Epideomology

Plant based diet and colorectal cancer

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This paper is a literature review that talks about the relationship between colorectal cancer and plant based diet. The review includes epidemiological studies, cohort studies, case control studies, and systematic reviews, meta analysis published in peer-reviewed journals.

The search was conducted using data: PubMed, Google scholar, and Web of Science.

Keywords used: “Colorectal cancer”, “Colon Cancer”, Plant-based diet”, “Processed meat”, and “Cancer Risk”.

A systematic

1. Introduction
   1. What is Colorectal Cancer

Colorectal cancer (CRC) is a major global health issue, ranking as the third most commonly diagnosed cancer in both men and women worldwide and is the second leading cause of cancer-related deaths. It is also the primary cause of mortality among gastrointestinal cancers (Dobre et al., 2015). Several risk factors contribute to its development, including poor dietary habits, smoking, inflammatory bowel diseases, the presence of polyps, genetic predisposition, and aging. Approximately 90% of individuals diagnosed with colorectal cancer are over the age of 50, with the median age of diagnosis being 64 (Siegel, Miller and Jemal, 2015). However, when the disease occurs in younger patients, it tends to be more aggressive. According to the American Cancer Society, colorectal cancer was responsible for over 49,700 deaths in 2015 (Granados-Romero et al., 2017).

CRC is currently the most harmful tumor in the gastrointestinal tract, accounting for 13% of all cancer cases. It ranks as the second leading cause of cancer-related deaths globally, affecting men and women equally across both developed and developing nations. Studies suggest that its mortality rate will increase and be greater than that of heart disease (Dobre et al., 2015; Siegel, Miller and Jemal, 2015). The highest incidence is observed in individuals aged 65 to 74, with women showing slightly higher rates. However, the disease is increasingly being diagnosed in younger individuals, driven by risk factors such as obesity, physical inactivity, poor diets high in fats and proteins, smoking, and the overall aging of the population (Granados-Romero et al., 2017).

CRC commonly presents with symptoms such as abdominal pain, persistent changes in bowel habits, altered stool patterns, unintentional weight loss, nausea, vomiting, general discomfort, loss of appetite, and abdominal bloating. Distal tumors are more likely to cause noticeable rectal bleeding, while proximal tumors often result in blood mixed with stool, making it less apparent. As a result, these cases can go unnoticed and may lead to anemia as a secondary indication (Granados-Romero et al., 2017).

Prevelance

In 2020, there were around 2 million reported cases of CRC, and 1 million CRC deaths, these numbers represent 10.7% of newly diagnosed cancer cases and 9.5% of deaths worldwide (Morgan et al., 2022). Beyond its global impact, CRC also presents a significant health challenge within the United Kingdom. It is the fourth most common cancer nationally, with over 41,000 cases reported every year (NICE, 2021).

Demographic trends further complicate the situation. The incidence of CRC is higher among older adults, particularly those aged 50 and above, though recent data suggest a concerning rise in younger populations as well (Siegel et al., 2020). Risk factors such as diet, lifestyle, genetic predisposition, and environmental exposures contribute to these trends, with red and processed meat consumption, physical inactivity, obesity, and low fibre intake being well-established contributors (World Cancer Research Fund, 2018).

Causes

Age is a major risk factor for colon cancer, but it cannot be modified. On the other hand, alcohol intake and smoking are acknowledged as modifiable risk factors. Here our attention is now turned to diet-related and other lifestyle factors that individuals can influence to potentially reduce their risk (Rose, 2019).

In October 2015, processed meat has been classified as carcinogenic to humans by the International Agency for Research on Cancer (IARC), part of the World Health Organization, based on strong evidence linking its consumption to risk of colorectal cancer. And several new epidemiological studies and reviews have been published that further supporting the IARC’s classification (Rose, 2019).

Heriditery factors

It was estimated that 35% of colorectal caner was hereditery.It is linked to gene mutations involved in the mismatch repair (MMR) pathway of errors in DNA pairing (Granados-Romero et al., 2017).

