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http://www.jrdiabet.ro
Rom J Diabetes Nutr Metab Dis. **22**(2):193-200
doi: 10.1515/rjdnmd-2015-0024

A REVIEW OF RECOMMENDED FOODS IN THE PREVENTION OF CANCER

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received: February 16, 2015 *accepted*: May 23, 2015
available online: June 15, 2015

Abstract

Both the medical practice and the scientific research proved that a number of nutritional products or nutritive elements could have a preventive role (especially in subjects in whom these reach a lower level than the physiological ones) in the prevention of cancer. The list of these products is quite large, but in this article we shall present only part of them. We emphasize that the aliments described are easy to find and are not expensive.

key words: *cancer, nutritive products, prevention*

Introduction

The cancerous diseases arise from the combined action of various endogenous factors (age, sex, genetics, preexisting diseases, etc.) and environmental factors. The last are related by causality to carcinogenesis in percentages of 60 to 90% [1]. Among all the environmental factors, diet seems to have a crucial role in the occurrence and evolution of malignant tumors. It is estimated that over 50 % of cancer cases in women and one third of those in men are owed to nutritional factors [1,2].

The importance of food in carcinogenesis is underlined by the sensibly higher quantity of carcinogenic factors spread by enteral way in comparison with the quantity of carcinogenic substances introduced in the body through other pathways (skin and lungs). The ratio between the quantity of carcinogens introduced into the body by foods and the one introduced by pulmonary way and respectively skin is 1.000.000 / 1.000 / 1 [1-4].

The main feature of food is the fact that it is consumed all along life, exposing the body to long contact with carcinogenic substances. Even when ingested in small doses, they can become poisonous because the carcinogenic action accumulates, thus the malignant effect could install much later, after a certain period of time. For these reasons, the modification of nutritional style, with increased intake of protective foods, can partially prevent the induction of malignant disease.

The nutritional circumstances of oncogenic prevention

In terms of the present day industrialized society, when the biologically active substances intake is more necessary than the caloric intake, a series of foods are used not only for their nutritive properties, but also for the anticancer protection they offer.

The fear of malignant degeneration imposed in certain population categories the introduction

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of products with proven anticancer qualities in the daily food intake. An example is represented by garlic (its unpleasant smell previously limited its current use). The fact that it delays the onset of tumours (due to a substance called allicin), at the same time having hypotensive and hypocholesterolemiant properties, made the garlic to be used more frequently in the menus [5-7]. The interest in this product led to further research with the goal to obtain varieties without unpleasant smell, which can be consumed more frequently and in larger quantities. Until the present day, we cannot state if these varieties have kept their therapeutic qualities.

We mention that the reduction in malignant degeneration risk is reached not only by the consumption of foods which contain proved anticancer substances, but also by the use of nutritive products with as less as possible carcinogens (we lower the consumption of meat, fats, salty and smoked products, fried foods, etc., and we increase the consumption of vegetables, fruits, cereal products, etc.) [8,9].

In the following pages we shall present the main natural nutritive products with proven anticancer properties.

Vegetables and Fruits

The vegetables and fruits consumed on a daily basis and in a significant quantity exert an anticancer protective role, both through the anticancer substances intake they contain (as detailed in Table 1) and through the volume restrictions they bring about other alimentary categories involved in carcinogenesis (excessive meat, high fat content, etc.) [10].

As it results from Table 1, the anticancer natural substances from vegetables and fruits act through the inhibition of precarcinogenic substances formation (ex. nitrosamines) and of enzymes involved in carcinogens activation, through the increase of degradation degree of mutagenic substances, and through the stimulation of activity of the immune system. Apart from the above mentioned anticancer substances, in vegetables and fruits are present other substances which can inhibit the malignant transformation.

Table 1. Anticancer natural substances from vegetables and fruits and their action mechanism [11-15].

