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Nutrients in diet that effective in cancer prevention

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Abstract

Human health has many aspects, we need to feed the diet which provides better nutrition and gives good health, an absence of disease and good behaviour. There are many health-related problems and conditions are responsible for the weak health and sometimes death causing illness, in which cancer is one most common health risk in human healthcare. Cancer is the state in which cell division is uncontrolled which damage the cells and in the last stage, if incurable caused death. There are many reasons why cell got infected due to cancerous infections, in which food habits and quality of foodstuffs are also increased the risk of cancer, like mycotoxins contamination in the food. MSG additives, taste enhancer, food colouring etc. done by the chemical processing which produces toxins inside the during the oxidation process of food. Cancer is causes of death rate higher than other health risks all over the world. The number of cancer cases is likely to rise up to 24 million by 2035. Several studies were performed in the last years in order to explore and analyze associations between diet and risk of cancer. The risk of cancer is depending on the degree of exposure to contaminated food, availability of nutrients in the body, dietary pattern and lifestyle as well as food behaviour. Research from a number of sources provides information that some vegetables, fruits, and whole grains, dietary fibre, certain micronutrients, few fatty acids and physical activity protect against cancers. Whereas poor dietary intake, imbalanced nutrition, less physical activity trances fatty acids, food processing and cooking method may increase risks.

Keywords: Cancer, death, nutrition, fruits and vegetable

Introduction

Cancer cells do be unsuccessful away at the natural point in a cell's life cycle. Cancer is a broad term. Carcinogenesis is the term used for initial cancer. Oncology is a medical branch that study of all forms of cancer. It describes the disease that marks when cellular metabolic changes origin the uncontrolled growth and division of cells [1]. Usual cells take notice to signals from nearest cells and discontinue growing when they infringe on nearby tissues something called contact inhibition. Cancer cells take no perceive of these cells and invade close by tissues [2]. Benign tumours have a fibrous capsule. Carcinogenesis has appeared in different form like visible out cell growth called tumours and internal forms like leukaemia. Each cell has definite functions and predetermined lifespan [3]. While apoptosis is a state in which normal cells died and form a new cell is natural and benefits phenomena. This process makes healthier cells and destroys the damaged cell so that function if the organ could perform the best action directed by the brain. Cancerous cells are lacking in the mechanism that instructs them to stop dividing and to die. Needless nutrients utilize by a cancerous cell that nutrient use in optimal growth for other cell and repair tissue. As a result, they fabricate up in the body, using oxygen and nutrients that would usually nourish other cells. Cancerous cells can outward appearance tumours, impair the immune coordination and reason other changes that prevent the body from performance frequently. Cancerous cells may originate in one area and then expand via the lymph nodes [1, 3].

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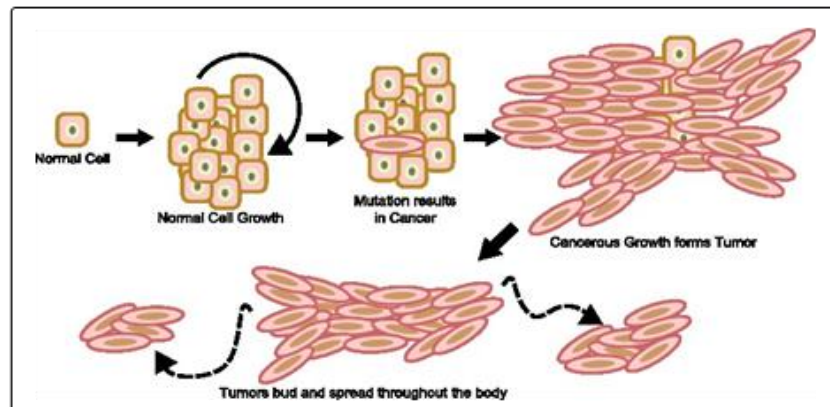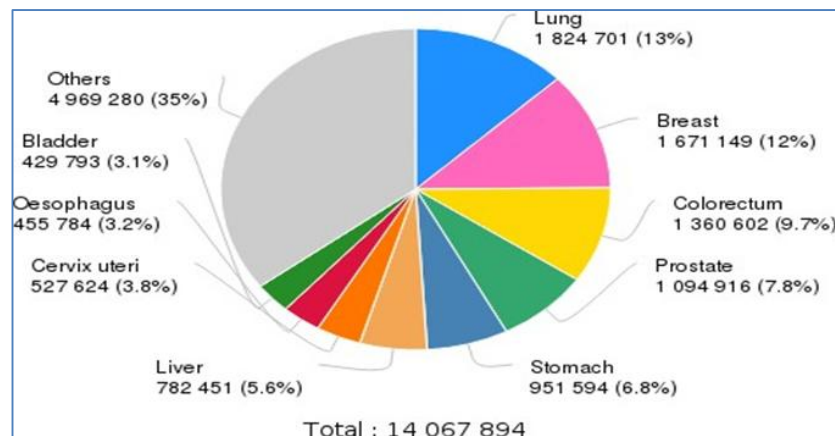
Source: Nastasia Belc and Gabriel Mustatea 2018 [4].

