

Review Article

Nutrition and Personal Care for Head and Neck Cancer Treatment: A Review of Literature

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ABSTRACT:

Head and neck cancer are the sixth most common cancer worldwide. These cancers account for approximately 3% of all cancers and are nearly twice as common among men as they are among women. A role of diet, physical exercise and nutrition in cancer treatment is well established. This article summarizes the importance of nutrition and physical activity in patients undergoing cancer treatment.

Key words: Diet, Nutrition, Personal care.

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INTRODUCTION

Head and neck (HN) cancers include cancers of the lip, oral cavity, oropharynx, hypopharynx, tonsil, salivary glands, nasopharynx, nose paranasal sinus, and middle ear. They are the sixth most common cancer worldwide. HN cancers account for approximately 3% of all cancers in the United States and are nearly twice as common among men as they are among women.¹ Squamous cell carcinoma (SCC) constitutes for >90% of all HNCs. Among all the etiologic factors, smoking and chewing of tobacco are considered important for the development of HNCs. In India, there is a significant increase in the incidence of HNCs and there is variability in the management of these patients. According to GLOBOCAN 2018 report (given below), worldwide HNC statistics indicate that there are 834,860 cases of HNC per year, resulting in approximately 431,131 deaths per year. High incidence rates have been

reported from developing countries including India, Pakistan, Bangladesh, Taiwan, and Sri Lanka. HNCs account for approximately 30–40% of all cancer sites, in India. The Cancer Atlas project by the Indian Council for Medical Research (ICMR) reports incidences of different cancers across India. The incidence in Assam, Manipur, Mizoram, Tripura, and Nagaland has been reported to be higher (54%). The world's highest incidence of cancers in men, which was of the lower pharynx (11.5/100,000 people) and the tongue (7.6/100,000 people), was reported from Mizoram. Pondicherry has also reported the incidence of mouth cancer in males (7.8–8.9/100,000); however, the highest incidence of nasopharyngeal cancer has been reported from Nagaland. The possible reasons for the higher incidence of HNCs in India include extensive use of tobacco, pan masala (which include betel quid, areca nuts, and slaked lime), and gutkha. In 2011, approximately 52,000

people in the United States were diagnosed with HN cancers and over 5000 in Canada, and the 5-year survival rate is currently at 57%. Advances in medical detection and interventions are helping to increase 5-year overall cancer survival rates, leading to an ever-growing number of cancer survivors. Since the long-lasting effects of the disease and treatments may impact all survivors, the focus on survivorship care and patient outcomes is paramount.² Nutritional needs change for most persons during the phases of cancer survivorship. Although many cancer survivors live with active or advanced disease, a large and growing number live extended, cancer-free lives. 65% of Americans diagnosed with cancer now live more than 5 years.³ The need for informed lifestyle choices for cancer survivors, becomes particularly important as they look forward to successful completion of therapy and search for the best strategies to recover from treatment and improve their long-term outcomes. For long-term cancer survivors, an appropriate weight, a healthful diet, and a physically active lifestyle aimed at preventing recurrence, second primary cancers, and other chronic diseases should be a priority. For some, managing nutritional needs while living with advanced cancer becomes a particular challenge.⁴

Table 1: GLOBOCAN 2018 report showing HNC statistics of India

Type of HNC	Incidence of new cases	Number of deaths	Five-year prevalence
Lip, oral cavity	119,992 (60.7)	72,636 (61.7)	265,255 (63.2)
Oropharynx	17,903 (9.1)	14,953 (12.7)	43,015 (10.2)
Larynx	28,721 (14.5)	17,640 (15.0)	65,041 (15.5)
Nasopharynx	5086 (2.6)	3715 (3.2)	12,640 (3.0)
Hypopharynx	25,947 (13.1)	8804 (7.5)	34,081 (8.1)
Total	197,649	117,728	420,032

Data shown as n (%). All percentages are based on total HNC cases.
HNC=Head and neck cancer

Different Modalities of Treatment:

Surgery

After surgery, the body needs extra calories and protein for wound healing and recovery. This is when many people experience pain and lethargy. Surgery related side effects may also render them unable to have a normal diet. The body's ability to use nutrients may also be changed by surgery that involves any part of the digestive tract (like the mouth, esophagus, stomach, small intestine, pancreas, colon, or rectum).

