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EDITORIAL

# What about "5-a-day" dietary education programme 20 years later? The five colours of cancer and obesity prevention

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Many international studies have demonstrated that a vegetal-rich diet reduces the probability of cancer by 30%–40%, and there is scientific evidence showing that some of the most common cancers develop as a result of mistaken dietary habits.

According to the American Institute for Cancer Research, this is due to the excessive consumption and poor quality of some food groups, and this seems to be demonstrated by the increased incidence of neoplastic diseases in industrialised countries, where there is a prevalence of industrially refined foods rich in fats and simple sugars [1–4].

More specifically, epidemiological studies have identified an association between some dietary imbalances and/or insufficiences and certain forms of cancer: cancer of the stomach is influenced by a lack of proteins and vitamins; breast and prostate cancer are favoured by an excessive consumption of animal and polyunsaturated fats; tumours of the mouth, esophagus and larynx are directly related to excessive alcohol consumption and a lack of fresh fruit and vegetables, and hepatic cancer also depends on a high alcohol intake; finally, colon and rectal cancer are associated with a lack of vegetal fibres and an excessive consumption of saturated fats [3].

For this reason, the American National Cancer Institute (NCI) developed its "5-a-day" dietary education programme in 1991 with the aim of increasing the consumption of fruit and vegetables to five portions a day and recorded a first important result in 1999: a regression in the incidence of intestinal cancer, the second largest cause of cancer deaths in industrialised countries [5].

The "5-a-day" programme set an example for all other countries, and projects based on the American model were also introduced in Europe.

In Italy, the nutritional value of fruit and vegetables was promoted by means of the "Five colours of well-being" campaign launched in 2004 by UNAPROA (Unione Nazionale tra le Organizzazioni dei Produttori Ortofrutticoli, Agrumari e di Frutta in Guscio), interlocutor of the European Union for the application of economic policy directives and interventions in the fruit and vegetable sector. Its aim was to encourage the daily consumption of at least one portion of foods belonging to each of five colour groups: red, green, yellow/orange, white and blue/violet.

The most recent studies of human nutrition have found that the colour of fruit and vegetables is an indicator of their nutritional value: i.e. the presence of phytocompounds, the different kinds of chemical substances that have a protective effect on the human body and are only found in vegetal products [6].

Although the overall evidence that fruit and vegetables reduces the risk of cancer has weakened over recent years, it is still strong in relation to various cancers [7,8]. One ongoing research project is currently investigating the potential benefits of particular types, including dark green and orange vegetables, crucifers (e.g. cabbage,

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broccoli, cauliflour, Brussel sprouts), soy products, legumes, plants of *Allium* genus (garlic and onions), and tomatoes and tomato derivates.

In addition to providing nutrients that reduce the risk of developing cancer, fruit and vegetables also contribute towards weight maintenance. Although this is still a limited epidemiological finding [9], there is some evidence to suggest that people who eat large quantities are less likely to gain weight and at lower risk of becoming obese over time [10].

The finding that fruit and vegetable consumption reduces the risk of cancer suggested the idea of isolating their specific nutrients and administering them as nutritional supplements, sometimes in massive doses [11]. However, the majority of these attempts have not led to the prevention of cancer or pre-cancerous lesions, and some have actually had the opposite effect [11]. This may be due to methodological challenges concerning nutrients in cancer RCTs because investigators often have to face problems such as dose-response data, the duration of treatment, the best time for administering the individual nutrients, and so on.

It is worth mentioning the four randomised trials of beta-carotene as a means of preventing lung cancer, which were started because observational epidemiological studies had found a lower risk of developing lung cancer in people who ate foods containing large quantities of beta-carotene [12,13]. However, the subjects who received high-dose beta-carotene supplements in two of these trials actually developed lung cancer more frequently than those who received the placebo [14–16]. Despite considerable scientific evidence that people who consume large amounts of dietary beta-carotene were at lower risk of lung cancer, these findings suggest that beta-carotene may represent a model for other nutrients found in foods as a whole which, when taken individually in large quantities, may even be harmful at least in some population sub-groups. This is because phytochemicals exert their protective action when taken with the foods that contain them naturally, but their use as supplements leads to the risk of an overdose.

A certain number of recommendations have been made to encourage the general population to eat a larger number of portions of fruit and vegetables [17–19] but, despite this, their consumption remains low in both adults and children: only 24.5% of adults and 21.4% of young people eat at least five portions a day in the USA [20, 21].

It is therefore necessary to implement policies that encourage a further increase.

As eating fruit and vegetables is also associated with a reduced risk of developing other chronic diseases (especially cardiovascular diseases and obesity), encouraging their consumption can be associated with caloric restriction [17,22–24]. Epidemiological findings underline the need to reduce the caloric density of meals by using fruit and vegetables as a means of fighting the increase in overweight and obese subjects.

A weight management programme in which meals were replaced by liquid substitutes significantly increased the intake of fruit and vegetables in a group of premenopausal women treated for two years and, despite the recommendation to encourage their consumption in a natural manner, this may indicate a new role for such substitutes in controlling overweight and oncological risk [25].

In conclusion, published evidence shows that the intake of fruit and vegetables reduces the risk of cancer. The numerous substances that contain (particularly antiestrogen, anti-oxidant and anti-inflammatory substances) have anti-cancer potential at all stages of the carcinogenic process: initiation, promotion and progression [26,27].

However, the micronutrients contained in vegetal products act synergistically and there are few published data indicating that the individual phytocompounds have any anti-carcinogenic action [5,6].

Consequently, the 5-a-day axiom remains valid: the recommendation is to eat at least five daily portions of different fruit and vegetables although, for greater well-being, the American Cancer Society encourages an even greater intake depending on individual caloric needs [28]. The task of scientific nutritional societies is therefore to repeat the need to implement and/or increase the consumption of fruit and vegetables by means of more dietary education and the greater advocacy of dietary models rich in vegetal products, such as the Mediterranean diet.

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