

## Smoking and Vitamin C: *Clarifying the concerns*

The information explosion in the science of nutrition very often creates the impression that available information is contradictory. Consequently, it is no longer easy to distinguish between fact, misinformation and fiction. The Nutrition Information Centre of the University of Stellenbosch (NICUS) was established to act as a reliable and independent source of nutrition information.

### **CIGARETTE SMOKING**

Cigarette smoking is an important cause of death worldwide, accounting for more or less 5 million of the 57 million deaths globally, primarily through heart attacks, strokes and lung disease. In South Africa, smoking accounts for more than 25 000 deaths per year - roughly 5% of the total deaths.

The increased health risks associated with cigarette smoking are well-known and diseases which can be related to this risk include coronary heart disease, cancer and chronic obstructive pulmonary disease, which are among the major killers worldwide. In order to understand this increased risk better, it is necessary to refer to a process called oxidative stress. Oxidative stress is a process during which oxygen triggers the formation of oxidant compounds and free radicals, which have the ability to cause destructive changes in the body. These changes are suspected of initiating some of the early stages of many diseases, including cancer and heart disease.

Cigarette smoke contains an abundance of free radicals and other oxidants. Smokers therefore have a significant exposure to oxidative stress and this may be one of the pathways through which smoking contributes to the development of disease. The direct exposure from cigarette smoke, however, represents only a portion of the oxidative stress experienced by smokers. Emerging evidence indicates that cigarette smoke also contributes to additional oxidant formation in the body through effects on the inflammatory –immune response.

The word ‘antioxidant’ is well-known to most health-conscious individuals. In essence, antioxidants are nutrient substances which prevent the formation of excess harmful oxidants and free radicals in the body. In this way they impede the process of oxidative stress and prevent damage. Some micronutrients (vitamins and minerals) act as antioxidants and represent one line of defense against oxidative stress, such as that which stems from smoking. These micronutrients consumed in the diet may thus act to diminish some of the adverse effects of cigarette smoking. Antioxidant micronutrients that have been the topic of research in relation to smoking are vitamin C, vitamin E and carotenoids.

Vitamin C, also known as ascorbic acid, is a water-soluble vitamin and is essential for normal functioning of the body. Unlike most mammals, humans do not have the ability to produce their own vitamin C and, therefore, must obtain it through their diet. Apart from its antioxidant capacity, vitamin C may also be able to reactivate other antioxidants, such as vitamin E, so that they can be reused by the body. This vitamin is also involved in several enzyme systems for the synthesis of collagen (connective tissues, cartilage, teeth and skin), healing of wounds and conversion of nutrients into their functional forms. Furthermore, vitamin C is essential for immune system function, promotes resistance to infection, protects lung function, and enhances iron absorption from non-haeme food sources, which is found primarily in fruits, vegetables, dried beans, nuts and grain products.

When comparing smokers with non-smokers, evidence consistently indicates that current smokers have lower blood levels of vitamin C. Additionally, studies have shown decreasing vitamin C levels as the number of cigarettes smoked per day increases.

### HOW DO WE EXPLAIN THIS DECREASE IN THE BLOOD LEVELS OF VITAMIN C?

One of the reasons smokers can be expected to have lower blood levels of antioxidant micronutrients is based on the simple observation that smokers tend to eat less healthy diets than non-smokers in general, and also specifically tend to consume fruits and vegetables, the major sources of vitamin C less frequently, than non-smokers.. However, this observation alone cannot fully explain the documented lower blood levels, since reduced blood vitamin C levels in smokers are present, even when adjustments are made for differences in vitamin C intake. More recent research findings indicate that the exposure of blood plasma to cigarette smoke depletes vitamin C present in the plasma. Essentially though, the complex interrelationships between smoking and dietary patterns and between dietary patterns and blood levels of vitamin C and other antioxidant micronutrients remain to be fully elucidated and specific mechanisms and pathways need to be clarified.

### SMOKERS NEED MORE VITAMIN C

The Institute of Medicine, Food and Nutrition Board in the USA, have formulated the Dietary Reference Intakes (DRIs) with the aim at maximizing health and improving quality of life, which includes the reduction of risk of chronic disease. In view of the relationship between smoking, vitamin C and chronic disease risk, an additional intake of 35mg/day above the DRIs for gender and age has been recommended for individuals who choose to smoke, based on the available data (Table 1).

With prevention being an obvious better alternative than cure, it is clear that the focus and emphasis should be on interventions to stop and discourage cigarette smoking and in doing so, to promote a healthier lifestyle. However, since many people worldwide find it very difficult to stop smoking, it would be prudent to recognize the important interaction between smoking and vitamin C, and to act proactively according to current recommendations by increasing the dietary intake of this vitamin. Good food sources of vitamin C include citrus fruit, strawberries, tomatoes, peppers, cabbage, guava, potato, paw-paw and broccoli.

### Dietary Reference Intakes for Vitamin C

Gender	Age	EAR	RDA	AI	UL	NOAEL	LOAEL
	Years	mg/day	mg/day	mg/day	mg/day	mg/day	mg/day
Male/Female	0 – 0.5	-	-	40 <sup>a</sup>	*	-	-
	0.5 - 1	-	-	50 <sup>a</sup>	*	-	-
	1 – 3	13	15	-	400 <sup>b</sup>	-	-
	4 – 8	22	25	-	650 <sup>b</sup>	1000 <sup>e</sup>	3000 <sup>f</sup>
Male	9 – 13	39	45	-	1200 <sup>b</sup>	1000 <sup>e</sup>	3000 <sup>f</sup>
	14 – 18	63	75	-	1800 <sup>b</sup>	-	-
	19 – 30	75	90	-	2000	2000	3000
	31 – 50	75	90	-	2000	2000	3000
	51 – 70	75	90	-	2000	2000	3000
	> 70	75	90	-	2000	2000	3000
Female	9 – 13	39	45	-	1200 <sup>b</sup>	1000 <sup>e</sup>	3000 <sup>f</sup>
	14 – 18	56	65	-	1800 <sup>b</sup>	-	-
	19 – 30	60	75	-	2000	2000	3000
	31 – 50	60	75	-	2000	2000	3000
	51 – 70	60	75	-	2000	2000	3000
	> 70	60	75	-	2000	2000	3000
Pregnancy	≤ 18	66	80	-	1800 <sup>c</sup>	-	-
	19 – 30	70	85	-	2000 <sup>c</sup>	-	-
	31 – 50	70	85	-	2000 <sup>c</sup>	-	-

Lactation	≤ 18	96	115	-	1800 <sup>d</sup>	-	-
	19 – 30	100	120	-	2000 <sup>d</sup>	-	-
	31 – 50	100	120	-	2000 <sup>d</sup>	-	-

**For further, personalized and more detailed information, please contact NICUS or a dietitian registered with the Health Professions Council of South Africa.**

*References from the scientific literature used to compile this document are available on request.*

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