The name of the substance	Mechanism of action
Ascorbic acid, tocopherol alpha, cysteine, glutathione, polyphenols	They inhibit the formation of nitrosamines and nitrosamides
Aromatic isothiocyanates, antioxidants, polyphenols, indols, coumarins, flavonoids	They inactivate the enzymes involved in the formation of carcinogens, they induce the production of enzymes which accelerate the degradation of substances with carcinogenic potential
Carotenoids	They block the abnormal proliferation of cells
Mineral substances: selenium, magnesium, zinc, cooper, iodine	They inactivate carcinogenic substances and they stimulate the cellular immunity
Different natural substances: • coloured substances • vegetal sterols (beta sitosterol)	Insufficient specified mechanisms
Dietary fibers and other substances	They increase bowel transit and implicitly decrease the contact time of carcinogens with intestinal mucosa; they lower the pH of faces, preventing the development of microbial flora involved in the transformation of biliary acids in carcinogenic compounds; they increase the formation of butyrate, which protects the intestinal mucosa of the colon from malignant transformation

Some authors estimate that the anticancer potential is higher in colored vegetables in comparison with the colorless ones. It seems that part of the vegetal pigmented substances hold anti-tumor properties. An example is represented by betalain, the pigment specific to beet root. It interferes with the respiration of malignant cells, disturbing it. Also, carotenoids (involved in the blockage of malignant proliferation) are concentrated especially in red, orange and green colored vegetables. Important sources in carotenoids are carrots, red pepper, tomatoes, greens, peaches and apricots [16].

An important role in anticancer protection is attributed to fruits rich in natural polyphenols and especially in bioflavonoids (ex. grapes, gooseberries, bilberries, etc.). Bioflavonoids interfere with the activation of systems neutralizing carcinogenes [17].

Besides these, in vegetables and fruits are present isothiocyanates, phenolic antioxidants, and indols, all with anticancer action manifested when the vegetables they are contained in are consumed before or at the same time with the cancerous product [18,19].

The vegetables and fruits also represent an important source of alimentary fibers, involved in the prevention of indirect carcinogenesis. In contrast with the ones from cereals, these have a finer structure and are consequently better tolerated. Among the vegetables and fruits most involved in anticancer protection we mention garlic, wheat germs, apples, carrots, spinach, beet root leaves, cabbage, lettuce, hip-berries, gooseberries, grapes, bilberries, etc. A special attention is lately given to beet root juice (100 ml three times a day) and green barley juice (consumed diluted in water or apple juice, a glass three times a day) [20-22].

Oceanic Fish

Research performed in the past years has shown that oceanic fish is not only an alimentary source for protection against atherogenesis, but also against cancer. The estimates of breast cancer incidence in Greenland Eskimos showed lower values of this cancer location, although the consumption of fats is very high (70% of the caloric intake, but the lipids originate in fish and other marine animals fats rich in polyunsaturated fatty acids). As it is well known that lipid excess favors malignant degeneration, the issue of identification of anticancer factors in the diet of Eskimos was raised. The research performed showed that protection is offered by certain omega 3 fatty acids originating in fish fat. It involves eicosapentaenoic acid and docosahexaenoic acid. They inhibit the formation of eicosanoids (breast cancer risk factors) from arachidonic acid (also contained in fish fat). It was noticed that the richer in unsaturated fatty acids from omega 6 group (ex. linoleic acid and arachidonic acid) the diet is, the higher the risk of breast carcinogenesis is [23]. The addition of unsaturated fatty acids from the omega 3 group to the diet (ex. eicosapentaenoic and docosahexaenoic acids) reduces the above mentioned risk. It is important that the anticancer fatty acids intake is high enough in order to counterbalance the effects of the ones from the omega 6 group. The main natural alimentary source which can provide high quantities of eicosapentaenoic and docosahexaenoic acids is ocean fish [23,24] as shown in Table 2.

Products from wheat germs

Wheat germs are sub-products of the process of wheat grinding. They have both an exceptional nutritive value (the plant puts in germs the most important biological products) and a remarkable therapeutic potential (polyneuritis, eczema, bronchitis, certain digestive disorders, etc.) [27].

