

[Red Meats and its Relationship with Colorectal Cancer: Symptoms, diagnosis, treatment, and Prevention]

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[Colorectal Cancer (CRC) is a kind of cancer that arises in the colon or rectum. A multitude of factors can influence the risk of colorectal cancer. These factors may include age, environmental effects, diet, genetics, and intestinal bacteria flora. The main subject of this paper focuses on reviewing studies that suggest the connection between the consumption of red meat and colorectal cancer while offering an overview of CRC symptoms, diagnosis, treatment, and prevention.]

Introduction

Colorectal cancer (CRC) is one of the most diagnosed forms of cancer among men and women and is the most common in cancer deaths. The number of cases of CRC has been growing unexpectedly over the past few years. We are seeing more cases of CRC occur in younger people, which draws more concern and the potential for cases to increase. In the United States alone, there are over 140,000 people diagnosed each year, according to the CDC. According to another study, there were nearly a million CRC deaths worldwide in 2020 [9]. Importantly, this paper will overview CRC, including symptoms, diagnosis, treatment, and prevention. Many studies have been conducted, and recent findings express that people's diet has a pivotal role in developing colorectal cancer. Red meats are a common food source and are high in protein. These red meats include sausages, bacon, ham, steak, and others preserved through smoking, salting, or curing. Although a good source of protein, red meats contain high cholesterol, saturated fats, and even carcinogenic chemicals when cooked. Several studies have revealed a positive

association between red meats and an increased risk of colorectal cancer [11]. One group reviewed sixty eligible studies and observed different locations impacted by red meats, such as the proximal, distal, and rectal areas. The observation of the other regions of the colon is to assess which part is more susceptible to developing cancer when consuming red meat. Although the exact mechanisms remain unclear, these methods will help understand CRC and its relationship with red meats. This paper aims to examine the existing research on this topic and review the consumption of red meat that may contribute to an increased risk of colorectal cancer.

Causes of Colorectal Cancer

A person's genetic composition plays a role in the development of CRC. Those with a history of colorectal cancer and related first-degree are more likely to develop CRC [7]. In the first degree, the relationship dramatically increases the risk of CRC due to genetic composition or lifestyle and dietary habits contributing to the risk. A prime example is the hereditary Lynch syndrome, which means

the genetics could be passed down from parent to child due to inherited gene abnormalities that impact DNA mismatch repair [3].

Additionally, dietary habits are also a substantial factor in the development of CRC. Most notably, western diets typically contain more high fat with red meat and processed meat intake. According to a recent study, red meat and processed meats will likely cause human cancer. Studies suggest processed meats are carcinogenic and red meats are probably carcinogenic to humans [9]. Particularly, cooking red meats can form various chemicals that can cause human cancer. For instance, cured meats include N-nitroso compounds (NOCs) when digested, well-done meats contain heterocyclic aromatic amines (HAAs), and smoked meats contain polycyclic aromatic hydrocarbons. Chemicals such as N-nitroso compounds and HAAs can stimulate DNA damage and mutations inside colonocytes, leading to colorectal cancer. When red meat is smoked or charred, polycyclic aromatic hydrocarbons are present and can enter the bloodstream [9]. The chemicals formed when eating red meats, such as NOCs, can also lead to lipid peroxidation products. These lipid peroxidation products can cause damage to colon cells [11]. Once NOCS are ingested, they can cause DNA damage and mutations in colonocytes, increasing the likelihood of CRC. Additional research also found that a high-fat diet is harder to digest while promoting CRC growth and metastasis. The study found that a high-fat diet can induce cyclophilin B, which enhances a signaling pathway involving the STAT3 protein and long non-coding RNA called PVT1 [5]. Since red meats contain high fats, this could be an additional factor to consider due to high fats promoting the growth of CRC. More recently, there have been ongoing investigations into glycation end-products (AGEs) which form when proteins, lipids, nucleic acids, and sugars combine when red meats are cooked at high temperatures. Glycation end-products can promote inflammation and have been positively associated with CRC [6]. Notably, multiple studies in this paragraph suggest various ways red meats have been linked or associated with CRC. Although recent research has provided more knowledge about CRC and red meats, the exact mechanisms behind it are still unknown. Therefore, more research is needed to find the exact mechanisms to treat colorectal cancer properly.