Radiation therapy

The type of side effects radiation causes depends on the area of the body being treated, the size of the area being treated, the type and total dose of radiation, and the number of treatments. It usually start around the second or third week of treatment and peak about two-thirds of the way through treatment. After radiation ends, most side effects last 3 or 4 weeks, but some may last much longer. Side effects effecting nutrition that may happen during the treatment are mucositis, odynophagia, dysgnesia, dysphagia, sore throat, dry mouth, thick ropy saliva. Xerostomia,

osteoradionecrosis, changes in taste and smell may occur long term after treatment

Chemotherapy

The side effects of chemotherapy depends on the individual and the dose used, but commonly include fatigue, risk of infection, nausea and vomiting, hair loss, loss of appetite, and diarrhea. These side effects usually decline after treatment is completed.

NUTRITION DURING CANCER TREATMENT

Even before treatment begins, cancer can cause profound metabolic and physiological alterations that can affect the nutritional needs for protein, carbohydrate, fat, vitamin, and minerals. Symptoms such as anorexia, early satiety, changes in taste and smell, and disturbances of the gastrointestinal tract are common side effects of cancer treatment and can lead to inadequate nutrient intake and subsequent malnutrition.⁵ Substantial weight loss and poor nutritional status have been documented in more than 50% of patients at the time of diagnosis, although the prevalence of malnutrition and weight loss varies widely across cancer types. Maintaining energy balance or preventing weight loss is therefore vital for survivors at risk for unintentional weight loss, such as those who are already malnourished or those who receive directed treatment to the gastrointestinal tract. Other patients begin the cancer treatment process in a state of overweight or obesity, and for some, weight gain can be a complication of treatment. Nutritional screening and assessment for survivors should begin while treatment is being planned and should focus on both the current nutritional status and anticipated symptoms related to treatment that could affect nutritional status.⁶

Balancing fat, protein and carbohydrate intake:

A common misconception is that all fats, proteins, or carbohydrates are similar in their health effects. It is now clear that the type of fat, protein, or carbohydrate and the food source can make a difference in long term health. The choice of such foods is probably more important than the total amount of fat, carbohydrate, or protein in the diet. Some fats, such as monounsaturated and omega -3 fatty acids, are associated with reduced risk for heart disease and possibly cancer, whereas others saturated fats, are associated with increased risks. Adequate protein intake is essential during all stages of cancer treatment, recovery, and long-term survival. The best choices to meet protein needs are foods low in saturated fat (e.g., fish, lean poultry, eggs, low-fat meat, nonfat and low-fat dairy products, nuts, seeds, and legumes). Healthful carbohydrate choices are foods that are rich in essential nutrients, phytochemicals, and fiber, such as whole grains, vegetables, legumes, and fruit. These foods should constitute the majority of carbohydrate-containing foods in the diet. Because nutrient-poor, low-fiber, carbohydrate-rich foods (highly refined foods such as

white bread and rice or foods with added sugar) simply add calories to the diet or replace more healthful foods, and thereby reduce the overall diet quality, these foods should be only a small source of carbohydrate in the diet. Limiting sugar consumption is recommended.⁷

Ghreltin:

It is a novel 28-amino acid peptide, which up-regulates body weight through appetite control, increase food intake, down-regulate energy expenditure and induces adiposity. Furthermore, ghrelin inhibits pro-inflammatory cytokines may cause oral mucositis and anorexia, which are the results of weight loss. Thus weight loss during RT is an early indicator of nutritional decline, we propose that recombinant ghrelin used prophylactically could be useful as an appetite stimulant; and preventive of mucositis because of its anti-inflammatory effect, it might help patients maintain weight over the course of curative RT of the HNC and can improve specific aspects of QOL. This issue warrants further studies.⁸

Dietary vitamin and mineral supplements:

The use of dietary vitamin and mineral supplements during cancer treatment is controversial. It may be counterproductive, for e.g., for survivors to take folic acid supplements or to eat fortified food products that contain high levels of folic acid when receiving methotrexate, a chemotherapy drug that acts by interfering with folic acid metabolism. Many vitamin supplements contain higher levels of antioxidants (e.g.; vit C & E) than those recommended in the Dietary Reference Intakes for optimal health⁹.