Research undertaken 15-20 years ago has shown the existence of some factors in the wheat germs which increase the resistance of cells against malignant degeneration. A part of them are represented by tocopherol, selenium and zinc, nutritive factors also well known for their anticarcinogenic potential. They are found in higher concentrations than in wheat beans, flour or bran. The presence of phenolic compounds increases the antioxidant efficiency and, implicitly, decreases the genotoxic potential induced by free radicals [27,28].

Table 2. The content of unsaturated fatty acids in various fish species (g/100 g eatable product) [25,26].

The type of unsaturated fatty acids	Fish species										
	carp	bream	perch	sheat fish	pike perch	pike	brill	mackerel	sardines	horse mackerel	tuna
linoleic acid	0.27	0.16	0.03	0.04	0.02	0.05	0.02	0.16	0.13	0.38	0.04
octadecatetraenoic acid	0.01	0.07	0.02	0.01	–	–	0.06	0.27	0.10	–	0.02
arachidonic acid	0.02	0.08	0.03	0.05	0.02	0.04	0.09	0.36	0.08	0.45	0.06
eicosapentaenoic acid	–	0.03	0.02	0.03	0.02	0.02	0.19	0.71	0.86	1.44	0.30
docosahexaenoic acid	0.02	0.07	0.28	0.06	0.04	0.04	0.21	1.32	0.70	2.16	0.66

Given their special nutritive and therapeutic properties, the wheat germs are used to obtain a wide range of alimentary products. In order to use them in human nutrition, we must perform a high purification and an inactivation of antinutritive substances existing in wheat germs. To achieve this high purification we can use classic methods of separation from the grist industry. To reach the inactivation of antinutritive substances existing in wheat germs, as hemagglutinins and growth inhibitors, we perform a dry frying process or we sterilize germs at 120ºC, for 20-45 minutes. The dry frying process allows us to acquire a product with an alimentary value superior to the one obtained through sterilization. Through thermal treatment, wheat flour becomes easier to preserve and acquires a more pleasant aroma.

Beer Yeast

The beer yeast is a valuable biological product, with a complete harmonious chemical composition, able to provide human body with a wide range of nutrients that have caloric, nutritional and, in certain cases, therapeutic value. The beer yeast has proved its benefic influence for a large group of disorders: obesity, diabetes mellitus, atherosclerosis, denutrition, inflammatory and liver diseases, nervous system disorders, etc. [29-31].

During the last two decades, the clinical and experimental results proved the usefulness of beer yeast in the preventive therapy of cancer. It can also be used for the correction of nutritional deficiencies of patients with malignant degeneration [32,33].

Its influence against carcinogenesis is partially due to the fact that it provides high quantities of glutathione. It also contributes to cellular protection against different genotoxic peroxides. Glutathione is part of the glutathione-oxidase, an enzyme considered by some authors to be the most efficient protection against peroxidation (it combines the antioxidant capacity of thions and selenium; the products of the reaction are not free radicals but hydrosoluble substances easily metabolisable; it neutralizes all species of essential peroxides; glutathione is easily regenerated through pentose phosphate pathway; it decomposes oxygenated water much more efficiently than catalase, etc.).

The activity of glutathione oxidase can be optimized if the selenium intake is adequate (glutathione oxidase is a selenoenzyme and this mineral is connected with the sulfur amino acids, forming selenomethionine, selenocysteine, selenoglutathione). With that end in view, taking into account the high capacity of yeast to form complexes with metals, a yeast enriched with selenium has been obtained. By this way, high quantities of glutathione and selenium are provided to the organism, increasing the biological potential to neutralize genotoxic peroxides [34-36].

The quantity of beer yeast recommended for daily intake is up to 35 grams [37].

Nutritive products enriched with iron

The iron deficiency facilitates the emergence of malignant degeneration at the level of upper digestive tract [38]. To correct this deficiency, we use easily assimilable natural products very rich in iron or nutritive products with enriched composition in iron.

A particular importance for the enrichment of alimentary products with iron has the adequate selection of salts of this mineral, as a part of them (orthophosphate, iron oxide, etc.) are hardly assimilated by the organism.

