THE ROLE OF FOODS IN CANCER: A NARRATIVE REVIEW

O papel dos alimentos no câncer: uma revisão narrativa

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Abstract: Cancer is a disease with a silent cause disease and it is the second cause of death in Brazil, falling behind only to cardiovascular diseases, reaching about six million people, representing 12% of death all year. Thus, the objective of this work is to elucidate the main types of food that have carcinogenic and protective effect in the onset of the disease. The paper is a bibliographic-like research. A research was done for the scientific literature in the following databases and research portals: Scielo, LILACS, BVS, Pubmed and Academic Google. The descriptors used were cancer, feeding, prevention, carcinogenic substance. Vitamins A, C, E, as well as carotenoids help in preventing the onset of the disease, also working as antioxidants. The antioxidant nutrients act by inhibiting the oxidative damages in the DNA, since the carcinogenic process is characterized by a chronic oxidative state, which characterizes the antioxidant foods as chemo preventive. Vitamin C is considered one of the most important and the least toxic of the natural antioxidants. In contrast, some foods are responsible for the onset of the disease, highlighting the nitrosamines present in the sausages, salami, ham, aflatoxins present in peanuts, corn and nuts from Brazil, and aromatic and polycyclic hydrocarbons present in roasted meat. Therefore foods have the function of developing or inhibiting the formation of cancer, being of extreme importance a healthy diet rich in antioxidant vitamins so that it is possible to change the disease scenario.

Keywords: Cancer; Feeding; Prevention; Carcinogenic Substance.
Resumo: O câncer é uma doença de causa silenciosa e é a segunda causa de morte no Brasil, perdendo apenas para as doenças cardiovasculares, atingindo cerca de seis milhões de pessoas, representando 12% de morte todo o ano. Com isso, o objetivo do trabalho é elucidar os principais tipos de alimentos que tem efeito carcinogênico e protetor no surgimento da doença. O trabalho trata-se de uma pesquisa de natureza bibliográfica. Foram realizadas buscas de literatura científica nas seguintes bases de dados e portais de pesquisa: Scielo, LILACS, BVS, Pubmed e Google Acadêmico. Os descritores utilizados foram: câncer, alimentação, prevenção, substância cancerígena. As vitaminas A, C, E, bem como os carotenoides auxiliam na prevenção do surgimento da doença, funcionando também como antioxidantes. Os nutrientes antioxidantes atuam inibindo os danos oxidativos no DNA, uma vez que o processo carcinogênico é caracterizado por um estado oxidativo crônico, o que caracteriza os alimentos antioxidantes como quimiopreventivo. A vitamina C é considerado um dos mais importantes e o menos tóxico dos antioxidantes naturais. Em contrapartida, alguns alimentos são responsáveis pelo surgimento da doença, destacando as nitrosaminas presentes nos alimentos embutidos como: salsicha, salame, presunto, aflotoxinas presentes no amendoim, milho e castanha do Brasil, e os hidrocarbonetos aromáticos e policíclicos presentes na carne assada. Portanto, os alimentos têm a função de desenvolver ou inibir a formação do câncer, sendo de extrema importância uma alimentação saudável rica em vitaminas antioxidantes para que se possa mudar o cenário da doença.

Palavras-chave: Câncer; Alimentação; Prevenção; Substância Cancerígena.
INTRODUCTION

Cancer is a disease with a silent cause disease and it is the second cause of death in Brazil, falling behind only to cardiovascular diseases, reaching about six million people, representing 12% of death all year. If preventive measures are not taken, it is estimated that 84 million people in the world will die due to this disease over the next ten years.1

Cancer is characterized by the uncontrolled growth of cells forming a mass of tumor. This disease is defined as a chronic degenerative disease of genes vulnerable to mutation, however, the disease can also develop through of genes inherited from family, what determines a small portion of cancers. Studies show that environmental factors are the most worrying for the onset of disease, among these are the diet, tobacco, radiation, lack of physical activity and body composition. 80% of the cases are related to environmental factors and can be modified by man.2

Diet is responsible for the onset of about 35% of several types of cancers. The consumption of foods high in saturated fat, cholesterol, sugars and low intake of vegetables, fruits and fibers contribute to the onset of the disease. It is believed that a healthy diet could prevent three to four million new cases every year.1

The body imbalance caused by excess of free radicals is known as oxidative stress, its accumulation is associated with the aging process and with the emergence of several diseases, including cancer. A healthy diet, rich in fruits and vegetable avoids such stress, as well as cellular damages.3

Cancer causes some nutritional damages to the patient. In recent years, several forms for the nutritional management of the disease have been studied. The use of immunomodulatory diets, that is, rich in immunonutrients is able to modulate the immune function. It has been observed great results with the use of the same, concomitant to the use of antioxidants. Probiotics are part of this group.4

Probiotics are living organisms that bring benefits to the host when ingested in a certain number and are found in foods and supplements. These have the function to inhibit the growth of some pathogens by reducing the pH of the lumen, in addition to improving the function of the barrier of the mucosa and modulate the innate and adaptive immune response.5 Thus, the objective of this study is to address the main types of foods which play a protective role in the cancer formation.

