lluminating focus on the health benefits of fermented foods against cancer

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ABSTRACT:

Currently, mortality rates have increased considerably all over the world, with cancer being the leading cause. Death due to cancer accounted for nearly 10 million deaths in 2020. Unhealthy eating habits, genetic composition, colonization in cities, and obesity are the main risk factors for cancer onset and development. More efficacious remedies are needed for the treatment of cancer. Nowadays, fermented foods have gained immense popularity as a result of their advanced health benefits. The fermentation procedure can reduce the number of pathogenic microorganisms. Various fermentation procedures can also reduce the concentration of some harmful chemicals in food while increasing the concentration of some beneficial bacteria for our health. Fermented food consumption has been shown to be beneficial for cancer patients. Some nutrients present in fermented foods can work against several diseases. In view of the current scenario, the present review paper is orchestrated the anti-carcinogenic properties of various fermented beverages and foods.

Keywords: Beneficial bacteria, Cancer, Fermented food, Nutrition, Anti-carcinogenic properties

INTRODUCTION

Cancer is defined as a disease that causes the growth and multiplication of malignant cells, which occur via genetic mutations. Out of the numerous causes of death, cancer has emerged as the leading cause worldwide, with

9.6 million deaths in 2018(Tasdemir and Sanlier, 2020). According to Kesikaet al.(2022), lifestyle modifications and unhealthy eating habits had led to an increase in the risk of developing cancer.

Cancers are not only the effect of lifestyle modifications, but gender has also been an important aspect. Prostate cancer in males and breast cancer in females have become more prevalent in recent years. In India, around 13,92,179 cancer patients were found in the year 2020-the cervix, mouth, breast, lungs, and tongue being the chiefly affected areas (Mathur et al.,2020). Lifestyle and dietary modifications have been shown to be effective in curing and preventing the onset of cancer.

From ancient times, fermented foods have been an important part of the diet of humans across the world. The probiotic bacteria present in fermented foods contain health-promoting factors that improve human health (Baruah et al., 2022). In this review article, we will discuss the health benefits of fermented foods in relation to cancer and its prevention.

Classification of fermented foods

Fermented foods can be classified on the basis of:

Categories

Fermented animal proteins (e.g., pepperoni, sausage, etc.), fermented plant proteins (e.g., Tofu, Kimchi, etc.), Fermented pickles (e.g., Sauerkraut), fermented vinegar (e.g., red wine vinegar, apple cider vinegar, etc.), fermented milk products (e.g., Yoghurt, Buttermilk, etc.).

Commodity

Alcoholic beverages (e.g., Beer, Whisky, etc.), Fermented cereals (e.g., Bread, Dosa, etc.), Fermented roots (e.g., Cassava).

Classes

Dairy products, Meat products, Cereal products, Vegetable products, and Legumes.(Steinkraus,1997).

In the rest of the review paper, the anti-carcinogenic effects of some fermented foods will be discussed.

Relationship between probiotics and cancer

Probiotics are non-pathogenic living microbes present in fermented foods that help to improve the gut microbiome and maintain a healthy intestinal environment (Williams,2010).

Probiotics had also been shown to suppress the growth of cancer. Some harmful bacteria led to the conversion of procarcinogens into carcinogens. Probiotics helped in the reduction of these harmful bacteria, thereby inhibiting the production of carcinogens and hence reducing their count (Leblanc et al., 2007).

Kimchi

Kimchi is a traditional Korean food made of fermented cabbage, which is basically fermented by lactic acid bacteria. Due to the uncontrolled increase of cancer in Korea, it has become the leading cause of death there. Chemotherapy and radiation therapy do not only kill the cancer cells but also the healthy cells present along with them. Kimchi has been shown to have anti-carcinogenic effects.

Bacteria like 7-α-dehydrogenase, ß-glucuronidase, nitroreductase, andß-glucosidase are harmful because they cause the transformation of procarcinogens into carcinogens which cause cancer in the body. Kimchi contains lactic acid bacteria produced post-fermentation, namely Lactobacillus plantarum and Weissellacibaria.

The Chinese cabbage in kimchi contains a huge amount of dietary fibre and has shown anti-cancerous properties

by reducing colorectal and stomach cancer. Garlic is also an important ingredient in kimchi. Garlic contains a high concentration of organosulfur (33 types). Organosulfurs have anti-proliferative properties which have helped to reduce breast, prostate, and colon cancers. A risk factor for stomach cancer is Helicobacter pylori. Garlic has antimicrobial properties which help to fight H. pylori bacteria and thus reduce the incidence of stomach cancer. Another important ingredient of kimchi is hot red chili pepper powder. It contains capsaicin (trans-8-methyl- N-vanillyl-6-nonenamide), which helps in the production of reactive oxygen species and thus causes the death of cancer cells (Kwak et al., 2014).

Neither fully ripe nor fresh kimchi showed the best results regarding the anti-cancer effect. 3-week old fermented kimchi reduced the division of cancer cells and helped in controlling the onset and prevention of cancer (Kim et al., 2015).

Kimchi has also been effective on human leukemia and human osteosarcoma cells but does not cause damage to healthy cells.

Kefir

Kefir originated from the Caucasian mountains in Russia (Plessas et al., 2017). It is made from Kefir greens and has a creamy consistency. Kefir is a fermented product rich in proteins, carbohydrates, minerals, vitamins, and some nutraceutical components.

Apart from its high nutrient concentration, kefir has effective anti-microbial and anti-carcinogenic properties(Ahmed et al., 2013).