FOODS WITH ANTICANCER PROPERTIES

Tomatoes

Recent findings Intervention studies show that the daily consumption of one serving of tomatoes or tomato products, but not supplementation with lycopene alone, increases the resistance of mononuclear leukocytes against DNA strand breaks induced by reactive oxygen species in healthy volunteers. Increasing evidence suggests that a single serving of tomatoes or tomato products ingested daily may contribute to protect from DNA damage¹⁰. Mechanistic studies also revealed that lycopene induced the upregulation of the pro-apoptotic protein, B-cell lymphoma-associated X protein, and therefore, resulted in the inhibition of the protein kinase B and mitogen-activated protein kinase signaling pathway. These data provided insights into the antitumor activity of lycopene rich foods in Head and Neck squamous cell Carcinoma.¹¹

Curcumin

Curcumin has been found to possess anti-cancer activities via its effect on a variety of biological pathways involved in mutagenesis, oncogene expression, cell cycle regulation, apoptosis,

tumorigenesis and metastasis. Curcumin has shown anti-proliferative effect in multiple cancers, and is an inhibitor of the transcription factor NF- κ B and downstream gene products (including c-myc, Bcl-2, COX-2, NOS, Cyclin D1, TNF- α , interleukins and MMP-9). In addition, curcumin affects a variety of growth factor receptors and cell adhesion molecules involved in tumor growth, angiogenesis and metastasis.¹² Also, gargling with turmeric by head and neck cancer patients undergoing radiation therapy provided significant benefit by delaying and reducing the severity of mucositis.

Turmeric is readily available, relatively inexpensive, and highly accepted making it useful in cancer treatment.¹³

Garlic and Onion

Studies showed there was an inverse relation between garlic consumption and HNC risk. The pattern of risk was similar for onion, though the inverse association was significant for larynx only. In particular, high garlic use was associated with a significant risk reduction of overall HNC and oro/hypo pharyngeal cancers by 26% and 38%, respectively. Further, consuming more than 3 portions of onion per week was associated with a significant reduction of laryngeal cancer risk by more than 30%. The inverse association between allium vegetables and the risk HNC may be related to various components of garlic and onion. Allium vegetables contain many chemicals with potential antioxidant and anticancer activity, including organosulfur compounds, flavonoids, minerals and vitamins. Differences in the composition, concentration, and activities of bioactive compounds are seen according to the modalities of cooking. The modalities of consumption (raw or cooked) and the cooking methods (boiled, fried and temperature of oven heating) of allium vegetables are responsible of their bioavailability and the activity of their bioactive components. Indeed, it was reported a reduction of about 30% in quercetin content by boiling onions, and boiled allium vegetables lose much of their antioxidant activity. In particular, cooking garlic may inactivate the enzyme alliinase, which is responsible for converting alliin to alliin, which in turn yields all other bioactive compounds.¹⁴

Zinc

Zinc has been found to be deficient in many head and neck cancer patients. In a study, pretreatment zinc status and nutritional status (measured by the Prognostic Nutritional Index [PNI]) were correlated with clinical outcomes in 47 patients. The patients were followed-up for a median of 52 mo from the time of enrollment. Our results showed that the tumor size and overall stage correlated significantly to zinc status. The results also showed that impaired zinc status was associated with an increased number of treatment morbidities, unplanned hospitalizations, and treatment delays (P, 0.05). The disease-free interval

was highest for the group which had both zinc-sufficient and nutrition-sufficient status. Although our data do not prove conclusively, they do suggest that impaired zinc status at presentation may contribute to treatment morbidity, and that for an optimal mean disease-free interval, a sufficient zinc and nutritional status is required.¹⁵ Zinc sulfate supplements may help some patients to recover their sense of taste (200 mg 2–3 times a day). This change can be permanent in some patients.¹⁶ Zinc sulfate is effective in reducing the severity of radiation induced oropharyngeal mucositis. In addition, it delays the development of mucositis and may be used at a lower dose (30 mg 3 times daily) with the same benefit but fewer side effects.¹⁷