Symptoms of CRC

The symptoms of CRC can sometimes be challenging to determine due to stage IV. Most people will not report symptoms until later stages or progressions. Particularly this is because due to tumor's stage and location. The symptoms of CRC can be caused by colon blockage resulting in constipation or changes in stool consistency,

which is more common in later stages of CRC. Blood in stools is common, along with abdominal pain [1]. Other specific symptoms include sudden weight loss, changes in appetite, exhaustion, nausea, or vomiting. Colorectal cancer in later stages might induce digestive system blockage due to tumor growth, resulting in nausea, severe abdominal pain, cramping, and vomiting [7]. This can explain the difficulty of maintaining weight for people with CRC. Furthermore, if cancer has spread to other organs, such as the liver or lungs, it can cause additional symptoms, such as jaundice, shortness of breath, or coughing. Some patients have reported after chemotherapy that some foods do not taste the same; as a result, this could also contribute to weight loss. If CRC is left untreated, it could result in death if the cancer is too advanced. In The early stages of cancer, some people may not report or feel any symptoms; therefore, symptoms can vary.

The Diagnosis of Colorectal Cancer

Compared to other types of cancer screenings and examinations, colorectal cancer has a higher screening detection rate. The need for Various tests and examinations are typically required to screen colorectal cancer to confirm the diagnosis. However, a physical exam is usually among the initial evaluations, during which the doctor checks for any irregularities with a gloved, lubricated finger [8]. Further, another way of detecting colorectal cancer is by using blood tests. Nevertheless, colonoscopy is the ideal and gold standard for colorectal cancer screening. The nature of other tests results in higher false positive results, but the colonoscopy has a lower false positive rate; therefore, it is more standard. Doctors use a long, flexible tube with a camera attached. The device is used for any lumps or abnormalities to view the entire colon and rectum [1]. The doctor will check and remove any growths or tumors during a colonoscopy. Additionally, the doctor could take a biopsy or sample to determine if it is cancerous during the colonoscopy. According to the American Cancer Society, colonoscopies are recommended for people starting at the age of forty-five every ten years because people are at an average risk of developing CRC around this age. However, recent trends show the age may be lowered since there has been an increase in cases among people in their twenties and thirties. Various colorectal cancer tests include fecal occult blood tests, colonography, and fecal immunochemical tests. However, all these tests are less accurate and reliable than a colonoscopy, but they are helpful in cases to screen someone for CRC [8].

Treatment of Colorectal Cancer

The treatment options for colorectal cancer vary depending on the cancer's spread; therefore, surgery is the likely treatment option in this case. [2]. Stage I of colon cancer

describes cancer that has grown deeper into the layers of the colon wall but has not spread outside the colon wall. Stage I treatment typically involves surgery to remove a cancerous polyp, but more surgery is needed if there are other cancer cells around the polyp. In some cases, there is a need for a partial colectomy, which removes part of the colon and is reattached to prevent the cancer cells from spreading. However, colectomy can change bowel function. Stage II of CRC includes growth outside through the colon's wall and possibly affecting the nearby tissues. A partial colectomy and the removal of surrounding lymph nodes are needed. However, if the doctor suspects the patient has a higher risk of reoccurring cancer, the doctor may suggest chemotherapy [4]. Chemotherapy can also cause many symptoms, including nausea, fatigue, hair loss, and even weaken the immune system. Stage III colon cancer means that cancer has spread to nearby lymph nodes but has not spread throughout the body. In this stage, a combination of treatments involves a partial colectomy, including surrounding lymph nodes. After partial colectomy, chemotherapy is the common treatment. Stage IV of colon cancer is severest because cancer from the colon spreads to other distant organs. In this stage, the most common organ cancer spreads to is the liver [2]. However, it can still spread to other organs, such as the lungs, brain, and the abdominal cavity's lining. The treatment in stage four is met with chemo to shrink the size of the tumor to give a better chance of removing it with surgery. Surgery by itself in stage four is unlikely to cure cancer. The five-year survival rate for Stage IV colorectal cancer is around 15%, but this can vary on a multitude of factors that include the patient's age, response to treatment, and overall health are a few factors [2].