Fig 1: Cancer growth and progression

Causes

The accurate origin of cancer is not well known but diverse factors are likely at active play. Inheritance factor consider the major risk of prognosis of cancer but genetic factors have been concurrent to certain types of cancers, study reveals that less than 10 percent of cancers are inherited, not more than 10 percent of breast cancers are connected with mutated genes known as BRCA1 and BRCA2. These two inherited genes report for in relation to 50 percent of the inherited forms of breast cancer. The most of the cancer are stated due to the genetic mutations of cells that occur due to the lifestyle and environmental factors such as food habits, cigarette smoking and exposure to radiation [5, 6].

Source: Nastasia Belc and Gabriel Mustatea 2018[4]

Revelation to the following ecological factors cans Origin cancer

Tobacco smoking: Smoking caused lung cancer and is also linked with an increased risk for cancers of the larynx, oesophagus, mouth cancer, bladder, and cervix cancer [7, 8, 9].

Chemicals: Chemical contact with industrial dyes, asbestos, and benzene are correlated with cancer [8].

Ionizing radiation: An association between ionizing radiation and cancer has been made, but the accurate amount of radiation exposure that increases the risk of cancer is still. Not well known [8, 10].

Viruses: Certain types of viruses like HIV AIDS, Acquired Immune Deficiency Syndrome is responsible for increasing the risk of cancer, like hepatic cancer, lymphomas, and sarcomas [8, 11]. HPV viruses are responsible for the cervical and anal cancer.

Sunlight: Long time exposure directly in sun light which contains too much Ultraviolet rays causes skin damage and may result skin cancer [8].

Genetic factors: Studies observed that genetic factors can contribute to the progress of cancer. A person's genetic code programmed their cells when to divide and expire. Mutation in the genes can go ahead to faulty instructions, and cancer can consequence. Genes also persuade the cells' transcription and translation, assembly of proteins, and proteins transmit many of the information for cellular growth and division

Some genes alter proteins that would typically repair damaged cells. This can direct to cancer. If parents have these genes, they may get ahead of on the altered directives to their offspring. Some genetic changes occur after birth, and environmental factors such as smoking and sun exposure can enhance the risk. Previous changes that can consequence in cancer take place in the chemical signals that conclude how the body deploys, or "expresses" specific genes

Types of cancer

Oncologists have divide cancer into types based on where its prognosis. Four main types of cancer are:

Carcinomas: A carcinoma origin in the skin or the tissue that covers the surface of internal organs and glands. Carcinomas more often than not form solid tumours. They are the most

common type of cancer. Examples of carcinomas include lung cancer, prostate cancer, breast cancer, and colorectal cancer.

Sarcomas: A sarcoma begins in the tissues that hold up and connect the body. A sarcoma can spread in all cells of body if not cured on time. It may damage the muscles, bones, nerves system, etc.

Leukaemia: Leukaemia is cancer of blood cells, which damage the cells shape in uncontrolled way and destroy the blood cells the four most important types of leukaemia are as follows,

- Acute lymphocytic leukaemia.
- Chronic myeloid leukaemia.
- Chronic lymphocytic leukaemia, and
- Acute myeloid leukaemia.

Lymphomas: Blood contains lymphocytes which increase the immunity of the body, it present in the lymph nodes, spleen, bone marrow, even the cancerous cells infect the lymphocytes it spreads if another part body, and in other organs and tissues. Lymphoma can, however, spread to other parts of the body.

The two most important types of lymphoma are Hodgkin lymphoma and non-Hodgkin lymphoma. Cure options include chemotherapy and radiation. In various cases, lymphomas are curable [4].