METHODOLOGY

This is a narrative, descriptive-like review of the literature study. A research was done for the scientific literature in the following databases and research portals: Scielo, LILACS, BVS, Pubmed and Google Academic. The search was carried out in the first half of 2017, using the descriptors: Cancer, diet, prevention and carcinogenic substance. The time delimitation covers the years 2005 to 2017 in order to evaluate the current scientific production. The inclusion criteria used were articles in their entirety and review, published in national and international journals, between the years mentioned above. The articles were totally studied and selected according to the relevance given to the particular theme of this study. In total 96 articles were found, however, only 23 fit the inclusion criteria.
LITERATURE REVIEW

Cancer Formation

The cancer formation is slow, thus, a cancer cell can take years to develop and form a tumor and this process goes through several stages until the neoplasm formation. The first stage is known as initiation stage, in it the cells suffer the effect of a carcinogenic agent, i.e., an onco initiator agent, which causes changes in some of their genes. At this stage the cells are altered, however, it is not possible yet to detect a tumor clinically. Examples of carcinogenic chemical substances: Dimethyl, aflatoxin, dimethyl nitrosamine, and benzopyrene. In the promotion stage, the cells genetically altered suffer carcinogenic effects. At this stage the cell is transformed into a malignant cell slowly. For the cell to become malignant it is necessary a contact with the carcinogen for a long and continuous period. At this stage the suspension of contact with the carcinogen can interrupt the process. In the last stage, the cancer is already formed, the cells multiply in an uncontrolled way, this process is irreversible. Thus, the first signs and symptoms of the disease begin. The substances that promote the initiation or progression of the disease are called carcinogens.

Cancer prevalence in the World

The neoplasms represented in beginning of the 21st century a public health problem throughout the world. About 26 million new cases are expected for the year 2030. Cancer is characterized as a non-communicable disease (NCD), among them, 80% occur in low-income countries, mainly due to the high rate of obesity, poor diet and cardiovascular diseases. Breast cancer in women and lung cancer in men are the types of cancers that most affects the population in developing countries, whereas the countries developed, breast cancer for women continues to be the main type of tumor, and for men is prostate cancer, followed by lung cancer.

Cancer preventive foods

A proper diet is of utmost importance to maintain health, because it contributes to the reduction of risk of disease. Through a healthy diet it is possible to promote recovery, rehabilitation, as well as the detoxification of cells, which provides a greater vitality to the organs and tissue. With the increase in the cancer development, studies have been made with phytochemical compounds, i.e., those that have antioxidant properties, in order to demonstrate the power of protection against this disease. Vitamins A, C and E comprise this group. The carotenoids also help in preventing the onset of the disease. The antioxidant nutrients act by inhibiting the oxidative damages in the DNA, since the carcinogenic process is characterized by a chronic oxidative state, mainly at the promotion stage, which characterizes the antioxidant foods as chemo preventive.

Antioxidants are responsible for protecting the cells against oxidative stress that can initiate and promote the carcinogen process. Vitamin C is considered one of the most important natural antioxidants, which can be mainly found in citrus food, acerola, guava, kiwi, orange and some vegetables like Broccoli, cabbage, peppers.

The flavonoids have antioxidant properties, as well as anti-inflammatory, thus, contribute to the treatment of various chronic-degenerative diseases, such as: cardiovascular diseases, diabetes, atherosclerosis and cancer, these diseases are closely linked to the oxidative and inflammatory processes. These also have the function of preventing or delaying the development of some types of cancer, especially colon cancer, which is related to obesity.
A study was performed in rats which developed colon cancer and had phenotypes of obesity. The flavonoids employed were chrysin, quercetin, and mobilitin, the results suggest that these substances are able to eliminate the initial phase of carcinogenesis of colon cancer in obese rats, since these have properties to inhibit the activity of cell proliferation. The authors also mention that they indicate that the flavonoids may be used in the prevention of colon cancer in obese humans. The lycopene (precursor of vitamin A) also has a preventive function in the development of cancer, because it has antioxidant properties and its continuous use is able to prevent cancer. The presence of this nutrient stands out in tomato, since this has an average of 31 μg lycopene/g of fruit. This carotenoid give the tomatoes the red color and can be found in other foods, such as papaya, guava, watermelon, Brazilian cherry, among others.3