Prevention and Reduce Risk

Colorectal cancer may be difficult to prevent, but there are some ways to reduce the risks of developing it. Screening for CRC starting at the recommended time can help avoid CRC altogether. Screenings for CRC can also help catch it in the early stages. If caught early, cancer will be easier to treat. The doctor may recommend different methods of screening options based on the patient's risk factors. Another key strategy to prevent risk is maintaining a healthy weight through diet and exercise. Obese or overweight adults typically have an increased risk; people that are overweight or obese have a higher chance of developing colon cancer. Eating a healthy diet while limiting the number of processed and red meats can substantially reduce the risk of developing colorectal cancer. For example, the IARC group concluded that every fifty grams of processed meat or one-hundred grams of red meat increased the risk of colorectal cancer by 18% compared to people who eat other lean meat. [9]. Typically, a doctor recommends switching to a Mediterranean diet in

high-risk people for CRC or remission. Mediterranean diets consist of less red meat and, more generally, seafood. Adding fiber to an individual's diet is another method to reduce the risk of developing colorectal cancer. People that require a higher intake of iron and are at higher risk of CRC could find alternative foods to provide an iron-rich diet still. Some foods that are rich in iron include spinach, shrimp, whole wheat bread, strawberries, and lentils are some examples. Additionally, the consumption of alcohol and smoking increases the risk of CRC; therefore, quitting together or limiting it will reduce the chances of development. Finally, some recent studies have shown that taking anti-inflammatory drugs (NSAIDs) regularly, such as ibuprofen and aspirin, can reduce colon inflammation, lowering the risk of developing colorectal cancer. However, regular use of NSAIDs can come with risks, such as ulcers, so it is imperative to consult a doctor before starting everyday medication use.

Conclusion

In conclusion, colorectal cancer is a serious form of cancer that affects numerous men and women. CRC is one of the leading forms of cancer death, but it can be mitigated with a healthy diet with exercise the number of deaths would decrease. For the most part, CRC is a preventable form of cancer through diet, exercise, and screenings. However, some people have increased risks of developing CRC due to their genetic disposition. The screenings for people with an increased risk may have more frequent screenings starting at an earlier age in order to prevent the onset of CRC development. The increasing trend of people developing CRC warrants more concern, especially since the trend shows people in their twenties and thirties developing CRC. The younger amount of people being affected by CRC could be due to their dietary habits since people around this age are typically more physically active. The investigations of red meat have shown some carcinogens possibly responsible for increasing CRC risks and development. Multiple studies have suggested that increased consumption levels of red meats also increase CRC over longer periods. Overall, this paper has covered numerous topics relating to CRC, including red meat's relationship with CRC, symptoms, treatments, and mitigation strategies for preventative measures.

Recent Progress

Recent research surrounding cancer has been focusing on immunotherapy to specifically eliminate cancerous cells as opposed to traditional methods like chemotherapy that kill both healthy and cancer cells. On the other hand, recent progress has shown that T-cell-based immunotherapy and immune checkpoint inhibitors have

shown promising results in overcoming resistance to CRC. Moreover, monoclonal checkpoint inhibitor antibodies can reactivate the immune checkpoint in the T cells to kill tumor cells [4]. Immune checkpoint inhibitors have been shown to encourage results in non-small cell lung cancer, melanoma, and other cancers. However, it has only been effective for the CRC subsection with microsatellite instability or the existence of mutations that can lead to errors in DNA replication and repair [4]. Specifically, this means that it is only effective to a certain type, limiting the use. Other immunotherapies, such as cytokines, oncolytic viruses, and more, are currently in studies against CRC. The potential of immunotherapies to improve people's lives and treat cancer without the side effects of current traditional treatments is vital to the progression of therapies for cancer. Eliminating traditional methods and focusing on cancerous cells will improve cancer patients' overall health.

Discussion

Overall, a multitude of factors contribute to the development of CRC, and it can be complex to comprehend due to the exact mechanisms being still not fully understood. Conversely, recent studies have provided a new perspective on how red meats influence the progression of CRC. Red meats contain compounds such as NOCs, HAAs, and AGEs, which suggest red meats can incite damage to the colonocytes, increasing the risks of CRC. The compound-like of AGEs have not been explored thoroughly in-depth; it is possible that further exploration of T-cell immunotherapy could be the solution. T-cell immunotherapy can trigger an immune response to recognize and send in cells to repair damages or alterations caused by AGEs. However, there is a need for more research to fully understand the potential of T-cell immunotherapy and, more significantly, in the context of AGEs in colorectal cancer. Another possible direction is to evaluate the microbiota makeup of CRC patients to see if the foods being eaten cause dysbiosis, which could lead to increased proinflammatory bacteria that could contribute to CRC development. If further research confirms this, the new possible strategy is to target the proinflammatory bacteria to reduce the amount of inflammation in the colon. However, this is a suggestion of possible research; therefore, more information needs to be uncovered before

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