

Diet, Mood, and Chemotherapy: The Role of Nutrition for those with Cancer

Charlize C. Mackie

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Abstract

Diet plays a critical role in both mental and physical wellbeing, offering protective contributions against cancer, safeguarding healthy cells during chemotherapy, and enhancing mood. Fasting, by altering the metabolic systems and cellular processes, has been observed to reduce the severity of chemotherapy side effects such as fatigue and improving quality of life. Likewise, the Mediterranean diet's high amount of antioxidants and anti-inflammatories prevents cell degeneration and inhibits the proliferation of cancer cells. Additionally, diets rich in fruits, vegetables, omega-3-fatty acids, and those involving caloric restriction approaches, have been connected to reductions in depression and anxiety, suggesting that a cancer patient's diet during treatment can affect their mentality. These findings highlight the importance of educating cancer patients on the impact of diet on both mood and physiology to enhance their overall wellbeing.

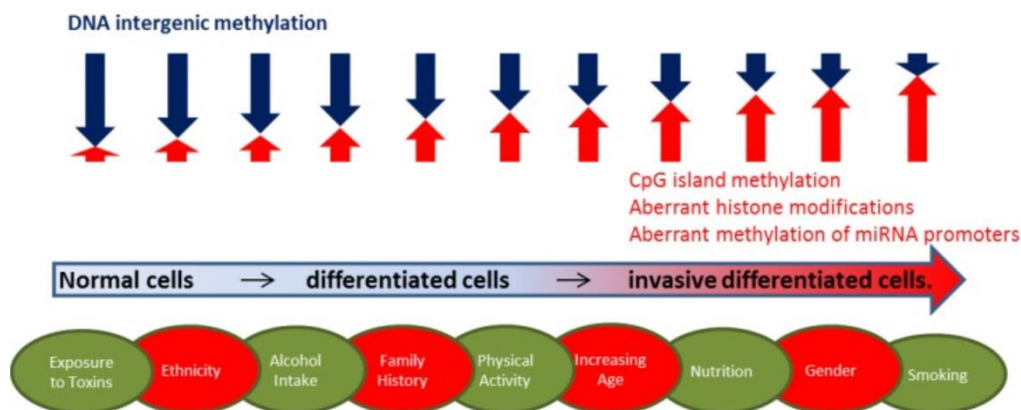
Key words: *diet, chemotherapy, fasting, Mediterranean diet, mood, depression, anxiety*

Diet, Mood, and Chemotherapy: The Role of Nutrition for those with Cancer

It is well known that diet contributes to the development of various illnesses (i.e., diabetes, hypertension, stroke, cardiovascular issues, some cancers, and some neurological challenges such as depression (Gropper, 2023; Kurowska et al., 2023). Fontana and Partridge (2015) showcased organ function and stress responded positively to dietary restriction. The World Cancer Research Fund International (Retrieved 2024) went on to suggest that diet could accelerate the development of cancer. In fact, Plotti et al. (2020) implied diet may affect the epigenetic program of human cells, leading to a modified expression in some genes that can involve the cells that proliferate and grow (i.e., modification to the cells that can rapidly increase the amount of cancer; Karen & Lynnette, 2015). Hopkins et al. (2018) identified, in laboratory mice, that hyperglycemia and the following increase in insulin could compromise the efficacy of chemotherapy. Because of this, numerous studies have assessed the connections between the consumption of different types of food and the development of some cancers like pancreatic cancer, colorectal cancer, gastric cancer, and so on (Plotti et al., 2020; Schwingshackl et al., 2017). Hence, this review will focus on highlighting dietary impacts on the physical and mental wellbeing of a cancer patient.

Figure 1

A diagrammatic representation of epigenetic modifications provided by Karen and Lynnette (2015)



Note. This diagram represents the extent and type of epigenetic modifications that promote cancer risk and/or progression. The green ovals are modifiable while red are non-modifiable. These variables may influence epigenetic modifications.

Epidemiology

Diet has been highly correlated with cancer incidence, as Hursting et al. (1993) highlighted the strong correlation between leukemia and overall calories. The World Cancer Research Fund and American Institute of Cancer Research Continuous Update Project recently determined there was enough empirical evidence to indicate body mass (otherwise known as BMI) and waist circumference increased the risk of esophageal, pancreatic, liver, colorectal, postmenopausal breast, endometrial, and kidney cancer (Steven et al., 2020), while contributing to the risk of oropharyngeal, stomach, gallbladder, ovarian, and advanced prostate cancers.

In early 2000's, Calle et al. (2003) released a prospective cohort study on more than 900,000 men and women from the United States that found obesity increased the risk of cancer mortality from the esophagus, colon, liver, gallbladder, pancreas, kidney, and Hodgkin's lymphoma and multiple myeloma, by approximately 14% for men and 20% for women (Rapp et al., 2005; Renehan et al., 2008). From a self-report food frequency questionnaire, Lope et al.'s (2019) case control study on 973 Spanish women found that fewer calories consumed reduced the risk of breast cancer in premenopausal women ($p < 0.001$). High protein intakes for 50-65 year olds were found with a heightened risk of cancer mortality (Levine et al., 2014) and red meat itself may be connected to breast cancer risk (Wu et al., 2016). Notably, weight loss control has emerging evidence towards reducing the risk of endometrial cancer by 29% (Luo et al., 2017) and obesity-related cancer (Luo et al., 2019).