Fruits and Vegetables

In studies conducted for fruit and vegetable intake patient in head and neck cancer patients, the association was stronger for vegetables than for fruits. When further sub classified into botanical groups, those in the highest tertile of leguminosae (dried beans, string beans and peas), rosaceae (apples, peach, nectarines, plums, pears and strawberries), solanaceae (peppers and tomatoes,) and umbelliferae (carrots,) had decreased risk of head and neck cancer. Results from this large prospective observational study are consistent with previous case-control studies and support the hypothesis that total fruit and vegetable intake is associated with reduced risk of head and neck cancer.¹⁸

Flaxseed

Flaxseed has a unique nutrient profile because it is the most concentrated source of both plant-based omega-3 fatty acids and more data are needed before any recommendations can be made to include flaxseed in the cancer survivors' diet. If survivors choose to consume flaxseed, using the whole seed (rather than only the flaxseed oil) provides the potential benefits of both the omega-3 fatty acids and fiber, but the seed coat must be broken (either through grinding or soaking) to liberate the omega-3 fatty acids. Because of the high propensity of flaxseed oil to oxidize, it should be consumed or refrigerated shortly after the seed coat is broken.¹⁰ Studies have also shown that omega-3 fatty acid decreases the mucosal damage caused by 5-FU-induced mucositis.¹⁹

PERSONAL CARE TO EASE TREATMENT PHASE:

Established Mucositis^{9,20,21}

Patient education is very important in managing chemotherapy-induced and/or radiation-induced mucositis: Patients are encouraged to sit upright at a 90degree angle and lean their head slightly forward. Eat slowly. Food should be cut in to small pieces and chewed completely. Take small bites, and chew your

food well. Eat small frequent meals instead of heavy meals. Food taken should be warm, or at room temperature. Hot food and drinks should be avoided. Similarly, crunchy foods such as potato chips and nuts should also be avoided. Choose soft, moist foods, such as watermelon, yogurt, and pudding. Finely chopped cooked meat, fruits, and vegetables should be taken. Milk shakes that have very high proteins can also be tried. Have a spoonful of warm soup or other liquid between mouthfuls of food. Moisten foods with broth, soup, sauces, gravy, yogurt, or creams. Patients can also try commercial baby foods, which are nutritious, convenient, and very easy to swallow. Avoid eating dry, starchy foods such as toast, crackers, or dry cereal. Sip on fruit nectars. Usage of straw will not only make drinking easy but will also avoid direct contact with the affected portion. In order to relieve discomfort of dry mouth, patients are asked to rinse mouth with water before and after every meal. Ice chip- It has been hypothesized that cooling of oral mucosa using ice chips will reduce the blood flow to the oral mucosa, thus reducing the availability of chemotherapeutic agents to the oral mucosa. Drink plenty of liquids throughout the day. (Drinking lots of fluids helps thin mucus) Always carry a bottle of water. Carry a small, clean spray bottle filled with water to spray water into your mouth throughout the day to help keep it moist. Try eating sugar-free mints, cinnamon or lemon drops or chewing sugar-free gum to make more saliva. Suck on sugarless candy or chew sugarless gum to stimulate saliva. Limit caffeine intake, from coffee, tea, energy drinks, and caffeinated soft drinks. Avoid alcoholic drinks. Avoid commercial mouthwashes that contain alcohol. If these supportive measures fail to meet nutritional needs, then other means of nutritional support may be temporarily indicated

Oral care

Patients should be referred to the dentist for a comprehensive examination to identify and correct any potential complication before cancer therapy is initiated. This includes the identification of infections requiring prompt antibiotic therapy to prevent systemic infection. Patients are encouraged to seek professional dental care throughout cancer therapy, as necessary. Routine mouth care should be performed every 4 days. Patient should be counseled to rinse mouth thoroughly their teeth with soft toothbrush and fluoridated toothpaste after every meal and before bedtime every day after every meal so that the food particles do not remain in the mouth. Toothbrush should be changed monthly. The routine oral care of patients includes removal of dentures, debridement of necrotic tissues, and oral rinse with saline regularly. Antibiotic rinses may also be used⁹

Practice preventive dental care

Clean teeth, Treat dental caries, Repair broken teeth or dentures, Brush teeth (using a soft toothbrush) or

dentures after each meal, Remove dentures or bridges until mouth sores heal., Floss teeth.– Can discontinue if pain arises or the platelet count is less than 40,000/mm³. Keep mouth and lips moist, Frequently sip water, Use a saliva substitute, Keep lips moisturized, Suck on hard candy to stimulate saliva.

