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Foods Consumption and Associated Risks in Different Types of Breast Cancer: Mini Review

Chandreyi Ghosh, Abhishek Saha, Abhik Saha Roy, Sourjeeta Roy, Moumita Saha, Deblina Mitra, Sirshendu Chatterjee*

Department of Biotechnology, Techno India University, West Bengal,
EM-4, Salt Lake, Sector- V, Kolkata- 700091, West Bengal, India

* sirshendu.chatterjee@gmail.com

Abstract

Consumption of various foods and maintaining a diet inhibit or promote human breast cancer development. Different types of fats have different effects on breast cancer development. Meat consumption is associated with exposure to heterocyclic amine (HCA), alcohol consumption may increase the risk of breast cancer risk, different fibre shows different effects on breast cancer risk, phytoestrogens help in reducing the risk of breast cancer, vitamin D reduce the risk of breast cancer, consumption of excessive iron may lead to DNA damage and oxidative stress. Therefore, in the article, we will be going to discuss the nutritional benefits and risks of a variety of foods that we consume on a daily basis, such as vegetables, fruits, fat, fibre, carbohydrates, phytoestrogens, and vitamin D, and iron. Concurrently, we are going to shed light on things that are used for intoxication purposes, such as alcohol and cigarettes, and their contribution to the development of breast cancer.

Keywords: Alcohol consumption, Breast Cancer, phytoestrogens, Food, prevention, Dietary factors.

INTRODUCTION

Breast cancer is the second most frequent cancer type in females worldwide and the most commonly occurring malignancy in women (De Cicco, P *et al*.,2019, Ferlay, J *et al*.,2010, Seward, B.W *et al*.,2014). Activation of some genes or inactivation of some genes involves the development of breast cancer by promoting malignancy. The subsequent steps in altering the gene for the progression of malignancy are still unknown. Breast cancer is sometimes associated with predisposing mutations, although it is a somatic cell genetic disease (Ingvarsson, S.,2001). In the patients where axillary nodes are prevalent, breast cancer further progresses to metastatic diseases. On the other hand, distant metastasis can occur where bone marrow and bone are prevalent. Estrogen is the most important risk factor in Breast Cancer. If estrogen level increases in a woman due to food consumption or any other reasons, the chances of Breast Cancer gradually increase (Ingvarsson, S.,2001).

Both nutrition and food play a significant part in the development of cancer for 35% of cancer cases (Ferlay J *et al*.,2010). Diet plays an important role in both promoting and inhibiting human breast cancer development (Holmes, MD & Willett, WC,2004). Reducing the consumption of alcohol, red meat and fat and increasing the consumption of fibre, vitamin D is preventive dietary advice given by doctors. Although all of the mechanisms of the dietary risk factors are not totally understood (Kotepui, M.,2016).

It's also important to eat a healthy balanced diet to keep our body functions optimal during cancer treatment. Foods full of nutrients, mild flavour and foods which are easy on our stomachs are the best options (Kim, EH *et al*., 2006, Hanf, V & Gonder, U., 2005).

A usual healthy diet for normal human

Dietary fat

Dietary fat is a sully nutrient and notoriously misunderstood. The myth that has prevailed since 1960 is that "fat is bad". There are three types of fat: **A**. fats, which come out from moderately hydrogenated oil (Trans fat), are unquestionably bad for the cardiovascular system, and intake of a high amount of these fats reduces vigilant high-density lipoprotein, low-density lipoprotein cholesterol (Mozaffarian, D *et al*.,2006). This results in a change in other important factors responsible for cardiovascular diseases. **B.** Saturated fats that generally come out from dairy products and red meat increases sinful LDL but also increase HDL. So, a moderate amount of taking this fat can be good for dietary intake, which can further lead to cardiovascular diseases. **C.** Polysaturated fats and monosaturated fats are good for a healthy diet. These fats are generally originated from vegetable oils, whole grains, seeds, nuts, and fish. Polyunsaturated omega-3 fatty acids are essential components of cardiac health and a healthy diet (de Lorgeril, M *et al*., 1999, Riediger, ND *et al*.,2009).

