REVIEW

Nutrition and Colon Cancer

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Abstract: Cancer is a disease caused by the uncontrolled division and proliferation of abnormal cells. Cancer can spread from its origin to other parts of the body and can be fatal if not properly treated. Colon cancer cells constitute a small subpopulation of cells with in a tumour that can regenerate, so it has the potential to increase resistance to radiotherapy and chemotherapy along with tumour metastasis rates. There are many important issues that patients exposed to colon cancer should pay attention to in their diet. Colon cancer patients should have the same sensitivity to nutrition as all individuals and maintain correct nutritional habits. Malnutrition and obesity are also among the causes of colon cancer. For this reason, dietary practices have an essential place in the prevention of colon cancer. Since it is a cancer of the digestive tract, nutritional management becomes necessary during the treatment process. As a result, nutrition with antioxidant content can reduce the risk of colon cancer.

INTRODUCTION

Colon cancer is the third most common type of cancer. Approximately 1.2 million new cases and 608,000 deaths are reported each year.

It ranks second after prostate cancer in terms of prevalence in men and third after breast and cervical cancers in women[35]. Colorectal cancer (CRC) is the third most common cancer globally with an estimated 1.8 million new cases in 2018. The incidence of CRC is much higher in men than in women, with 324/100,000 new cases compared to 253/100,000 new cases in 2018, compared to in Europe, respectively. 1 The main lifestyle-related CRC risk factors are smoking, alcohol consumption, obesity, physical inactivity, and some dietary factors. Many risk factors, such as advanced age, lifestyle, dietary habits, have been identified in the development of colorectal cancer. Despite all colon cancer treatment efforts, little improvement in the 5-year life rate has been achieved in the last 30 years[44]. Found that proinflammatory diets are associated with the risk of developing colorectal cancer (CRC), but there are inconsistencies in subregion and gender-specific associations. The relationship between CRC and combined lifestyle-related factors that contribute to a low-grade inflammatory profile has yet to be explored. The results suggest that a diet with a higher inflammatory potential is associated with an increased risk of CRC, particularly colon cancer, among men. Additionally, an inflammatory profile that included the inflammatory potential of diet, physical activity, and abdominal obesity was a strong predictor of colon cancer. Public health initiatives that jointly target these modifiable risk factors may be particularly effective in preventing colon cancer. Future research should identify specific dietary patterns related to plasma levels of inflammatory biomarkers in the same population[24]. In addition to these factors, oxidative and nitrosative stress may play a role in colon cancer development in some cancer types[19]. Large bowel cancer or colon cancer; covers cancer growths seen in the large intestine, rectum, and appended. It is the third most common type of cancer in the Western world and second among the cancers that lead to death. Adenoma, which occurs mostly in the large intestine, occurs from polyps[28].

Although large bowel cancer occurs at any age, more than 90% of patients are forty years of age or older. Every decade from this age, the risk nearly doubles. Those with large bowel cancer or large bowel polyps in their family and those with ulcerative colitis are at risk. Polyps and the early stages of cancer usually do not give symptoms. Therefore, from the age of forty, rectal examination, sigmoidoscopy, and secret blood testing of faeces should be performed[3].

At least 80% of large bowel polyps can be diagnosed by rectal examination, i.e. finger examination from the scissor. In the application of sigmoidoscopy, the rectum area is entered through the shear with the unique tool, and the area is examined in detail with the help of the light source. Secret blood testing

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in faeces is used to recognize polyps that do not show symptoms and bleed insidiously[28].

The rate of improvement in early diagnosed cancers is between 80-90%. To prevent large bowel cancer caused by the cancerization of benign polyps, i.e. pieces of meat over time, polyps need to be recognized from cancer and removed by surgical methods[4].