Kefir contains many varieties of Lactobacillus sp., including Lactobacillus lactis, Lactobacillus kefir, and Lactobacillus plantarum. Saccharomyces and Acetobacter are also present in kefir (Garrote et al., 2001).

Because of the presence of such a huge number of beneficial bacteria, kefir is said to be a very healthy option for people suffering from gastric tumors or cancer, or colorectal cancer. The beneficial bacteria present in kefir cause the death of cells. Metastasis is an important risk factor for breast cancer. The anti-metastatic effect of kefir has been proven beneficial for breast cancer patients. For patients with colorectal cancer, kefir provided relief because it had anti-inflammatory properties that reduced inflammation caused by the tumor cells (Zamberietal., 2016).

Doenjang

Doenjang is one of the famous Korean pastes. It is made from fermented soybeans (Lim and Rhee,2004). It is fermented for several months (3 months, 6 months, 24 months, etc.). Doenjang has properties that reduce the incidence of metastasis and tumor formation. It boosted the activities of glutathione-S-transferase and natural killer cells in the liver, thus killing or decreasing the tumor cell activity (Jung et al., 2006).

Doenjang is a helpful functional food for patients suffering from human gastric adenocarcinoma, human colon cancer, and human hepatocellular carcinoma because it reduces inflammation and causes relief. Doenjang was also compared to other soybean

products but was found to be more effective in treating cancer than others (Lim and Rhee,2004). Among the different fermented doenjang, the highest anti-cancerous properties were found in the 24- month-old fermented doenjang (Jung et al., 2006).

Yogurt

Yoghurt is a fermented milk product that contains many beneficial bacteria, such as Lactobacillus bulgaricus and Streptococcus thermophilus. Yoghurt has been consumed since ancient times because of its health benefits like anti-inflammation and maintaining good intestinal and gut health (Robinson et al., 2006).

Recent studies have shown that yogurt is also beneficial for cancer patients. It improves the immunity of the mucous membranes of the intestine where the tumor cells are present. Research had shown that yogurt contained probiotics that induced apoptosis (cell death) and diminished the size of the tumor cell (Perdigonet al., 2002). Yogurt inhibited the growth of procarcinogens in the large intestine where the tumor cells inhabited, thereby reducing the risk of developing cancer at a later stage (LeBlanc and Perdigón, 2005).

Fermented Brown Rice

Brown rice fermented with Aspergillus oryzae has been shown to prevent tumorigenesis in several organs. It has anti-proliferative properties which inhibit the multiplication of cancer cells in many parts of the body. Fermented brown rice had been shown to reduce gastric carcinoma in humans (Tomita et al.,2008). Research suggested that brown rice enriched with γ-aminobutyric (GABA)had apoptotic properties and it also inhibited the growth of cancer cells. GABA enriched brown rice was also beneficial for the treatment and prevention of acute lymphoblastic leukemia and cervical cancer (Oh and Oh, 2004).

Tobacco consumption and cigarette smoking have become serious concerns as they are the leading causes of lung cancer. Many carcinogenic elements are present in tobacco but 4-(methylnitrotransamino)-1-(3-pyridyl)-1-butanone (NNK) is the most dangerous agent which is primarily responsible for lung cancer. Fermented brown rice inhibited the formation of NNK- induced lung cancer by decreasing the multiplication rate (Phutthaphadoonget al.,2009).

Fermented brown rice is also effective in reducing colon cancer (Katyamaet al., 2002), hepatocarcinogenesis (liver cancer), colorectal (Katayama et al.,2003), urinary bladder cancer (Kuno et al.,2006) and breast cancer (Wu et al., 2019).

Thus, it can be said that fermented brown rice is an excellent dietary supplement for the chemoprevention of various types of cancer in humans.

Red Mold Rice

Red mold rice is a traditional Chinese food. It has many health benefits and is therefore considered a traditional medicine for the local people. Red mold rice has three major components which are anti-carcinogenic. These are total phenols, flavonoids, and monacolin K. It is considered an effective supplement for breast cancer patients as it had a cytotoxic effect on the tumor cells thereby causing cell death (Lee et al.,2013).

Red mold rice is immensely effective against oral cancer. It caused apoptosis and stopped cell division in the G2/M phase, reducing the increase in

squamous cell carcinoma (Hsu et al.,2010). It has been of great use as a medicine to fight various types of diseases. The anti-carcinogenic components present in them prevent inflammation, tumor growth, and oxidation of tumor cells. Thus, fermented red mold rice is now being used as a very effective medicine for oral and breast cancer (Hsu and Pan, 2012).

Fermented beetroot juice

Beetroots are one of the most consumed root vegetables because of their numerous health benefits. A mixed culture of Lactobacillus acidophilus and Lactobacillus Plantarum had been used to prepare fermented beetroot juice (Vaithilingamet al., 2016). According to a previous research work, research work, organic fermented beetroot juices had more anti-carcinogenic properties as compared to conventional ones (Kazimierczaket al.,2014).

Beetroots contain cancer reducing elements, namely flavonoids, polyphenols, dietary nitrates, etc., which helped in reducing the side effects of chemotherapy and inducing chemoprevention (Tan and Hamid,2021).

CONCLUSION

Fermented foods have been shown to be highly effective in reducing cancer cells, if not totally removing them. But long-term implications may also result in destroying the cancer cells completely. Consumption of fermented foods prior to the onset of cancer or while in a tumor condition may reduce the likelihood of cancer onset. In view of the upsurge in the demand for anti-carcinogenic products, the present article has provided all the potential health benefits of fermented foods to fight against cancer and provide its treatment.

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