Carbohydrates

In the present world scenario, the intake of carbohydrates is in the form of processed grains. The processing cuts out minerals, vitamins, healthy fats, fibre and phytonutrients, which produce processed grain such as white flour. Having a diet rich in this processed food leads to lowering the HDL level and an increase in triglyceride contents. These unfortunate responses may be infuriated in the situation of insulin resistance, which usually progresses during pregnancy (Mensink, RP.; & Katan, MB.,1992, Patrick, J *et al*.,2010).

The Glycemic Index

The glycemic index means after consumption of carbohydrates significant upsurge of blood sugar occurs. The greater the hike in glucose level a food develops, the greater the food's glycemic index reported. Highly refined grains boost the glucose level in the blood more than whole grains (Kastorini, CM.,2009). On the other side, foods made up of whole grains along with beans, vegetables, and fruits provide gradually digested carbohydrates that are well-off minerals, vitamins and fibres. The whole grain fibre lowered the risk of type 2 diabetes and cardiovascular disease (Mellen, PB *et al*.,2008).

Protein

Protein is an essential nutrient, but generally, it is not taken in isolation. Protein intake occurs with a group of other micronutrients. Although at the same time, increasing your consumption of protein from foods like beans and cereals as well as animal proteins and decreasing your consumption of carbohydrates does not reduce the chance of developing heart disease. (Halton, T *et al*., 2006).

Vegetables and fruits

Fruits and vegetables add on fibres and deliberately digest minerals, vitamins, phytonutrients and, most importantly, carbohydrates that are complementary to the safeguard of cardiovascular disease, bowel function maintenance and muscular degeneration. In the field of cancer study, the relationship between fruits, vegetables and cancer is less well established though vegetables and fruits are active against some sort of cancer such as lung, stomach, breast and colorectal cancer (King, DE *et al*.,2009, Vainio, H *et al*., 2005).

Vitamins and minerals

A favorable diet incorporates all the essential nutrients and minerals required for good health. Calcium is a good source of bone strength. Vitamin D shows potential against some types of cancer (Stechschulte, SA *et al*.,2009). Vitamin A as beta-carotene is favored.

Fig 1: Dietary food against Breast Cancer.