Several abnormalities in the DNA sequence cause all cancers. It is believed that 10-15% of cancers are hereditary, that is, they are transferred by genes from parents, while the remaining 85-90% is shaped by the exposure of DNA in living cells throughout life to mutagens, slight progressive changes in cell DNA and errors in replication. One of these mutations, which sometimes occurs, allows the cell in which it is located to grow and the formation of a cancer clone that derives from that cell. Cancer is multifactorial, with factors from bacteria to viruses, radiation to hereditship, environmental factors to feeding habits, and chemicals being blamed for cancer formation[52,6].

Antioxidants are molecules that inhibit the oxidation of other molecules. Oxidation is a chemical reaction in which electrons or hydrogens in the substance are taken and transferred to the oxidizing agent. Free radical formation occurs as a result of an oxidation reaction. These free radicals also cause a chain reaction to begin. A chain reaction within the cell also occurs with deformation in the cell or death of the cell. The oxidated cell has now mutated into another form. Antioxidant molecules eliminate free radicals, preventing chain reactions and other oxidation reactions that may occur. They do this by oxidizing themselves[2]. According to the surrounding intact tissue in patients with colon cancer, MDA reported increased levels of superoxide dismutase (SOD), glutathione peroxidase (GPX), and glutathione (GSH), and GSH decreased as the tumoral stage progressed[40].

Among the substances that oxide our body are heavy metals, oils, and countless chemicals that we eat and drink and even inhale. These are called free radicals or toxins. There is an average of 100 trillion cells in our body and thousands of molecules per cell. We can think of the term oxidation as oxidative wounds, such as gunshots targeted at our cells. If the bullet hits the cell wall, there will be some kind of damage. If it comes across protoplasm, there's different damage, but if it reaches DNA, then there's a lot of significant damage. Since DNA contains codes for cell regeneration, damage to DNA is of great importance. DNA codes are overly complicated and cause unedited new cell formation due to minor damage that may occur here[21,2]. Disorders in DNA repair cause many types of cancer, such as breast, colon, and skin cancer, as well as growth and brain anomalies[21].

Physiologically, the antioxidant defence system with the formation of free radicals is in a state of equilibrium. By shifting to the open radical side of the balance, the cell organelles' lipid and protein structure and membrane are disturbed, intracellular enzymes lose their activeness, and DNA damage occurs. Aerobic respiration in mitochondria deteriorates, lytic enzymes are activated, K^+ loss from the cell increases, vascular permeability is impaired, extracellular collagen tissue components are destroyed, platelet aggregate, and migration oocytes to tissues increases[11].

1.a. Colon and Cancer

It is the Latin general name for thick centres, which are part of the colon digestive system. The first 1.5-2 meters of thick edgings are called columns and the last 15-20 cm is called rectums and anal canals. The anal canal ends in the anus (the part of the thick intestine that opens out of the body)[7].

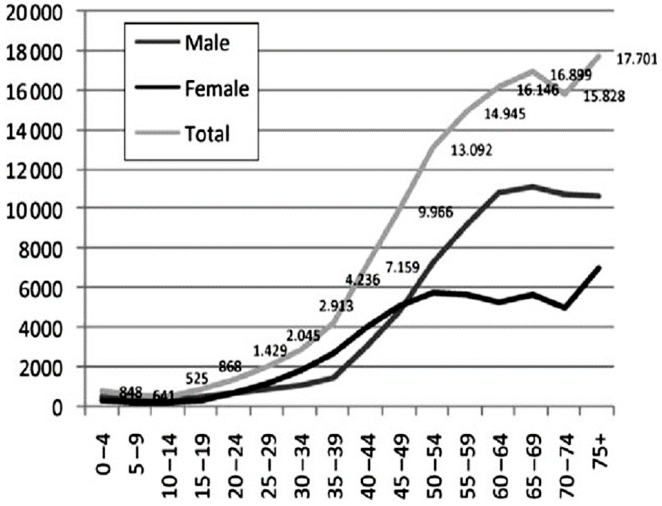
The digestive system is the organ system that deals with the digestion of nutrients (vitamins, minerals, carbohydrates, fats, proteins, and water) in food, absorbing the necessary nutrients and energy, and removing waste materials from the body. The digestive system consists of the oesophagus (osefagus), stomach, thin and thick blemishes. A dedyring feature of cancer is an increase in the number of abnormal cells that grow out of their bounds and are likely to spread to the body's reunification points and other organs, called "metastasis". Metastasis is the most common cause of death from cancer [53,8].