Dietary choices, physicsal inactivity, smoking, and high alcohol consumption is also a CRC risk. In addition, obesity is a well-documented risk factor (Chu et al., 2025). Research has shown that vegetarians and vegans have lower body mas index (BMIs) with vegetarians averaging a BMI of 25.7 and vegans averaging 23.6. Some studies have shown that vegetarians a 70%-80% lower chance of having hyperinsulinemia, which also reduces their risk of CRC (Rose, 2019).

Numerous epidemiological studies have shown that individuals with insulin resistance face a higher risk of developing various cancers, including breast, colorectal, liver, and pancreatic cancers (Rose, 2019). Metabolic syndrome contributes to both elevated insulin levels and insulin resistance, caused by factors such as excess body weight, high intake of saturated fats, and diets with a high glycemic load. This combination creates a hyperinsulinemic environment, which is believed to play a role in the development of colon cancer. Vegetarians are 70–80% less likely to experience hyperinsulinemia and tend to have lower insulin levels overall (Rose, 2019), which may help explain having lower risk of colon cancer.

Additionally, one study found that the likelihood of being overweight or obese was 65% lower for vegans and 46% lower for vegetarians (Rose, 2019).

Gut microbiome health also plays a crucial role in CRC risk. A well-balanced microbiome holds beneficial bacteria that help prevent chronic inflammation, protect intestinal cells, and support healthy cell division. Foods rich in fructo-oligosaccharides and galacto-oligosaccharides—such as onions, garlic, and artichokes—support microbiota diversity, further reducing CRC risk (Simpson and Campbell, 2015; Lin et al., 2018)

Plant based diet

Epidemiological research has shown that diets rich in plant-based foods are linked to a reduced risk of several types of cancer, including colorectal cancer (CRC). Many phytochemicals found in fruits, vegetables, whole grains, nuts, and spices have been identified as having cancer-preventive properties. These compounds can help inhibit cancer development through many actions, such as reducing DNA damage through their antioxidant effects or modulating inflammatory pathways (Rose, 2019).

Recent studies found that sulforaphane’s that are found in cruciferous vegetables, ability to act on multiple molecular targets may play a role in both the prevention and treatment of cancer. Its protective effects have been observed across all stages of the carcinogenesis process (Rose, 2019).

Research has consistently shown that higher dietary fibre intake is associated with a lower risk of colorectal cancer. Findings from various ecological and case-control studies indicate an inverse relationship between fibre consumption and the likelihood of developing this type of cancer. The EPIC study, which tracked participants for an average of 6.2 years and documented 1,721 cases, found that individuals with the highest fibre intake had a 21% lower risk compared to those consuming the least. A recent systematic review, demonstrating strong agreement across multiple studies, led the World Cancer Research Fund and American Institute for Cancer Research to categorize the evidence supporting fibre’s protective effects against colorectal cancer as “convincing”. Since vegetarians and vegans typically consume a diverse range of plant-based foods, they naturally have a significantly higher fiber intake compared to those who eat meat (Rose, 2019).

Since genetic makeup remains unchanged with migration while dietary habits often change, the rise in colorectal cancer cases is likely linked to having the Standard American Diet. While lifestyle factors like smoking are widely recognized as contributing to cancer risk, the influence of diet is less well known. Nonetheless, dietary factors may play a role in 70% to 80% of colorectal cancer cases [2–6]. Research has also identified which diets are most protective. A Canadian study found that a plant-based diet reduced the risk of colon cancer by 46% and rectal cancer by 73% (Chen et al., 2015).

Because genetic makeup remains unchanged with migration, while dietary patterns often shift, the increase in colorectal cancer cases may be associated with the Standard American Diet. Although lifestyle factors like smoking are well-known contributors to cancer risk, the impact of diet is less widely acknowledged. Nevertheless, research suggests that dietary influences could be responsible for 70% to 80% of colorectal cancer cases. Studies have also identified the most protective diets. For example, a Canadian study found that a plant-based diet was linked to a 46% lower risk of colon cancer and a 73% reduced risk of rectal cancer (Rose,2019).