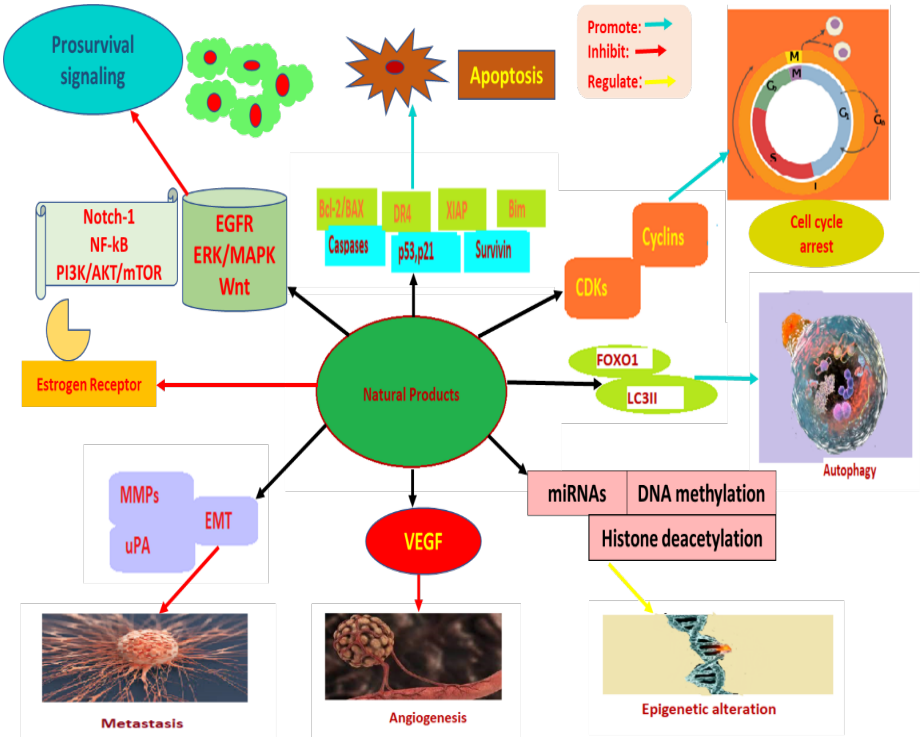

Fig 2: Mechanism of the dietary products as anti-breast cancer agents.

Dietary foods and their relation to Breast cancer disease

Vegetables, fruits and organic food associated with Breast Cancer

It is widely known and proven to us that more vegetable or plant-based foods may lower the chance of getting breast cancer (Patrick J *et al*.,2010). Organic foods are grown without pesticides or weedkillers. One French study found a link between these products and lower cancer risk (https://www.webmd.com/breast-cancer/ss/slideshow-diet-after-breast-cancer). Fruits and vegetables are essential components of our nutrition that helps in weight control and a healthy body, which is the key to keeping breast cancer from coming back (Freudenheim, JL *et al*., 1996). Green vegetables contain antioxidants and carotenoids, which help in reducing breast cancer risk (Aghajanpour, M *et al*.,2017). Researchers suggest eating more fruits and vegetables and washing them before eating to remove the residue of any chemicals. This strategy may help in protection against aggressive types of tumours (Tantamango-Bartley, Y *et al*.,2013). Fruit, in particular, avocado, contains healthy monounsaturated fat, which helps in increasing good cholesterol (HDL) and decreasing bad cholesterol (LDL). Avocados can be a good option during cancer treatment as it helps in curing constipation, mouth sores, dry mouth and weight loss (Yoshida H *et al*.,2010).

Cruciferous vegetables and Beans associated with breast cancer

Cruciferous vegetables contain glucosinolate compounds. This can be converted into isothiocyanates by our bodies that have significant anticancer potential. Examples of these types of vegetables are cauliflower, cabbage and broccoli (Soundararajan, P & Kim, J. S.,2018). Broccoli provides us with a good amount of vitamin C, which is vital for our immune system. Also, these types of vegetables contain sulforaphane, which helps in brain health and can be helpful during cancer therapy (Nishikawa Y *et al*.,2005).

Beans are basically a high fibre content, containing vitamins and minerals. A study on 2,571 women points out that high bean consumption can reduce breast cancer risk by 20% (Sangaramoorthy, M*et al*.,2018).

Fibres associated with Breast Cancer

Studies have shown that Breast cancer risk may decrease if we add fibres like whole grains, legumes, and fruits to our diet (Kotepui, M.,2016). Whole Grains have nutrients called phytochemicals which may even lower the chances of returning cancer. Phytochemicals prevent DNA damage and help in DNA repairing, which ultimately helps in reducing cancer cell growth (Hankinson SE *et al*.,2004). Some good examples of whole Grains are – Unprocessed wheat, corn, oats, rye, bulgur, barley and rice (Aghajanpour M *et al*., 2017).

A high fibre diet reduces the total estrogen body pool by absorbing the estrogens and binding them to unconjugated estrogens (Kotepui, M.,2016). Fibres reduce the breast cancer risk by decreasing cholesterol, a precursor of estrogen (Hankinson SE *et al*.,2004). Fibres help in maintaining blood sugar levels, helps in the digestive tract and are also good for the heart. In particularly, fibres can help in protection against an aggressive type of tumours and lower the risk of breast cancer (Holmes MD *et al*.,2004).

Meat consumption associated with Breast cancer

Many studies have investigated and tried to show us the association between meat consumption and Breast cancer. But all the studies showed inconsistent results. Some studies showed no association whatsoever, but some others show a minimal risk of breast cancer. A study shows that the women who are postmenopausal have a higher risk of breast cancer than other women if they eat red meat more often (Kotepui, M.,2016).