Colon cancers develop on a polyp floor. Usually, millions of thick lyk cells complete their task every day and die and are excreted with faeces. These cells are replaced by new cells. Due to genetic and environmental factors, there is a deterioration in the everyday life circulation of cells due to changes in these cells' genetic structure. Thus, newly formed, growing and developing, and multiplying cells do not die when they should die in due time and continue to multiply in the form of abnormally shaped cells. They appear and grow as a small polyp (hyperplastic and adenomatous polyps) in the large intestine section where they are found. Thanks to cancer-causing genes caused by genetic change, adenomatous polyps invade their organs, forming cancer and invading other organs in various ways[3,10]. About 10-15% of colon cancers are caused by the genetic transition (plethora predisposition). The remaining and most common causes are environmental factors or unknown reasons. It is most common after the age of 50. Most of the essential free radicals in biological systems are based on oxygen. Cells produce many free radicals when they are sick or old[30].

According to the statistics made by the Cancer War Department of the Ministry of Health, T.C. ranks 3rd in our country following colorectal cancer, lung cancer, and breast cancer. The incidence is 7.7% (Table 1). 59% of patients were male, and 41% were female[49].

Table 1. The ten most common types of cancer in Turkey

Organ	N	%	Insidy*Per(100000)
Lung	7754	15.70	11.0
Breast	5828	11.80	8.30
Leather	3703	7.50	5.27
Stomach	3448	6.98	4.91
Bladder	2400	4.86	3.42
Thick Lying	2247	4.55	3.20
Prostate	2122	4.30	3.02
Bone Marrow	18.33	3.71	2.61
Brain	1643	3.33	2.34



Cancer Trends and Incidence and Mortality Patterns in Turkey 2005 [54]

These results reveal the claim that the highest number of cases in Turkey is cancer over the age of 40. “It seems we're talking about the younger appearance of cancer. Twenty percent of cancer cases in women occur in 40 to 40 percent.

1.b. Risk Factors for Colon Cancer;

-Family history of colon or rectum cancer

-The person himself has a history of colon, rectum, ovary, endometrium, and breast cancer

-There is a previously detected polyp story in the colon. Ulcerative colitis (ulcers in the thick intestine) or a tale of Crohn's Disease.

Colon cancer prognosis may vary according to; The cancer stage (the prognosis is affected according to the tumour being limited only to the colon's inner surface, wrapping the entire colon, or progressing to other parts of the body)[51].

Today, TNM staging by the American Joint Committee on Cancer (AJCC) and Union Internationale Contre Le Cancer (UICC) is used.

According to these staging systems in colorectal cancers, 5-year life rates can be calculated accordingly:

Stage 0: Cancer was found only in the exciting layer of the colon or rectum. Carcinoma in situ is another name for colorectal cancer at this stage.

Stage I: The tumour developed on the inner wall of the colon or rectum. The tumour has not crossed the border.

Stage II: The tumour has spread more profound and even along the wall in the colon or rectum wall and inside the wall. It may have taken over nearby tissue, but the cancer cells didn't jump into the lymph nodes.

Stage III: It has spread to lymph nodes near cancer but not to other parts of the body.

Stage IV: Cancer has spread to other parts of the body, such as the liver and lungs.

Recurrence: It is cancer that recurs after a certain period after treatment and after a certain period. The disease may reappear in the colon, rectum, or other parts of the body.

Cancer obstructing the colon or creating a hole.

Cancer recurrence

-The general health status of the patient

Treatment options for colon cancer may vary based on:

Cancer stage

Cancer recurrence

-The general condition of the patient[38].

