

Antioxidants - friend or foe?

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Text

Particularly in the field of advertising and in popular scientific journals, antioxidants such as β -carotene (from carrots) or lycopenes (from tomatoes) and the vitamins C and E are one-sidedly portrayed as substances capable of offering protection against cancer or ageing because they diminish or prevent the effects of free radicals.

However, free radicals should by no means be considered as being exclusively destructive. On the contrary, processes such as energy metabolism (in the respiratory chain) and the defence of neutrophilic granulocytes against pathogens and foreign bodies depend on the formation of free radicals [1], [2].

For this reason alone, it has to be expected that a supply of antioxidants may also cause considerable undesired effects to the skin and the organism.

In addition, "under certain conditions, some anti-oxidants can also exhibit a pro-oxidant mechanism of action" [3], e.g. β -carotene [3] or vitamin C [4], with the question "When is an antioxidant not an antioxidant?" [4].

Many people with above-average consumption of fruits and vegetables undoubtedly demonstrate a lower risk of developing lung cancer. However about 10 years ago, completely unexpectedly two studies on highly dosed β -carotene supplementation had to be abandoned because the risk of lung cancer in smokers had unforeseeably increased following β -carotene supplementation. Further studies in vitro and in vivo were interpreted as showing β -carotene to act as an anticarcinogen, whereas its oxidation product acted as a carcinogen, possibly related to the instability of the β -carotene molecule in the free radical-rich environment in the lungs of cigarette smokers [5].

In a large-scale, multicenter, double-blind, placebo-controlled clinical trial on prevention, 864 persons, whose colon polyps had been removed, received 25 mg of β -carotene or placebo combined with 1000 mg vitamin C + 400 mg vitamin E or placebo on a daily basis. After four years, the following observations could be made concerning supplementation of β -carotene and the development of colon polyps:

- pronounced reduction of the risk for non-smokers and those abstaining from alcohol
- slightly increased risk for smokers or alcohol consumers

- a doubling of the risk for people who smoke cigarettes and consume more than one alcoholic beverage per day [6].

Further clinical studies showed that β -carotene supplementation caused no change in the incidence of non-melanoma skin cancer. As H. S. Black reported, after a β -carotene supplemented diet even a significant exacerbation of the UV-carcinogenesis occurred. A photoprotective effect was not achieved [7].

The artificial supply of antioxidants into the human skin poses further questions. In everyday life, on holidays or at work, large amounts of optical radiation can penetrate into the skin and modify the effects of antioxidants. It has been known for a long time that large quantities of free radicals can be generated in human skin as a result of UV irradiation [8], [9].

The World Cancer Research Fund carried out the largest ever inquiry into lifestyle and cancer, and issued several recommendations. They include the recommendation not to use nutrient supplements for cancer prevention since the risks/benefits ratio cannot be confidently predicted and there may be unexpected and uncommon adverse effects. Increasing the consumption of the relevant nutrients by means of the usual diet should be preferred [10]. The current fact sheet of the U.S. National Cancer Institute states as key points [11]: "Laboratory and animal research has shown antioxidants help prevent the free radical damage that is associated with cancer. However, results from recent studies in people (clinical trials) are not consistent. Antioxidants are provided by a healthy diet that includes a variety of fruits and vegetables."

A systematic review and meta-analysis of the Cochrane Hepato-Biliary Group, Copenhagen [12], which included 68 randomised trials with 232,606 participants (385 publications) concluded: "Treatment with beta carotene, vitamin A, and vitamin E may increase mortality. The potential roles of vitamin C and selenium on mortality need further study."

So far, no adequate randomised, placebo-controlled, multicenter studies or even meta-analyses have emerged which can shed light on the question of whether antioxidants applied in or on the skin can alter phenomena such as ageing or carcinogenesis of the skin in an unfavourable or favourable sense. We still do not know how UV, visible light and infrared or portions or combinations of these may act on modified concentrations of various antioxidants and on their components in the skin. This is a considerable challenge to the field of dermatological research. Or, to quote H. S. Black: "At present, beta-carotene use as a dietary supplement for photoprotection should be approached cautiously" [7].

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