Between 1966 and 1993, 12 case-control and 5 cohort studies were published that reported an increased risk of breast cancer with high versus low meat consumption. Among them, seven studies showed a high association rate for red meat consumption than other meat consumption (Kotepui, M.,2016). Some studies tried to explain that the association occurs due to the activation of HCA. According to this explanation, cytochrome P450- mediated N-hydroxylation activates HCA in the liver and transports it to the breast. Then N-acetyl transferase activity makes the HCA active. This method induces genetic mutations when active HCA binds to the DNA, causing DNA adducts and this results in mammary gland carcinogenesis (Zheng W *et al*.,1998).

There is no explanation for the incontinent results in the association between meat consumption and Breast cancer risk, but maybe the association is proportional to the difference in the type of the meat and how we cook the meat (Sinha, R *et al*.,2000).

Iron and breast cancer

Studies show that high levels of iron increase the development of tumours in humans, and a low iron diet leads to slow tumour growth. A high intake of meat and dietary supplements containing iron can cause a high concentration of iron. Animal sourced foods that have Heme iron are claimed to have an association with high breast cancer risk (Chang, V C *et al*.,2009).

A high concentration of iron may increase the risk of breast cancer by leading to oxidative stress, lipid peroxidation, and DNA damage, including DNA base modification and DNA strand breaks, and ultimately causing more interaction with estrogen (Stevens, RG *et al*.,1998).

Angiogenesis is necessary for any tumour to grow beyond a certain volume and helps in tumour progression. Many premenopausal women have lowered iron concentration. Iron deficiency leads to angiogenesis. That's why premenopausal women with breast cancer are more susceptible to cancer recurrence than postmenopausal women (Jian J *et al*.,2011).

Flavonoids, Carotenoid associated with Breast Cancer

Flavonoids are found in certain plants. There are two specific types of flavonoids – 1. flavonols and 2. flavones, which can help in lowering the breast cancer risk Hui, C *et al*., 2013). Onions, broccoli and tea, have flavonols.

Flavones can be found in celery, parsley and chamomile drinks. Flavonoids lower the risk of breast cancer effectively in women who are past menopause (Butler, LM *et al*.,2010). Flavonoids have a wide variety of anticancer effects. They scavenge enzyme activities by modulating reacting oxygen species. Flavonoids induce apoptosis and autophagy and suppress cancer cell invasiveness and proliferation (Butler, LM *et al*.,2010).

Another plant-based phytochemical is Carotenoid. Orange, yellow, and dark green vegetables and fruits can give us Carotenoids (Hui, C *et al*., 2013). Some examples are – carrots, pumpkins, winter squash, cantaloupe, spinach, kale, and sweet potatoes. If we add this to our daily or weekly diet in the form of food (supplements can be dangerous), it can lower the breast cancer risk. Carotenoid has antioxidant actions, communication and cell signalling functions. Antioxidant defence is an effective factor for reducing breast cancer risk (Sato, R *et al*.,2002).

Phenolic compounds associated with Breast Cancer

Garlic, soybeans, flaxseed, green tea, cabbage, tomato, and watermelon has a certain type of chemical which may lower the risk of breast cancer. Many studies have shown anti-carcinogenesis ability of phenolic compounds can slow down the initiation of cancer. Phenolic compounds act as antioxidants which can stop the reaction of free radicals and prevent damage to DNA. Phenolic compounds also reduce the risk of cancer by scavenging superoxide radicals, hydroxyl (OH-), peroxyl (ROO-) etc. (Losada-Echeberría, M *et al*., 2017). According to a study, phenolic compounds block the initiation of carcinogenesis by deactivating the exogenous/endogenous genotoxic molecules, including the reactive oxygen species (Zhang Y *et al*.,2008). Phenolic groups also help in triggering apoptosis, targeting the cancer cells.