1.c. Factors Still Considered to Pose a Cancer Risk Today

Excessive fat consumption: According to research, there is little evidence that the total amount of fat consumed increases the risk of developing cancer. However, the richness of the diet from fat means that it is also high in calories. High-calorie intake can lead to obesity, therefore, even indirectly, the formation of cancer. In some epidemiological and experimental studies, it has been stated that consuming too much fat by diet (liquid and fats) increases the risk of the rectum, large bowel, ovarian, chest, testicle, and prostate cancer, and high cholesterol intake increases the risk of lung and pancreatic cancer[32].

Food additives: Many substances are added to the food to give taste, smell, and consistency. New food additives are controlled by the Food and Drug Administration (FDA) and tested by research on health -appropriate experimental animals. In today's lifestyle, food additives have become part of our diet. Some of the additives are carcinogenic, while some of them increase the effectiveness of carcinogens. Carcinogenic ones are not allowed to be used in food. These effects are not known when allowed but are prohibited if they are later understood. For example, some synthetic additives such as dulcin, cinnamyl anthranilate, and thiourea have been detected by experiments that cause liver cancer. The use of these substances in food is prohibited (International Agency for Research on Cancer-1 (IARC). We can give sodium nitrite (E250) or potassium nitrite (E249), nitrite salts, to substances that are in use that increase the risk of cancer. These are added antibacterially and as colour holders to processed meat products such as sausages and sausages. Consuming 50 per day from this type of processed meat product increases the risk of developing bowel cancer by 21%[22].

Processed meats: Some studies have found that processed meats may increase colon and stomach cancer risk. Smoked meats with high salt content are also shown as the cause of cancer. It is suggested that heterocyclic aromatic amines, polycyclic aromatic hydrocarbons and nitrite, nitrate and similar compounds used for storage purposes due to the cooking method in foods may increase the risk of breast and colorectal cancer. Heterocyclic aromatic amines and polycyclic aromatic hydrocarbons form during frying, grilling, cooking in flames, roasting of foods, and are genotoxic[15].

Those who prefer such cooking methods are reported to have 6.5 times higher risk of colon cancer [50]. Nitrates and nitrites are incredibly widely used to control the protective, colouring, flavour-enhancing, and microbial stability of processed meat products such as sausages, sausages, salami, and bacon. Nitrites that turn into nitrosamines have been shown to cause bladder cancer in animal models[3].

Obesity: Colon cancer is also more common in fat individuals. Especially in male individuals, a more robust relationship was found between the increase in BKI and colon cancer than in women. In women, as opposed to breast and endometrial cancers, the hormone estrogen has been protective against colon cancer. However, the balance between obesity and estrogen can also trigger colon cancer. The risk of colon cancer increases in women who take estrogen during the pre or postmenaposis period, which has a high BKI value. In individuals between the ages of 30 and 54 with a BKI value of 30 and above, the risk of colon cancer was reported to increase by 50%. Abdominal obesity can be a triggering factor for both sexes. Besides BKI; waist/hip ratio or waist perimeter measurement also positively correlates with colon cancer. The most crucial hypothesis that studies the relationship between colon cancer and obesity; high insulin and insulin-related growth factors in obese individuals will increase tumour development[6]. There is strong evidence that modifiable lifestyle factors, such as obesity, play an important role in colorectal carcinogenesis. Epidemiological data have consistently reported a positive association between obesity and colorectal cancer. The relative risk (as assessed by BMI) associated with overall obesity is higher in men than in women and for colon cancer than for rectal cancer. Abdominal obesity (as assessed by waist circumference (WC) or waist-to-hip ratio) is associated with an increased risk of colorectal cancer in both sexes, with stronger associations for colon cancer than for rectal cancer. Reasonable biological mechanisms include insulin resistance, hyperinsulinemia, chronic inflammation, altered levels of growth factors, adipocytokines, and steroid hormones. In addition to its impact on colorectal cancer incidence, obesity may play a role in colorectal cancer recurrence, treatment outcomes, and survival[26].