Food Safety

Food safety is of special concern for cancer survivors, especially during episodes of iatrogenic immunosuppression. During any immunosuppressive cancer treatment, survivors should be particularly careful to avoid eating foods that may contain unsafe levels of pathogenic microorganisms. To make food as safe as possible, survivors should follow the general guidelines for food safety: Wash hands thoroughly before eating. Keep all aspects of food preparation clean, including washing hands before food preparation and washing fruits and vegetables thoroughly. Use special care in handling raw meats, fish, poultry, and eggs; thoroughly clean all utensils, countertops, cutting boards, and sponges that have contacted raw meat; keep raw meats and ready-to-eat foods separate. Cook to proper temperatures; meat, poultry, and seafood should be thoroughly cooked, and beverages (milk and juices) should be pasteurized. Store foods promptly at low temperatures to minimize bacterial growth (below 40°F). When eating in restaurants, avoid foods that may have

bacterial contamination such as salad bars, raw or undercooked meat, fish, shellfish, poultry, and eggs.

Topical agents that help against mucositis

Natural honey is a product with rich nutritional qualities that could be a pleasant, simple, and economic modality for the management of radiation mucositis.²² Sucralfate mouthwash is beneficial in decreasing the intensity of radiation induced mucositis and oral discomfort. It is cheap, easy to administer with no serious side effect, and maybe used in patients receiving head and neck radiotherapy.²³ Hydroxypropyl cellulose (MGI 209), which is a bio adhesive, may serve as a protective barrier over mucosal ulceration, allowing pain relief and improved healing. In a pilot study, investigators concluded that MGI 209 could relieve oral ulcer discomfort for at least 3 hours even with exposure to an acidic, irritating beverage. Topical Anesthetics-Local anesthetics such as lidocaine, cocaine, and capsaicin have shown mixed results.⁹ Oral Aloe Vera mouthwash may not only prevent radiation-induced mucositis by its wound healing and anti-inflammatory mechanism, but also may reduce oral candidiasis of patients undergoing head and neck radiotherapy due to its antifungal and immunomodulatory properties.²⁴ Sandalwood oil and turmeric based cream-Local application of sandalwood and turmeric cream can be useful in radiodermatitis.^{25,26}

American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention²⁷

- Eat a variety of healthful foods, with an emphasis on plant sources.
- Eat five or more servings of a variety of vegetables and fruits each day. Choose whole grains in preference to processed (refined) grains and sugars. Limit consumption of red meats, especially those high in fat and processed. Choose foods that help to maintain a healthful weight.
- Adopt a physically active lifestyle
- Adults: Engage in at least moderate activity for 30 minutes or more on 5 or more days of the week ; 45 minutes or more of moderate to vigorous activity on 5 or more days per week may further enhance reductions in the risk for breast and colon cancer.
- Children and adolescents: Engage in at least 60 minutes/day of moderate to vigorous physical activity at least 5 days per week.
- Maintain a healthy weight throughout life. Balance caloric intake with physical activity. Lose weight if currently overweight or obese.
- Limit consumption of alcoholic beverages

CONCLUSION

Cancer survivors are often highly motivated to seek information about food choices, physical activity, dietary supplement use, and complementary nutritional therapies to improve their treatment outcomes, quality of life and survival. Physical activity and nutrition play an important role in keeping patients in good form during and after cancer treatment

REFERENCES

1. Brown JK, Byers T, Doyle C, Courneya KS, Demark-Wahnefried W, Kushi LH, Mc Tiernan A, Rock CL, Aziz N, Bloch AS, Eldridge B. Nutrition and physical activity during and after cancer treatment: An American Cancer Society guide for informed choices. CA: A cancer journal for clinicians. 2003 Sep;53(5):268-91.
2. Kamangar F, Dores GM, Anderson WF: Patterns of cancer incidence, mortality, and prevalence across five continents: defining priorities to reduce cancer disparities in different geographic regions of the world. J Clin Oncol 2006;