Fat associated with Breast Cancer

Some studies say that fat play a role in the growth of breast tumours, but it is not proven clearly. All of the previous studies suggest that different types of fats from different types of foods may have different effects on breast cancer risk (Kotepui, M.,2016). For example, if we take alpha-linolenic acid (ALA) from fruit and vegetable oils, it lowers the risk of breast cancer. On the other hand, if we take ALA from processed foods, it increases the risk of breast cancer (Comba, A *et al*.,2010). Some saturated fats and trans fats promote apoptosis leading to inhibition of cell growth or promoting the growth of cancer cells. So, limiting the consumption of foods like butter, cheese, commercial baked goods, ice cream, and fried foods and focusing on the consumption of fish and chicken can decrease the risk of breast cancer (Comba, A *et al*.,2010). Fishes can give us Omega-3, which supports brain health and boost anti-inflammatory properties. Also, fish can help in avoiding unnecessary weight loss during cancer treatment. Some fish, like salmon, herring contain vitamin D, which helps in immunity (Nowicki, J *et al*.,2020).

Sugar associated with Breast Cancer

A spoonful of sugar in daily coffee or tea consumption will not make cancer cells grow faster. But it is wise to maintain the sugar level in our diet. We know the idea "Sweets feed cancer". A lot of sugar intake on a daily basis can cause obesity and other conditions which leads to cancer (Dobson R., 2005).

We all know high sugar patients consume insulin serum on a daily basis. A study shows that insulin enhances Growth hormone levels and synthesis of IGF, which has anti-apoptotic and mitogenic effects on breast cancer cells (Roda, N. 2020).

Soy products associated with Breast Cancer

Soy-based foods have chemical named phytoestrogens, which have both anti-estrogenic and estrogen-like properties (Brzezinski, A & Debi, A., 1999). Previous studies have shown that the major component of soy, isoflavones, enhances the proliferation of breast cancer cells. But newly done studies in recent years have shown that soy helps in decreasing cancer risk (Kotepui, M.,2016). Moreover, it may even lower the odds of return of the disease. Some examples of soy-based products are- Edamame, soymilk, and tofu.

Isoflavones help in inhibiting the enzyme aromatase and convert androgens to estrogens (Rice, S., & Whitehead, AS. 2008). One study proved the importance of soy products by this result – breast cancer risk was found in more western women than Asian women. Asian population consumes soy products more than the Western population (Kotepui, M.,2016).

Vitamin D associated with Breast Cancer

Vitamin D deficiency has been linked to an increased risk of breast cancer in numerous studies. Intake of vitamin D and higher chances of breast cancer. The lower level of vitamin D can lead to the growth of tumours (Roda, N. 2020). Vitamin D inhibits the invasion and metastasis of cancer cell 1,25(OH)2D (Colston, WK., and Hansen, MC.,2001). Vitamin D also has anti-angiogenic properties, which can inhibit tumour cell invasion and decrease the activity of matrix metalloproteinases (Krishnan, A.V *et al*., 2010). Vitamin D also helps in inhibiting the estrogen pathway that converts androgens to estrogens. Vitamin D has an anti-inflammatory ability which helps in lowering the expression of cyclooxygenase-2 and plays a role in prostaglandin synthesis in human breast cancer (Krishnan, A.V *et al*., 2010). Some good examples of foods containing vitamin D are – oily fish (salmon, herring), egg yolks, orange juice etc.

Dairy products and eggs associated with Breast Cancer

Animal research suggests that dairy products have immunity-enhancing probiotics, which help in breast cancer reduction (Aragón, F *et al*., 2014).

Till now, there is no solid proof of a direct association between consumption of dairy fluids, dairy solid and Breast cancer risk. A categorical analysis suggested a J-shaped association for egg consumption. This analysis showed that women, who eat two eggs in a week, have a lower chance of cancer rather than the women who consume one or more than one eggs per day. In the last 20 years, many studies have been done, but a significant association was not found between poultry intake and

Breast cancer (Missmer, A.S *et al*., 2002). Eggs can supply good fats(4gm/egg) and proteins(6gm/egg) which help in fighting tiredness during cancer therapy. During therapy, mouth sores can be a common symptom. Eggs are an ideal meal for that situation (Missmer, A.S *et al*., 2002). A review of 27 studies stated that fermented dairy products like Yogurt and kefir help in reducing the risk of breast cancer worldwide (Missmer, A.S *et al*., 2002, Zang, J *et al*.,2015).