Drug residues: A small number of drug residues found in vegetables and fruits can be toxic and increase cancer risk. Therefore, vegetables and fruits must be washed before they are consumed. In addition to the chronic effects of 40 types of chemical drugs in agricultural production, acute poisoning and death events are also seen during its use. According to World Health Organization data, 500,000 people are poisoned with pesticides every year, 5,000 of whom died because of it. Today, data on the brain, lymph cancer, and leukaemia of pesticides widely used in the USA and our country are increasing[33].

Salt: In many studies, it has been supported to suggest that salted canned foods increase the risk of gastric, ginger, and throat cancer. However, moderate salt consumption does not affect cancer formation. Therefore, the consumption of 6 grams of salt per day will be sufficient[27].

Sugar: High sugar intake can increase cancer formation by increasing the risk of obesity and raising insulin levels. Honey and brown sugar are no different from white sugar in increasing the number of calories and insulin levels. The relationship between excessive sugar consumption and cancer was twice revealed by Germany's Otto Warburg, who was awarded the Nobel Prize in Medicine. Warburg has shown that cancer cells have a different metabolism than healthy cells. While the body's normal cells use both oxygen and oxygen-free metabolism pathways for their energy, cancer cells can only use the oxygen-free metabolic pathway[1].

Cancer cells use 3-5 times more sugar than healthy cells. The only harm to sugar is not that it feeds cancer tissue. However, excessive consumption of flour and sugar leads to obesity and insulin resistance, and according to some sources, their unbalanced consumption is a risk factor in the disease. A study showed that fasting hyperglycemia and diabetes increase cancer risk[25]. Increased risk affects the pancreas the most, followed by oesophagus, liver, bilious, colon, rectum, and cervical cancers[6].

Alcohol: Liver cancers are more common in people who consume large amounts of beer, large-time cancers, rectum cancers, mouth, head, and neck cancers in those who consume stiff drinks, and individuals with high alcohol consumption. Alcohol taken with smoking increases the risk of cancer several times. Also, alcohol is among the substances that increase cancer risk, as it also negatively affects nutrition to protect against cancer. It is stated that folate perpetrates intake may be useful in drinking too much alcohol because alcohol reduces folate absorption[32].

Antioxidant Substances: Antioxidant, a substance that slows down the oxidation of fats. In living things, chemical processes (processes), especially oxidation, cause free radicals. Highly reactive free radicals can quickly react with different molecules, thereby damaging cells, living things. Antioxidants react with free radicals (bonding with them) preventing them from damaging cells. With these features, they reduce the risks of normalization of cells and, as a result, tumour building and reduce cell destruction and increase the chances of living a healthier life where the effects of old age are minimal. Enzymatic antioxidants are enzymes such as superoxide dismutase (SOD), glutathione peroxidase (GPx), and catalase. Non-enzymatic are tocopherol, carotene, ascorbic acid, uric, cysteine, ceruloplasmin, transferrin, and albumin[46]. Our body has a system that recognizes and neutralizes free radicals. This system consists of enzymes and antioxidants; it attracts and connects free radicals to the cell membrane without attacking nucleic acids (DNA) and cell components[31].