Cancer spreads
As a cancerous tumour grows, the bloodstream or lymphatic system may bring cancer cells to other parts of the body. During this process, known as metastasis, the cancer cells grow and may expand into new tumours. One of the first organs cancer often spreads is to the lymph nodes. Lymph nodes are small, bean-shaped organs that help fight infection. They are located in clusters in different parts of the body, groin area, such as the neck, and under the arms [13, 14].

Cancer may also spread through the bloodstream to far-away parts of the body. These parts may include the bones, lungs, hepatic, renal or brain. Frequently, a diagnosis begins when a person visits a clinic about an unusual symptom. The oncologist will have a discussion with the person about his or her medical history and symptoms. Then the oncologist will perform various clinical, biochemical, genetic tests to find out the cause of these symptoms. Although many people with cancer have no symptoms. For these people, cancer is diagnosed during a medical test for another issue or condition [15].

Sometimes an oncologist diagnoses cancer after a cancer screening test in an otherwise healthy person. Screening tests include colonoscopy, mammography, and a Pap test. A person may need additional tests to confirm or disprove the result of the screening test. Biopsy test confirms the person has cancer or not [16].

Treatments
Novel research has fuelled the development of new medications and treatment technologies. Oncologist usually prescribes treatments based on the type of cancer, its phase at diagnosis, and the people in general health. The side effects of chemotherapy include hair loss, lack of appetite [4].

Approaches to cancer treatment
Chemotherapy: Chemotherapy target to destroy cancerous cells with medications that target speedily dividing cells. The

drugs can also help reduce in size tumours, but the side effects can be cure [17].

Hormone therapy: Hormone therapy involves taking medications that change how certain hormones work or interfere with the body's ability to produce them. When hormones play a significant role, as with prostate and breast cancers, this is a frequent approach [18].

Immunotherapy: Immunotherapy uses medications and other treatments to boost the immune system and encourage it to fight cancerous cells. Two examples of these treatments are checkpoint inhibitors and adoptive cell transfer [4, 17].

Personalized medicine: Personalized medicine is a newer, developing approach. The principal of personalized medicine are using genetic testing to decide the finest treatments for a person's particular presentation of cancer. Researchers have yet to show that it can effectively treat all types of cancer [19].

Radio nucleotide therapy: Radiation therapy like radio nucleotide therapy uses radioisotopes X- rays' gamma high-dose radiation to abolition cancerous cells. Also, an oncologist may recommend using radiation to shrink a tumour before surgery or reduce tumour-related symptoms [20].

Stem cell transplant: Stem cell transplant can be in particular beneficial for people with blood-correlated cancers, such as leukaemia or lymphoma. It involves removing cells, such as red or white blood cells, that chemotherapy or radiation has ruined [21].

Surgery: Surgery is frequently a part of a treatment plan when a person has a cancerous tumour. Also, a surgeon may get rid of lymph nodes to reduce or prevent the disease's spread.

Targeted therapies carry out functions within cancerous cells to stop them from multiplying. They can also help to boost the immune system. Two examples of these therapies are widely used by oncologist small-molecule drugs and monoclonal antibodies [4].

The role of Diet: In Cancer. Diet plays important role in cancer treatment. Antioxidant rich foods protect the body from few types of cancer. Healthy nutrition inhibits the growth of cancerous cell inside the body and keeps healthy for long time. Nutrition may alter the carcinogenic process at any stage. Transcription and translation affected by nutrients during pregnancy and childhood, all over the life span. Oncologist revealed that developed country low physical activity high risk of the diverse type of cancer. Various types of chemicals are found in a normal diet, some carcinogenic factors are measurable but numerous factors are not yet near useable. Some dietary carcinogenic are naturally occurring pesticides or herbicides produced by crops for preventing action against harmful pests, rodents, fungus, algae, etc. secondary metabolite like Aflatoxin, fumonisins, ochratoxin-A and food preservative chief factor of induces cancer [22].