Alcohol consumption and Breast cancer

Alcohol consumption has been associated with a variety of different forms of cancer in women for several centuries (Boffetta, P., & Hashibe, M. 2006). There are many convincing pieces of evidence that alcohol consumption increases the risk of cancers of the oral cavity, larynx, pharynx and Oesophagus. Evidence of association between breast cancer and alcohol consumption has come to our site during the past 20 years. Among women who consumed 5-14g of alcohol on a daily basis, breast cancer risk was reported at 1.3. Women who consumed 15g of alcohol or more on a daily basis showed a relative risk of 1.6. Increasing consumption of alcohol on a daily basis showed the highest increased risk of breast cancer. Women under the age of 55 years, who consume 15g of alcohol or more per day, have a risk of 2.5 (Willett, W.C *et al*.,1987).

Influence of alcohol consumption on breast cancer?

Although the increase in risk is small, a large population of women consumed moderate amounts of alcohol on a daily basis. 7.7% of all breast cancers in Europe are caused due to alcohol consumption, and 9.4% of breast cancer happens in France due to alcohol consumption (Boyle, P., & Boffetta, P. 2009).

Alcohol can increase the intracellular estrogens in women, causing breast tumour growth. Alcohol can also interfere with the DNA repair mechanism. Moreover, alcohol can affect the menstrual cycle variability and can increase the frequency of menstrual cycles, which ultimately results in an excessive amount of endogenous estrogen (Boyle, P., & Boffetta, P. 2009).

Dietary choices to help prevent breast cancer.

Just as Breast cancer can start in different places, grow in different ways, and require different kinds of treatment. As we previously discussed, certain cancers respond better to various medicines, and certain cancers respond well to specific nutrients.

Table 1: Types of food to eat and to be avoided.

Foods to eat	Foods To Avoid
A variety of fruits & vegetables	Alcohol
Low fat milk and dairy products	Fat
Soy based products	Red Meat
Foods containing anti-oxidants	Processed foods
Foods with inflammatory properties	Added sugar
Foods rich in vitamin D & Foods rich in fibre	Fried foods

A **B**

Fig3: A: Foods to eat **B**. Foods not to eat**.**

CONCLUSION

Nutrition is the most malleable facet of our lifestyle, and it deeply influences our life and risk of cancer. Our body weight is directly proportional to what we consume on a daily basis. Excessive weight leads to obesity and increases the chances of breast cancer. If someone already has the disease, gaining extra weight can also make the disease come back in taking some of the dietary products like soy, vegetables, low-fat milk, and fruits conversely correlated to the risk of breast cancer. Several studies have proven that many natural products can be a probable source for the prevention of breast cancer. The natural products contain many bioactive compounds, which can be a great source for the prevention of breast cancer. Some of the bioactive compounds are daidzein and genistein (found in soy), ellagitannins (pomegranate), naringin (citrus fruits), shogaols and gingerols (ginger), thymoquinone (black cumin) and organosulfur compounds(garlic). Everyone must have a healthy diet including vegetables, fibres, chicken, fish, soy-based products, vitamins, good quality dairy products, berries, fruits, and beans, and we have to avoid foods like alcohol, grilled meat, and saturated fats, excessive sugar, fried foods. Excessive estrogen productivity is one of the main reasons for breast cancer development. So, we must maintain the estrogen pool in our body, and we have to avoid the foods which affect estrogen interaction. Then only we can decrease the chances of breast cancer development, and we also can boost our chances of living even after breast cancer. As the role of dietary factors in breast cancer is not resolved totally, we have to collect more data about the potential benefits and risks related to more foods by collecting information from continued follow-up patients with breast cancer.

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Ethical Approval

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Conflict of Interest

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