Impact of Diet During Cancer Treatment

Fasting

Considering data from various laboratory studies, the literature indicates that fasting may encourage the protection of healthy cells during chemotherapy, as the noticeable changes in metabolic

and gene expressions induced by fasting promotes changes in the metabolic pathways and cellular processes (Lee & Longo, 2011; Safdie et al., 2009). Research on short term fasting and chemotherapy consistently shows that the combination is effective in enhancing the efficacy and tolerability of chemotherapy (Bauersfeld et al., 2018). Participants recruited from November 2013 and March 2015 indicated short term fasting reduced severity of chemotherapy-induced side effects (Bauersfeld et al., 2018). Raffaghello et al.'s (2008) randomised pilot-study on 13 women, who were randomly separated into a healthy common diet and a short term fasting diet, found hematological toxicity of chemotherapy was reduced and faster recovery of DNA induced. Lee et al. (2012) identified short-term fasting protected healthy cells against the adverse effects of chemotherapy while tumor cells were made to be more vulnerable. Bauersfeld et al.'s (2018) randomised analysis on 34 gynecological cancer patients found short-term fasting appears to improve quality of life and fatigue during chemotherapy (fasting started 36 hours before and ended 24 hours after chemotherapy). Dorff et al. (2016) and Lee and Longo (2011) findings from animal studies uncovered associations between caloric restriction and intermittent fasting reducing cancer risk, as well as a protective effect of fasting being mediated, in part, by the reduction of glucose and insulin-like growth factor 1 levels.

Mediterranean

Opposite to fasting, the Mediterranean diet is one of the most healthy dietary patterns worldwide as a consequence to its foods rich in antioxidants and anti-inflammatory nutrients (Mentella et al., 2019). Dietary patterns that consist of a regular intake of fruit, vegetables such as garlic, cabbage, and wasabi, and the consumption of foods with selenium, acid, vitamins, and antioxidants (e.g., carotenoids) all have a protective role in cancer onset (Donaldson, 2004). As the Mediterranean diet is characterised by a high consumption of vegetables, legumes, fresh fruit, non-refined cereals, nuts, and olive oil, with a moderate consumption of fish and dairy and a low intake of red meats, the diet promotes the prevention of cell degeneration and inhibits proliferation of cancer cells (see Figure 2; Ciancarelli et al., 2017). Protective effects of the Mediterranean diet come from the high polyphenols contained in the olive oil, wine, and vegetables, which are known for their antioxidant and anti-inflammatory properties (Machowetz et al.,

2007; Praud et al., 2014; Rossi et al., 2013). However, when it comes to the effects of the Mediterranean diet during cancer treatment, the literature is sparse.

Future research should investigate the effects of the Mediterranean diet while chemotherapy occurs, as it is hypothesised a protective effect may develop, especially if short term fasting was combined with the Mediterranean diet.

Food and Mood

Over the past decade countless studies have highlighted the impact food has on mood. A qualitative analysis on 24 cancer survivors described diet can be “*a potential cause of cancer development*”, where the patients commonly thought the food they were eating were mainly the cause of their cancer (Beeken et al., 2016). These cancer patients also developed beliefs regarding foods that may impact their long-term health, such as “*white flour and sugar are kind of poison to your body*” and become highly sensitised to anything cancer related (e.g., “*when the barbecue’s black... a big no-no, is it carcinogenic or something...*”).

Mediterranean diets are better correlated with improved mental health when compared to a Westerners diet (Arab et al., 2019; Firth et al., 2020). Depression decreased with a higher consumption of vegetables, fruits, nuts, and olive oil (Ekinici & Sanlier, 2023) then increased from a high consumption of processed foods (Ljungberg et al., 2020). These findings were replicated in a Netherland study on 1,634 adults, where non-refined grains and vegetables correlated with reduced depression and anxiety, while strong correlations occurred between junk food and psychological distress (Gibson-Smith et al., 2020; Malmir et al., 2023). Psychological distress refers to depression, anxiety, and somatic symptoms (Belay et al., 2021). Aucoin et al. (2021) also identified, across 1,541 articles, that less anxiety was correlated with more fruits, vegetables, omega-3-fatty acids, caloric restriction, ketogenic diet, breakfast consumption, and a range of vitamins.

However, a lack of research emerged on the impacts diet can have on mood for cancer patient’s undergoing treatment. To demonstrate, a cancer patient doing chemotherapy that is consuming an average

diet of processed foods may have more maladaptive emotions when compared to someone consuming a Mediterranean diet.

Conclusion

Diet plays a significant role in mental and physical wellbeing. The literature indicates that educating cancer patients about the impact of their dietary choices can not only protect their physical health but also enhance their psychological resilience during and after treatment.

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