Consuming the particular types of foods that having antioxidants prior to, during, and after treatment can assist patients to get the greatest assistance from treatment, including feeling healthier and stronger. Proper and balance diet intake is very difficult in cancer patients. A lot of the side effects of treatment, such as nausea, vomiting, poor appetite or mouth sores, can deter patients from eating regularly. Studies observed that weight loss or loss of appetite so strong

that they can technically be declared anorexic an unfortunate reality that only emphasises the importance of good nutrition [23]. There are several nutrients essential to helping the body maintain the strength it needs in the fight against cancer, fat, protein, Cancer patients typically necessitate more protein than usual during treatment. Protein not only aids the immune system during treatment, but it also helps to refurbish body tissue without breaking down muscle for fuel. Effective together with your cancer care team can help better identify nutrition goals, and plan strategic ways to help you meet them during treatment. Though there's no evidence to concretely prove that eating certain foods can prevent or cure cancer, there are healthy habits that are recommended, both prior to and after diagnosis [22,23].
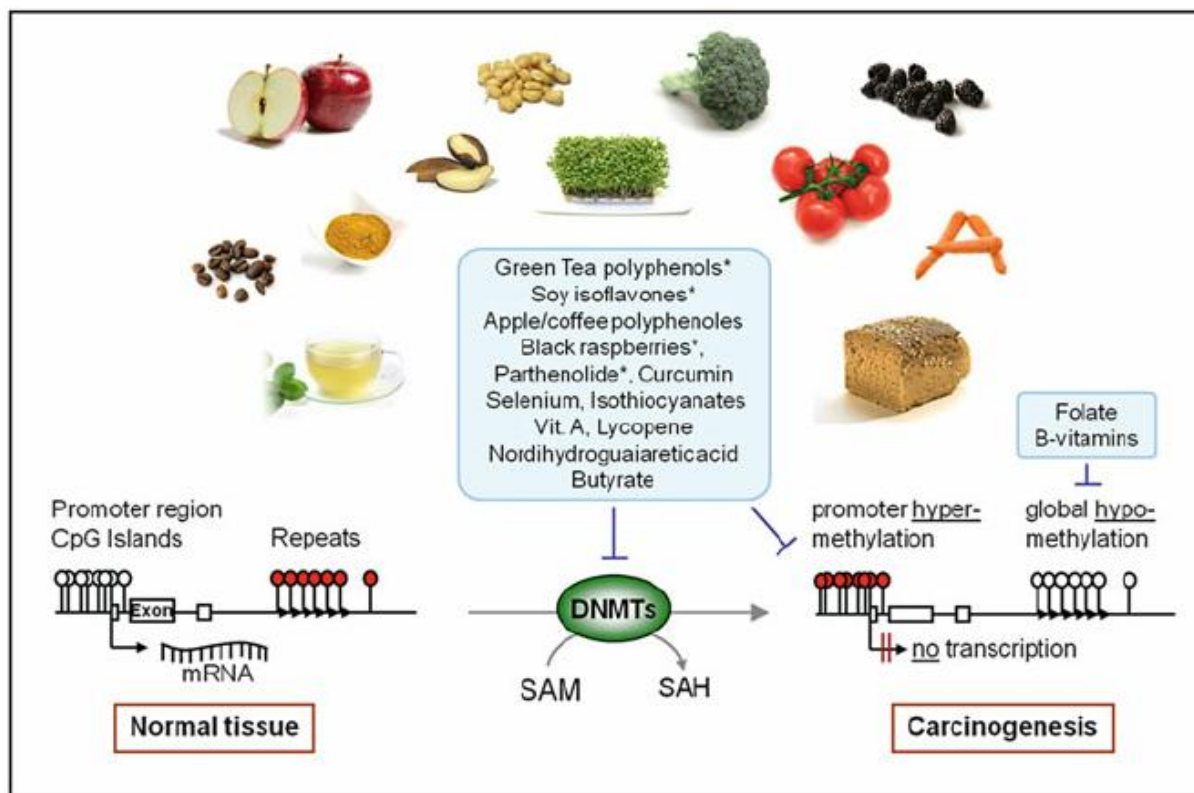
Sources: Clarissa Gerhäuser 2012[5].

Diet is a significant changeable risk factor for cancer. Adequate diet modification may play a key role in reducing the incidence of a number of cancers. The increasing body of epidemiological evidence recommended links of some nutritional exposures with individual cancers [4, 23].