The body uses useful substances called antioxidants, which are high in vegetables and fruits, to bind harmful substances (oxide) released during metabolism functions. Antioxidant substances; Vitamin A, C, E, copper, selenium, zinc, vegetables, and fruits give colour (flavonoids, lycopene). Research shows that these substances can reduce the risk of cancer with a diet containing vegetables and fruits[16]. However, it has not been proven whether it affects individuals who take vitamins and minerals from the outside in capsule form. In healthy people, the balance of free radicals and antioxidants, in people who are not beneficial, this balance is impaired in the direction of free radicals. However, when antioxidant mechanisms are made more active, or this degraded balance is shifted in the direction of antioxidants, it becomes easier to deal with diseases caused by imbalance. To prevent free radicals' harmful effects, antioxidants come into play, connecting to the radical and neutralizing the radicals' free electrons. Antioxidants show their effectiveness by holding free radicals or translating them into a weaker new molecule, effective with free radicals and reducing their activity, linking free radicals to themselves and breaking or repairing the reaction chain[18]. Found that oxidative damage occurs in patients with antioxidant deficiency and colorectal cancer. They found that patients with colorectal cancer had lower TAC levels than healthy controls. It was concluded that patients were exposed to oxidative stress and needed to increase plasma antioxidants in significant amounts, which may have played a role in the etiopathogenesis of the disease. One of the contributing causes of colon cancer has been proven to be the effect of oxidative stress on the DNA sequence of the adenoma resulting in eventual progression to carcinoma. Studies on the effect of antioxidants on oxidative stress and CRC are not always in agreement, but positive health effects of antioxidants on CRC have always been implied. As a result, antioxidants were consumed almost routinely in patients with CRC. This is despite the fact that direct human data has not been verified. However, data from in vitro studies and animal models appear to reduce the rate of progression of CRC. Therefore, larger studies involving CRC patients are needed to further elucidate the importance of dietary antioxidants in colorectal carcinogenesis. In summary, at this point, they recommended the use of antioxidants in patients with a history of IBD and CRC[34].

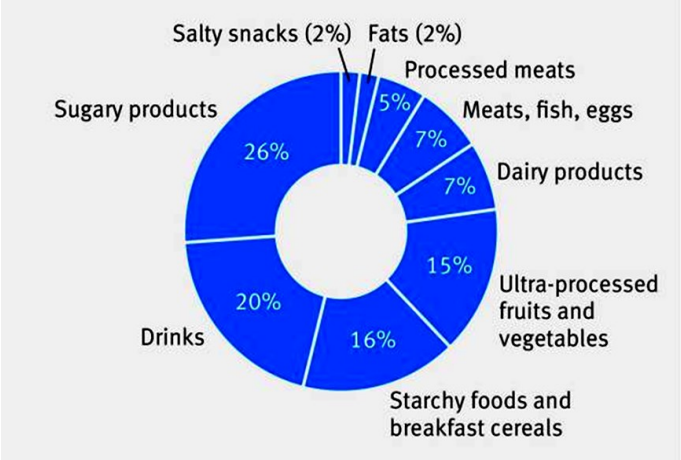


Figure 1. Relative contribution of each food group to ultra-processed food consumption in diet.[20]

2.a. Colonoscopy

It is the process of videotaping the images taken by displaying the thick bleeds' inner surface with a telescope. At the same time as this procedure, biopsies (tissue samples) can be taken; polyps can be removed, haemorrhages can be intervened, even early colon cancers can be treated. Samples and polyps taken are sent to the pathologist's laboratory for detailed analysis and definitive diagnosis.

3.a. Clinical Findings in Colon Cancers

The clinical findings that are usually seen are; defecation habits include a change in the practice of defecation, bleeding from the anus, mucus secretion mixed with rectal discharge or faeces, changes in the characteristics and diameter of the stool, density, age, and badly smelling gas, abdominal pain and anorectal pain, dissection, obstruction, tumour perforation, abscess, fistula, weight loss, weakness, loss of appetite and anaemia. In physical examination, it is possible to detect the tumour in the mass, rectal key. 1/3 of rectum tumours are within the access[12,45].

