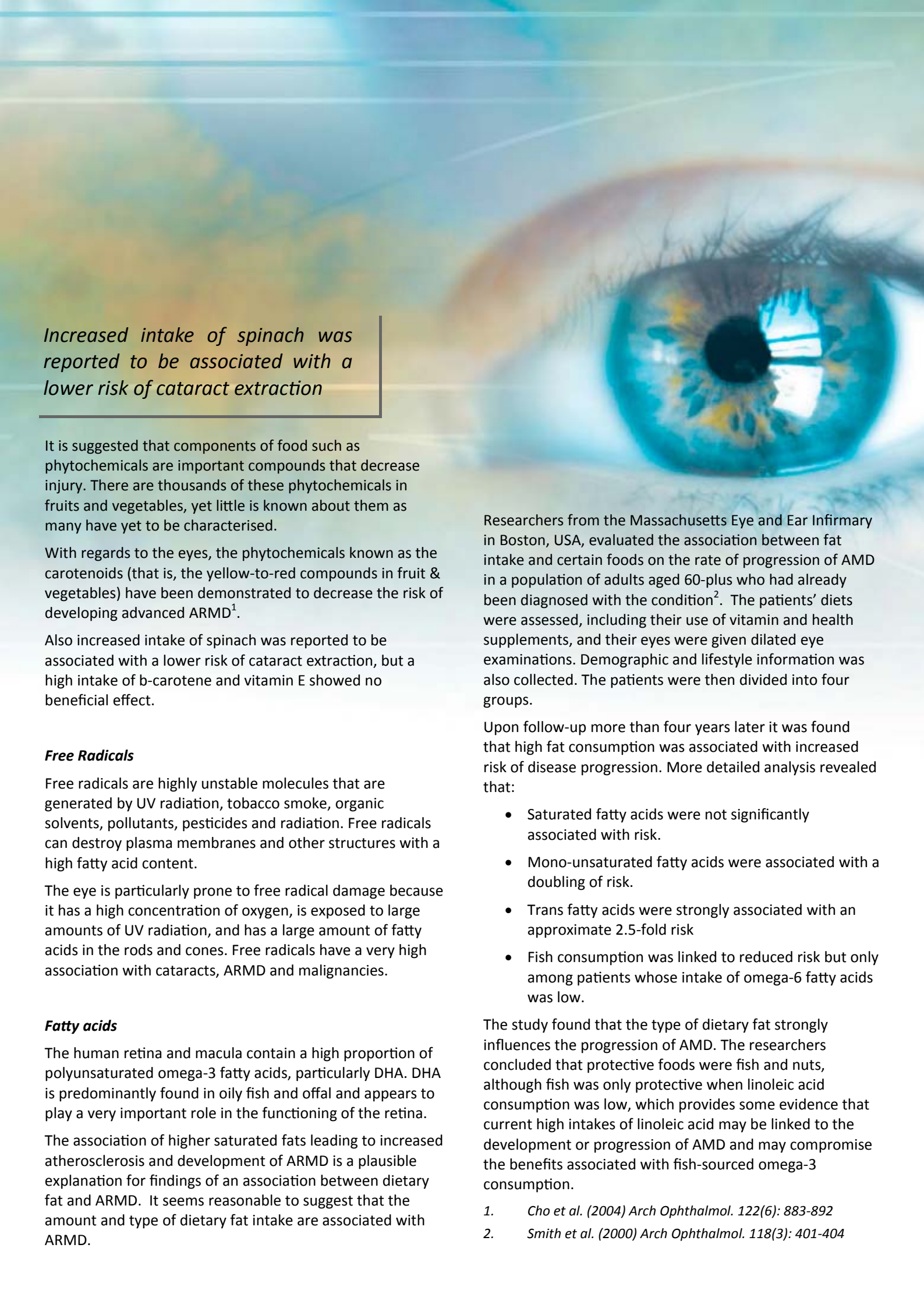
However copper toxicity is potentially fatal, and can certainly cause ocular manifestations in the cornea (Kayser-Fleischer ring) and the lens (sunflower cataract).

### Phytochemicals

Some studies have documented that ingestion of certain foods decreases the risk of diseases related to long-term wear and tear of the body.

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*Increased intake of spinach was reported to be associated with a lower risk of cataract extraction*

It is suggested that components of food such as phytochemicals are important compounds that decrease injury. There are thousands of these phytochemicals in fruits and vegetables, yet little is known about them as many have yet to be characterised.

With regards to the eyes, the phytochemicals known as the carotenoids (that is, the yellow-to-red compounds in fruit & vegetables) have been demonstrated to decrease the risk of developing advanced ARMD<sup>1</sup>.

Also increased intake of spinach was reported to be associated with a lower risk of cataract extraction, but a high intake of b-carotene and vitamin E showed no beneficial effect.

### **Free Radicals**

Free radicals are highly unstable molecules that are generated by UV radiation, tobacco smoke, organic solvents, pollutants, pesticides and radiation. Free radicals can destroy plasma membranes and other structures with a high fatty acid content.

The eye is particularly prone to free radical damage because it has a high concentration of oxygen, is exposed to large amounts of UV radiation, and has a large amount of fatty acids in the rods and cones. Free radicals have a very high association with cataracts, ARMD and malignancies.

### **Fatty acids**

The human retina and macula contain a high proportion of polyunsaturated omega-3 fatty acids, particularly DHA. DHA is predominantly found in oily fish and offal and appears to play a very important role in the functioning of the retina.

The association of higher saturated fats leading to increased atherosclerosis and development of ARMD is a plausible explanation for findings of an association between dietary fat and ARMD. It seems reasonable to suggest that the amount and type of dietary fat intake are associated with ARMD.

Researchers from the Massachusetts Eye and Ear Infirmary in Boston, USA, evaluated the association between fat intake and certain foods on the rate of progression of AMD in a population of adults aged 60-plus who had already been diagnosed with the condition<sup>2</sup>. The patients' diets were assessed, including their use of vitamin and health supplements, and their eyes were given dilated eye examinations. Demographic and lifestyle information was also collected. The patients were then divided into four groups.

Upon follow-up more than four years later it was found that high fat consumption was associated with increased risk of disease progression. More detailed analysis revealed that:

- Saturated fatty acids were not significantly associated with risk.
- Mono-unsaturated fatty acids were associated with a doubling of risk.
- Trans fatty acids were strongly associated with an approximate 2.5-fold risk
- Fish consumption was linked to reduced risk but only among patients whose intake of omega-6 fatty acids was low.

The study found that the type of dietary fat strongly influences the progression of AMD. The researchers concluded that protective foods were fish and nuts, although fish was only protective when linoleic acid consumption was low, which provides some evidence that current high intakes of linoleic acid may be linked to the development or progression of AMD and may compromise the benefits associated with fish-sourced omega-3 consumption.

1. Cho et al. (2004) *Arch Ophthalmol.* 122(6): 883-892
2. Smith et al. (2000) *Arch Ophthalmol.* 118(3): 401-404