Types of diet preventive role of carcinogenesis
1. Dietary patterns
Nutritional epidemiologists make use of multivariate statistics, such as principal components analysis and factor analysis, to measure how patterns of dietary behaviour control the risk of just beginning cancer. Based on their dietary pattern score, epidemiologists categorize people into quantises [22, 24]. To estimate the influence of dietary behaviour on the risk of cancer, they measure the association between quintiles and the distribution of cancer prevalence in case-control studies and cancer incidence in longitudinal studies. They more often than not include other variables in their statistical model to account for the other differences between people with and without cancer confounders. For breast cancer, there is a replicated trend for women with an additional "prudent or healthy" diet, i.e. higher in fruits and vegetables, to have a lower risk of cancer. A "drinker dietary pattern" is also connected with higher breast cancer risk, while the association is inconsistent between a more westernized diet and prominent risk of breast cancer. Pickled foods are concurrent with cancer [4].

2. Restrictive Diets
A number of diets and diet-based regimes are claimed to be useful against cancer. Well-liked types of "anti-cancer" diet include the Garson therapy; Breuss diet the Budwig protocol and the macrobiotic diet. None of these diets has been found to be effective, and some of them have been found to be harmful [22, 25].

3. Dietary components
A. Alcohol abstaining
Biochemist observed by many cases and cohort studies Alcohols regular consumption elevated the risk of cancer it is a major cause or considerable contributing factor to numerous types of cancers. Ethanol affects the metabolism of anticancer drugs. It significantly increases the risk of viral hepatitis and liver cancer. Researchers have hypothesized various ways that alcohol may amplify the risk of cancer, including:
Metabolizing breaking down ethanol: - In alcoholic drinks to acetaldehyde, which is a toxic chemical and a possible human carcinogen; acetaldehyde can damage both DNA and proteins, Generating [26].
Reactive Oxygen Species chemically reactive molecules that contain oxygen: - which can harm DNA, proteins, and lipids fats in the body through a development called oxidation impairing the body's capacity to break down and take up a variety of nutrients that may be connected with cancer risk, including vitamin A; nutrients in the vitamin B complex, such as folate; vitamin C; vitamin D; vitamin E; and carotenoids. Alcoholic beverages having a lot of carcinogenic factors this

factor contaminated during handling and processing, during fermentation and production, such as asbestos fibres, nitrosamines, phenols, and hydrocarbons [27].

B. Energy intake and body weight

Overweight is a major risk factor of cancer and may account 14 to 20% of all cancer-related mortality Kushi *et al*, 2012 [28]. The relationship between body weight, body mass index BMI, or relative body weight and site-specific cancer has been observed in various studies, a significant association has been seen with cancers of the oesophagus, pancreas, gallbladder, renal, colon, and rectum. Bariatric surgery or any weight loss methods shows significant effect decreases oxidative stress and cancer. The optimal adult BMI should be between 21 and 23, depending on the normal ranges with a different population. Ligibel *et al.* 2014 concluded that overweight and obese cancer surviving are at risk for reoccurrence and for developing additional problem surgery including impaired wound healing, lymphedema after lymph node dissection, second cancers, heart disease and diabetes[29].

C. Avoid Processed and red meat

Research shows that eating more than 18 ounces of red meat per week increases the risk of colorectal cancers. Beef, lamb and pork are all red meats. Researchers do not yet recognize precisely how red meat affects the development of colorectal cancer. Red meat contains compounds that have been revealed to damage the lining of the gut and possibly encourage cancer. Cooking red meat at high temperatures can also create other cancer-causing compounds. Processed meats are meats that have been preserved by smoking, salting, curing or adding other preservatives. Sliced turkey and bologna deli meats, bacon, ham, and hot dogs are all processed meats. Research shows that several amount of processed meat eaten frequently increases the risk of both stomach and colorectal cancers. The International Agency for Research on Cancer IARC has classified processed meat as a carcinogen, something that causes cancer. And it has classified red meat as a probable carcinogen, something that probably causes cancer [30]. Processed meat includes hot dogs, ham, bacon, sausage, and some deli meats. It refers to meat that has been treated in some way to preserve or flavour it. Processes include salting, curing, fermenting, and smoking. Red meat includes beef, pork, lamb, and goat [4, 30].

D. Fibre, fruits and vegetables

The research data on the effect of dietary fibre on the risk of colon cancer is various with some types of evidence showing an advantage and others not. Clinical studies found that regular fruit and vegetables minimize the risk of cancer. Different study found fruit but not vegetables protected against upper gastrointestinal tract cancer. While fruit, vegetable and fibre protected against colorectal cancer and fibre protected against liver cancer[31].