4. Discussion and Conclusion

Nutrition, air pollution, radiation, smoking, environmental pollution, food additives, and various toxins disrupt their gene function with their damage (mutation), and cells are excessively stuffed. Mutagenic or carcinogenic agents in the diet are linked to DNA, causing damage to it. When the damage reaches a critical level,

normal cells become cancerous cells. DNA repair enzymes and other gene protective mechanisms clean up 90% of the damage within 24 hours. If they don't have DNA repair enzymes or are undersized, these mutations quickly lead to cancer. The DNA repair capacities of the cells are limited. Therefore, gene protective mechanisms are fundamental. The protection of genes can be achieved mainly through nutrition. Adequate and balanced nutrition with the quality and quantities of the nutrients consumed is of great importance for newly formed cells[9,17]. It has been reported that diet and lifestyle are important risk factors in the development of colorectal cancer (CRC). However, they mentioned the uncertainty of the mechanism of action of dietary factors in CRC disease. The purpose of their study was to examine various dietary choices and their potential association with the risk of developing CRC. Another study of African American women found that a Western diet was associated with a 42% higher risk of colorectal adenoma. The Western Model of dietary choice has been directly associated with CRC. processed and heavily loaded with red meat, whole grains, coffee, hash browns, nuts, poultry, sweets and desserts. This food group has been described as the "Western" diet pattern. Western diet was responsible for 11.64% of the total variance. The second pattern, labeled as a "healthy" diet, contained high amounts of fruit, vegetables, dairy, tomatoes, carrots and nuts[39]. According to[43] applied three dietary patterns. In the study conducted in Jordan, they applied Western, Healthy and High Sugar/High Tea Patterns. Consistent with previous studies, they found that the Western diet was associated with an increased risk for developing CRC. They did not see a protective effect in the healthy eating group, but they said this may have been due to the inclusion of other non-preservatives. This study suggests that dietary factors may have a role in the development and prevention of CRC, but more research is needed on specific foods for which the evidence remains suggestive. According to a study conducted by [48], they supported these dietary recommendations for the prevention of CRC, emphasizing high dietary fiber, calcium and yogurt intake and lower red meat and alcohol intake. The resulting results suggested a possible role for the population's overall dietary patterns, which emphasized habitually consuming fruits, vegetables, grains and low-fat dairy, and reducing red meat and alcohol intake. Several mechanisms can lead to oxidative stress in cancer patients. Due to oxidative stress, lipids, proteins, enzymes, carbohydrates, and DNA can be damaged, random fractures and bindings may occur in DNA chains as a result of damage to membranes, damage to enzymes and structural proteins may end with the death of the cell, and these cases form the molecular basis for the development of cancer, neurodegenerative and cardiovascular diseases, diabetes and autoimmune disorders[14,29,36,37].

Research on cancers has found that colon and rectum cancers are more common in communities that consume low-pulped food. High pulp foods create more voluminous waste material, allowing cancer-causing substances to be quickly excreted with faeces and reducing cancer risk. Therefore, care should be taken to consume foods with plenty of pulp against colon cancer. It should limit the consumption of red meat and stay away from processed meat products. Excessive consumption of red meat triggers the risk of colon cancer. Because excessive consumption of red meat can lead to cancer by setting the stage for the formation of carcinogenic heterocyclic amines and nitrosamines, the weekly consumption of red meat should be limited to less than 500 grams. Also, care should be made when consuming processed meat products such as salami, sausages, and sausages today. However, these products' consumption carries severe risks for human health due to several preservatives and additives with carcinogenic properties during production. Therefore, processed foods should be avoided. It should also be remembered that there is an essential carcinogenic in their meat, which is cooked by burning in the barbecue.

Besides feeding on carbohydrates containing high calories, insufficient consumption of fruits and vegetables also leads to converting carcinogenic nitrate into nitrite. This transformation can trigger cancer because antioxidant and anti-proliferative fruits prevent the proliferation of the intestinal lining and the formation of polyps in the intestine. Also, they provide essential contributions such as binding bile acids and expelling harmful substances in the intestine by increasing bowel movement. It should contain sources of calcium and vitamin D in our diet. Smoking and alcohol should not be consumed. We must reduce excessive salt and sugar consumption. We should stay away from foods that contain food additives. The ideal weight should be reached to be protected from colon cancer, and this weight should be maintained. As a result, nutrition with antioxidant content can reduce the risk of colon cancer. Also, we must take care to protect ourselves from stress and the effects of free radicals.

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