In order to achieve good results, we need the iron salts to fulfill the following conditions: they must not confer unpleasant taste, smell or color to products; they must not degrade the products during preservation; they must be well rendered soluble in acidic medium and form salts which pass to ionic form, easily assimilable [39].

Frequently, we resort to ferrous sulphate and reduced iron. To a smaller extent, we can use ferrous phosphate, iron chloride, polyphosphates and iron glycerophosphate. The enrichment of bread with heme iron also presents interest.

The ferrous sulphate and reduced iron are well absorbed by the organism, but can worsen the quality of products. Due to this fact, in some countries, like Switzerland, the ferrous sulphate is not used anymore to enrich flour, because during its preservation, it reacts with the lipids in the flour and in time causes an unpleasant taste. Therefore, ferrous sulphate is added to bread during the preparation of the dough, before baking [40].

The process of enrichment of alimentary products addresses to the ones which occupy an important predominance in daily nutrition. Research has been done in order to fortify with iron the following products: flour, bread and bakery products, sugar products, macaroni, milk and dairy products, rice, soluble coffee, mashed potatoes, etc. [41-43].

The biggest attention was granted to the enrichment of flour and other cereal products with iron, as, on one hand, they represent basic foods in the daily caloric intake, and on the other hand, through the refinement of flour, the content of iron in white flour is three times lower than in the wheat beans.

Milk was also subject to fortification with iron. It has the advantage that it allows a very good solubilisation of iron salts and a considerable assimilation even after 6 to 12 months of preservation in conditions of sterilization.

The fortification with iron is applied to powder milk. It has a good stability in conditions of preservation. The addition of trivalent iron in milk used as raw material increases the thermostability of lipases, which are responsible for the bitter taste of milk. In exchange, the use of bivalent salts prevents the bitter taste [44].

Sugar is also a potential source of iron fortification, but adding this mineral creates problems related to the apparition of a color which affects the quality of the sugar. In order to avoid this, we use reduced iron combined with different reductive substances. Good results were achieved by fortifying sugar with 100-200 mg iron per kg and ascorbic acid. For this reason, iron was used in the form of ferric sulphate, ferric and ferrous ammonium sulphate, iron nitrate, iron phosphate, iron glycerophosphate, iron fructosate and iron complex with EDTA. The ascorbic acid was added in concentrations of 1-2 g/kg.

The assimilation of iron is dependent on the food used. The ferric phosphate is little absorbed when the enriched sugar is added in cereal products for breakfast (2.3%) in comparison with the situation when it is used to prepare jam (13.8%) [45].

The use of sugar enriched with iron for the preparation of different beverages like fruit juice, Coca-Cola and coffee has shown a reduced absorption of iron. Adding ascorbic acid increases the absorption of iron from coffee, but not for the one from Coca-Cola [46].

We estimate that sugar can represent a good vector for iron fortification, except its use to prepare tea or coffee.

The coffee and tea have been fortified with iron, but several problems related to color and bioavailability changes have emerged. It seems that the most pronounced changes of color are due to ferrous sulphate. Further research has shown that we can use iron fumarate without raising the same issues. The presence of tannin in tea and coffee limits the availability of iron in the organism, as it forms un-absorbable complexes [47].

Nutritive products enriched with zinc

According to some studies, providing a zinc supplement in nutrition is necessary for patients with high risk of esophageal cancer and simultaneous deficiency in this mineral [48,49]. In this case we can resort to foods enriched with zinc. The mineral addition is performed for the foods which occupy a considerable proportion in human nutrition. Often, we fortify flour. In the countries where the consumption of soya flour is widespread, this flour is fortified with zinc chloride (4-5 mg to 100 g of product), zinc oxide, zinc carbonate or zinc sulphate. In the case of common flour, the National Academy of Sciences from U.S.A. recommends the fortification with 10 mg of zinc to 1 kg of flour [50,51].

Conclusion

There is an obvious relationship between diet and cancer development. A diet drawn up according to the guidelines could decrease the incidence of various types of cancer and could lead the way to appropriate public health strategies and prevention activities aimed at reducing the global cancer burden.

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