Table 1: Different food groups of nutrients and their dietary sources [31, 32].

Nutrients in diet	Mode of actions	Food sources
Vitamins C and E, carotenoids, polyphenols	Antioxidant defence against oxidative damage to DNA, cellular macromolecules and membranes.	Fruit and vegetables generally: especially yellow and citrus fruit; berries, orange.
Dithiolthiones, isothiocyanates, allium compounds	Increases Type II detoxifying enzymes e.g. glutathione S transferase.	Cruciferous vegetables: broccoli, cauliflower, cabbage, Brussels sprouts, kohlrabi; alliums vegetables: onions, leeks, chives.
Vitamin C, allium compounds	Reduces bacterial formation of nitrosamines from nitrate in stomach. Decreases Type 1 activating enzymes e.g. aryl hydroxylase.	All fruit and vegetables Vitamin Particularly: blackcurrants, guava, citrus, kiwi fruit, broccoli, sprouts; allium vegetables: onions, leeks, chives.
Folic acid	Preserve integrity of DNA and ensure optimum DNA methylation.	Green leafy vegetables; avocado; oranges.
Carotenoids, Flavonoids	Induction of cell differentiation.	Yellow/orange fruits and vegetables: carrots, sweet potato, mango, pumpkin, red capsicum, rock melon, paw, tomato; Dark green vegetables: silver beet, spinach, broccoli, dark green lettuce, Chinese greens e.g. book Choy, kale, parsley, basil.
Soluble fibre, resistant starch	Decreases concentrations of secondary bile acids, which modify the enzyme activities of intestinal bacteria. Fermentation, which produces short-chain fatty acids that may inhibit carcinogenesis via effects on colonic pH and increased availability of butyrate.	All fruits and vegetables including legumes particularly: Soluble fibre such as dried apricots, dried figs, prunes, quince, okra, cabbage, carrot, broccoli, leeks, Brussels sprouts, beetroot, leeches, peas, mulberries, asparagus, lemons, oranges, Swede, parsnip, dates, plums. Resistant starch such as corn, bananas, peas, potato, sweet potato, broad beans.
Insoluble fibre	Dilutes carcinogens by increasing faecal bulking. Reduces interaction of carcinogens with mucosal cells by increasing stool transit time.	All fruits and vegetables, particularly guava, quince, peas, dried figs, corn, broad beans, berries, dates, pears, prunes, cabbage, spinach, pineapple, broccoli, onion, leek, asparagus, turnip, Swede, beetroot, squash, Brussels sprouts, okra, carrots, pumpkin, rhubarb, green beans.

4. Flavonoids

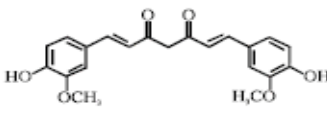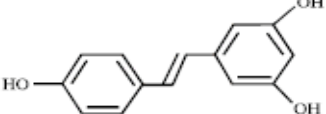Flavonoids such as the catechins are the most frequent group of polyphenols compounds in the human diet and are found ubiquitously in plants. While some research has observed Flavonoids may have a role in cancer prevention, others have been inconclusive or suggested they may be harmful [34].
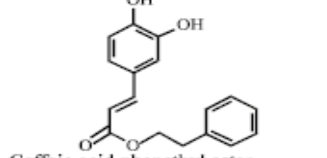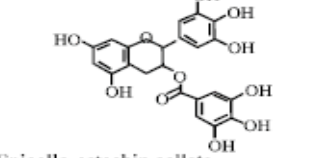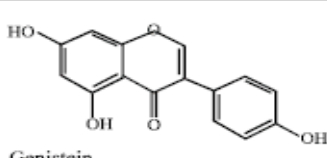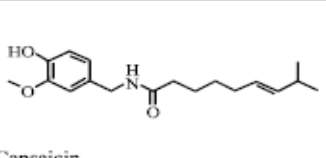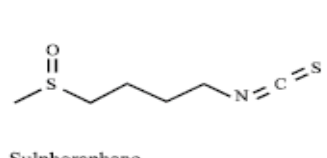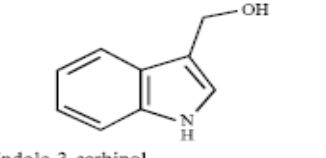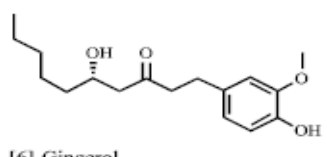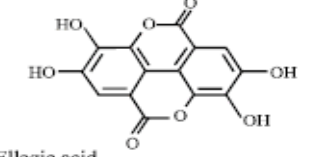
Table 2: Different groups of Flavonoids and their dietary sources.