The lycopene acts as a chemo preventive agent, antioxidant, combats free radicals, slows the aging and protects against cancer, especially prostate cancer, it is also found in plasma and in human body tissues, however, its absorption by the body is higher in sauces than the fruit in natura, once the thermal processing enhances its bioavailability.3

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<th>Table 1 - Antioxidant foods and their sources.</th>
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(Adapted from Nelli et al., 2015)16

**Probiotics and colon cancer**

The cancer of the colon and rectum is the third most common cause of cancer in the world both in males and females. This type of pathology has a survival of 5 years in 63% of cases. Both sexes are equally affected. When located only in the intestine, this disease is highly curable and treatable. Among the risk factors for the development of the disease stands out the family history of cancer of the colon and rectum, genetic predisposition to the development of chronic diseases of the intestine as the polyposis and adenomatosas, in addition to diets rich in fats, low intake of fruits, vegetables and cereals. It should be emphasized that the practice of physical activity is associated with a low risk of developing cancer of the colon and rectum.17

Many are the effects of probiotics such as relief of symptoms caused by lactose intolerance, treatment of diarrhea, increased immune response, anticarcinogenic effects, among others. The most common form of probiotics is in dairy products containing lactobacillus and bifidobacterium in most times.18

The lactic acid bacteria (LAB) have been studied for their protective effect against colon tumors. They play an important role in delaying the development of this type of pathology by the possibility to influence metabolic immunological and protective functions, Probiotics have been studied by showing action on the activity of the bacterial enzymes with carcinogenic effects, namely: B=glucoronidase, Nitro reductase and
azorredutase, these enzymes are related to the formation of aromatic amines which are harmful to the body.\textsuperscript{18} There are several studies that cite the role of these bacteria against the cancer of the colon and rectum, even though there is no clear evidence on this protective role.\textsuperscript{19}

**Interaction of carcinogenic substances**

The industrialized foods, especially cured meats such as sausage and ham are directly related with the onset of cancer, because these have in their composition nitrites and nitrates, used as a preservative for food, and stand out for being important carcinogenic agent. These types of food are responsible for the high rate of cancer stomach, once the nitrites and nitrates in the stomach are transformed into nitrosamines, highly carcinogenic substance.\textsuperscript{1}

The intake of foods containing nitrites and nitrates causes cells to form tumors by mechanisms that increase the nitrous compounds and, added to the increase of free radicals, causing injury to the cells on the stomach wall, decreasing thus the production of mucus, an important protective factor of the stomach, which increases the chance of developing malignant tumor in this location.\textsuperscript{11} The main concern with the use of nitrates in food is due to its excess in the diet, as well as the endogenous formation of nitrosamines. The process of endogenous nitration can be blocked by the action of antioxidants, because this situation does not occur in the presence of ascorbic acid (vitamin C), which blocks the conversion of nitrate and nitrite.\textsuperscript{20}

The aflatoxin is another mycotoxin that has carcinogenic effect. These are produced by the fungi *Aspergillus flavus*, *Aspergillus parasiticus* and *Aspergillus nomius*, the most widespread mycotoxin in Brazil. The mechanism of carcinogenesis generated by aflatoxin involves the onset or the progression of the tumor. It participates in the activation of proto-oncogenesis causing also mutations in the p53 gene. p53 is a phosphoprotein involved in the process of cellular growth and differentiation. When the phosphoprotein p53 loses its functions the mutations are transmitted to the cells and at some time triggers the cellular transformation. The aflatoxins contaminate mainly the peanuts, but it can cause contamination in maize and in brazil nut. It is known as the most powerful carcinogenic power natural substance due to its hepatotoxicity.\textsuperscript{21}

The use of roast beef has been shown to be another risk factor for cancer, especially of the stomach and esophagus, because they produce compounds such as polycyclic aromatic hydrocarbons and heterocyclic amines which have carcinogenic effect\textsuperscript{1}. The polycyclic aromatic hydrocarbons are formed from the process of combustion of organic material and have a wide distribution in the environment, is considered highly carcinogenic due to being metabolized by hepatic enzymes that bind to DNA causing errors of replication and mutation.\textsuperscript{22}

**CONCLUSION**

It can be concluded that environmental factors such as, for example, the inadequate diet, i.e., rich in fatty, sugar and industrialized foods corroborate to the cancer onset, however a healthy diet rich in antioxidant vitamins can change the scenario of the disease, especially in its initial phase by preventing the oxidative damage in the DNA of the cells.

It is necessary to carry out preventive
measures such as lectures on healthy eating, nutrition education, accessibility to early diagnosis in order to change the alarming figures of new cases of the disease.

**REFERENCE**