Bioactive compounds that are found in plants proide a variety of health benefits and are the focus of ongoing research for their potential impact on well-being. Numerous in vitro epidemiological studies have yielded encouraging findings regarding compounds such as polyphenols, flavonoids, plant sterols, salicylates, and glucosinolates (Esmeeta et al., 2022).

A research that comprised hundreds of studies, has examined the link between plant-based foods and cancer risk. The majority of these studies have shown that fruits, vegetables, legumes, whole grains, nuts, seeds, spices, and certain specific foods such as citrus fruits, tomatoes, cruciferous vegetables, soybeans, and wheat are associated with a reduced risk of various types of cancer (Schwingshackl et al., 2018; Tabung, Brown and Fung, 2017). Conversely, multiple studies have explored the connection between consumption of red and processed meats and colorectal cancer, with findings compiled in at least four major meta-analyses over the past decade (Schwingshackl et al., 2018). One systematic review and meta-analysis reported that for every 100 grams of processed meat consumed, the risk of colon cancer increased by 58%, while the same amount of red meat raised the risk of colorectal adenomas by 27% (Aune et al., 2013).

A major study, which used data from the European Prospective Investigation into Cancer (EPIC), found a significant link between red and processed meat consumption and an increased risk of colon cancer. Participants who consumed the highest amounts of these meats had a 35% greater risk of developing colorectal cancer (CRC) overall. Specifically, the study revealed a 55% increased risk of CRC for every 100 grams of processed meat consumed and a 25% increased risk for every 100 grams of red meat. In contrast, poultry consumption showed no increased risk, and fish intake was associated with a reduced risk. However, it’s important to note that these comparisons were made across different levels of meat and fish consumption, not against a plant-based diet (Norat et al., 2005).

A study comparing Buddhist priests—who are required to follow a vegetarian diet—with matched non-vegetarian controls found that non-vegetarians had a 54% higher risk of developing colon adenomas. More significantly, the risk of advanced adenomas was more than three times higher in non-vegetarians. These findings are particularly striking given that the non-vegetarians in the study consumed relatively low amounts of meat (Lee et al., 2013). Vegetarian and vegan diets not only increase the intake of beneficial plant-based foods and compounds, but also eliminate red and processed meats and support healthy weight management. Overall, both direct and indirect evidence indicates that vegetarian diets are an effective approach to lowering the risk of colon cancer (Rose, 2019).

In a six-year prospective study involving individuals who otherwise maintained a healthy lifestyle, meat eaters were found to have an 88% higher risk of developing colon cancer compared to long-term vegetarians. Unlike many previous studies, this research by Fraser et al. showed that white meat increased colon cancer risk just as much as red meat. Participants who consumed legumes more than twice per week experienced a 47% reduction in colon cancer risk. In paticular, those who followed a diet high in meat, consumed few legumes, and had a body mass index (BMI) above the normal range faced a threefold increase in their risk of colon cancer (Rose, 2019).

In another study, Orlich et al. found that individuals following a plant-based diet had a 49% lower risk of developing colon cancer compared to those consuming a typical American diet high in meat (Orlich et al., 2015). Interestingly, the meat eaters in the study were consuming less than 2 ounces of meat per day and already showed a 27% lower risk of colon cancer. Vegetarians demonstrated an additional 22% reduction in risk compared to these low meat consumers, resulting in a combined 49% decreased risk. However, the study had some notable limitations: those on a plant-based diet had been following it for a shorter duration than the meat eaters had been following theirs, and the vegetarian group was, on average, older than the meat-eating group (Orlich et al., 2015).

In October 2015, the International Agency for Research on Cancer (IARC), part of the World Health Organization, classified processed meat as carcinogenic to humans, based on strong evidence linking its consumption to colorectal cancer (Bouvard et al., 2015). Since then, additional epidemiological studies and reviews have been published that further reinforce the IARC’s conclusions (Domingo and Nadal, 2017).

Discussion

Conclusion

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