Flavonoid group	Subgroup	Major sources	Anti-cancer properties
Fvanols	Flavan-3-ols: catechins, gallocatechin, catechin-3-gallate, epicaechin, epigallocatechin Flavan-4-ols Flavan-3,4-diols	Chocolate, green and black tea, beans, cherry, strawberries, cocoa, apple	Human oral, rectal and prostate cancer
Flavones	Apigenin, chrysin, luteolin	Parsley, celery, capsicum, pepper, broccoli	Lung cancer, leukaemia, stomach, colon, thyroid, oral and laryngeal cancer, breast cancer
	Flavones: kaempferol, myricetin, quercetin, rutin	Brussels sprouts, apples, onion, curly kale, leek, beans, cherries	
	Flavanones: eriodictyol, hesperidins, naringenin	Orange juice, grape fruit juice, lemon juice	
	Flavanonols: taxifolin	Milk thistle, red onion, aecia palm, Siberian larch tree	
Anthocyanidins	Cyanidin, delphinidin, malvidin, petunidin, peonidin, pelargonidin	Aubergine, black berries, black currant, blue berries	Colorectal cancer
Isoflavonoids	Isoflavones: daidzein, genistein, glycitein Isoflavane: equal	Soy flour, soy beans, soy milk, miso, tempeh, beer Metabolized from daidzein by intestinal bacteria	Breast cancer, prostate cancer, colon, kidney and thyroid cancer

Source: Vidak M, Rozman D & Komel R 2015[33].

Table 3: Natural sources of chemo preventive petrochemicals and theirs chemical structures

Sources: N. Haque 2010 [34].

5. Mushrooms: Mushrooms and the immune system. Some studies seemed to show that these mushrooms could stimulate the immune system to fight disease. There is some evidence from a Japanese study that people who eat a particular type of mushroom all their lives have a lower risk of getting cancer. AHCC and Cancer. Two small studies suggest that AHCC may improve outcomes among patients with liver cancer. Active hexode correlated compound is a widely sold health supplement extracted from Basidiomycete mushrooms that is purported to improve immune function. In Asia, there are more than 100 types of mushrooms used to treat cancer. Some of the more common ones are Ganoderma lucidum.Trametes Versicolor Curious versicolor Lentinus edodes and Grifola frondosa [35].

6. Nutrient bioactive: Laboratory experiments have concluded that turmeric might have an anti-cancer effect. Although trials are ongoing, large doses would necessitate to be taken for any effect. It is not known what, in any, constructive effect turmeric has for human beings with cancer [4].
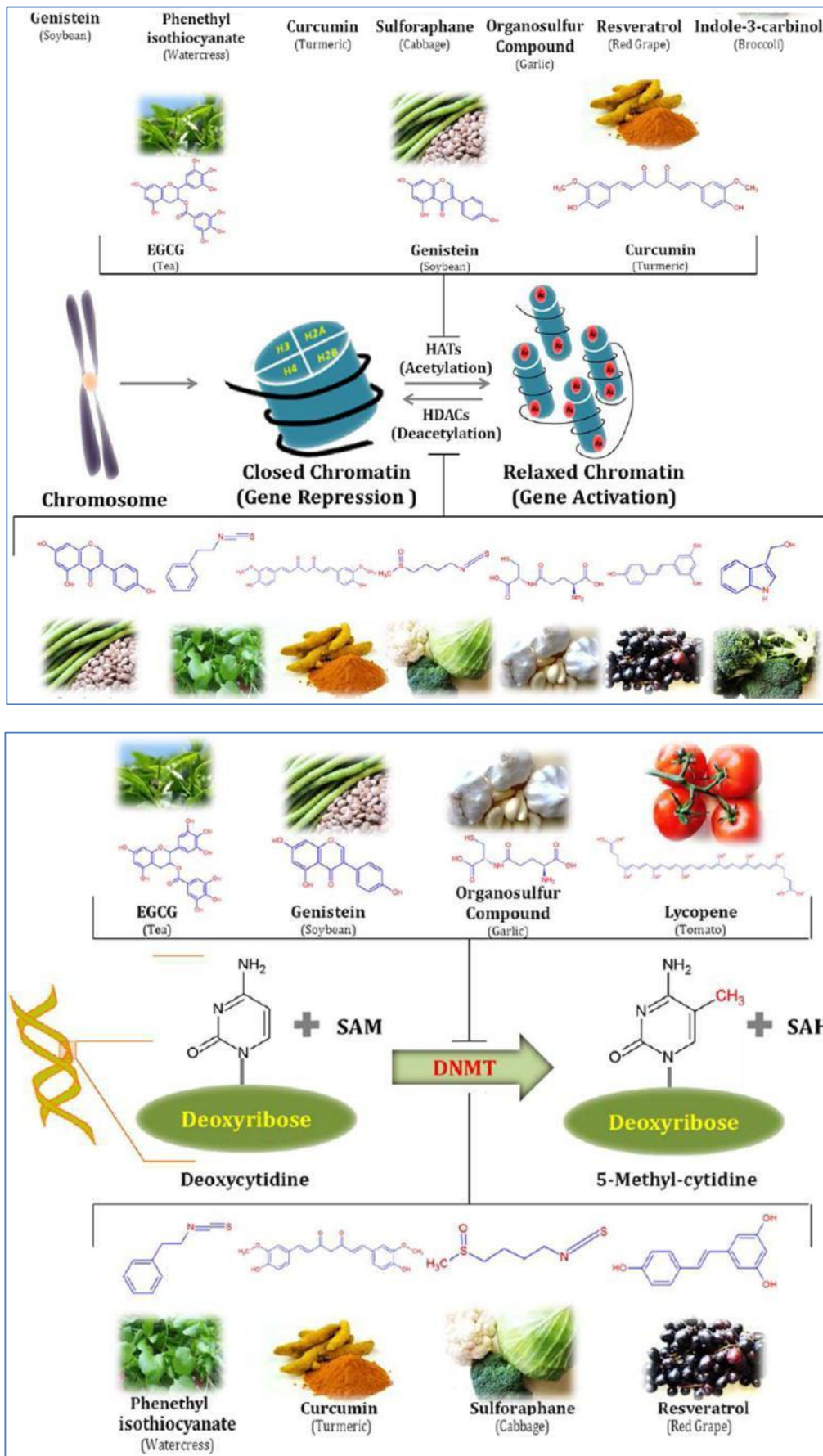
Sources: http://www.lavaldichiana.it/wp-content/uploads/2015/02/immagine2.jpg [36].

Table4: Recommendations for avoid Cancer risks

Body fatness Be as lean as probable within the normal range of body weight
Physical activity Be physically full of life as part of everyday life
Foods and drinks that encourage weight gain Limit consumption of energy-dense foods and avoid sugary drinks
Plant foods Eat foods predominantly of plant origin
Animal foods Minimum intake of red meat and avoid processed meat
Alcoholic drinks Limit alcoholic drinks
Preservation, processing, preparation Limit consumption of salt Avoid moldy cereals grains or pulses legumes
Dietary supplements intend to meet nutritional needs through di*et al*one
Breastfeeding Mothers to breastfeed; children to be breastfed
Cancer survivors Pursue the recommendations for cancer prevention

Source: NastasiaBelc and Gabriel Mustatea 2018[4].

Conclusion

Nutritional intake are considered to be imperative environmental factors, so scientists have revealed that dietary and nutrients might play a significant role in cancer development. The associations between diet and cancer are multifaceted. The risk of cancer is depending on the extent of exposure to infected food, availability of nutrient to the body, dietary pattern and way of life and food behaviour there are no end of evidence about particular contaminants known as cancer aspect risks but a definite diet with an effective defending role is still unidentified. Numerous manifestation of confirmation show that nutrients and non-nutrients in the diet have the potential to influence cancer development, but much work remains in identifying specific factors. Future diet studies with information on genotype will define whether targeted intervention is necessary and will help establish or exclude causality for nutritional factors. The ability to characterize tumours by stage, grade, histological subtype, and molecular subtype will also clarify the role of modifiable factors in cancer prevention. Advances in genotyping and biomarker technologies, combined with maturing large studies of diet and biomarkers in humans, will be integral in moving the field of diet and cancer forward.

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