- 24(14):2137–2150.
3. Canadian Cancer Society's Steering Committee on Cancer Statistics: Canadian cancer statistics 2012. Toronto, ON: Canadian Cancer Society 2012; 0835–2976.
 4. Andersen C, Adamsen L, Moeller T, Midtgaard J, Quist M, Tveteraas A, Rorth M: The effect of a multidimensional exercise programme on symptoms and side-effects in cancer patients undergoing chemotherapy—the use of semi-structured diaries. *Eur J Oncol Nurs* 2006; 10(4):247–262.
 5. Yabroff KR, Lawrence WF, Clauser S, Davis WW, Brown ML: Burden of illness in cancer survivors: findings from a population-based national sample. *J Natl Cancer Inst* 2004; 96(17):1322–1330.
 6. Thomas R, Davies N: Lifestyle during and after cancer treatment. *Clin Oncol (R Coll Radiol)* 2007; 19(8):616–627.
 7. Doyle C, Kushi LH, Byers T, Courneya KS, Demark-Wahnefried W, Grant B, McTiernan A, Rock CL, Thompson C, Gansler T, Andrews KS: Nutrition and physical activity during and after cancer treatment: an American Cancer Society guide for informed choices. *CA: a cancer journal for clinicians*. 2006 Nov;56(6):323-53.
 8. Guney Y, Turku UO, Hicsonmez A, Andrieu MN, Kurtman C. Ghrelin may reduce radiation-induced mucositis and anorexia in head-neck cancer. *Medical hypotheses*. 2007 Jan 1;68(3):538-40
 9. Naidu MU, Ramana GV, Rani PU, Suman A, Roy P. Chemotherapy-induced and/or radiation therapy-induced oral mucositis-complicating the treatment of cancer. *Neoplasia*. 2004 Sep 1;6(5):423-31
 10. Ellinger, S., Ellinger, J., & Stehle, P. Tomatoes, tomato products and lycopene in the prevention and treatment of prostate cancer: do we have the evidence from intervention studies? *Current Opinion in Clinical Nutrition and Metabolic Care* 2006; 9(6): 722–727.
 11. Ye M, Wu Q, Zhang M, Huang J. Lycopene inhibits the cell proliferation and invasion of human head and neck squamous cell carcinoma. *Molecular medicine reports*. 2016 Oct 1;14(4):2953-8.
 12. Wilken R, Veena MS, Wang MB, Srivatsan ES. Curcumin: A review of anti-cancer properties and therapeutic activity in head and neck squamous cell carcinoma. *Molecular cancer*. 2011 Dec 1;10(1):12.
 13. Rao S, Dinkar C, Vaishnav LK, Rao P, Rai MP, Fayad R, Baliga MS. The Indian spice turmeric delays and mitigates radiation-induced oral mucositis in patients undergoing treatment for head and neck cancer: an investigational study. *Integrative cancer therapies*. 2014 May;13(3):201-10.
 14. Galeone C, Turati F, Zhang ZF, Guercio V, Tavani A, Serraino D, Brennan P, Fabianova E, Lissowska J, Mates D, Rudnai P. Relation of allium vegetables intake with head and neck cancers: evidence from the INHANCE consortium. *Molecular nutrition & food research*. 2015 Sep;59(9):1641-50.
 15. Doerr TD, Marks SC, Shamsa FH, Mathog RH, Prasad AS. Effects of zinc and nutritional status on clinical outcomes in head and neck cancer. *Nutrition*. 1998 Jun 1;14(6):489-95.
 16. Devi S, Singh N. Dental care during and after radiotherapy in head and neck cancer. *National journal of maxillofacial surgery*. 2014 Jul;5(2):117.
 17. Moslemi D, Babae N, Damavandi M, POURGHASEM M, Moghadamnia AA. Oral zinc sulphate and prevention of radiation-induced oropharyngeal mucositis in patients with head and neck cancers: a double blind, randomized controlled clinical trial.
 18. Freedman ND, Park Y, Subar AF, Hollenbeck AR, Leitzmann MF, Schatzkin A, Abnet CC. Fruit and vegetable intake and head and neck cancer risk in a large United States prospective cohort study. *International journal of cancer*. 2008 May 15;122(10):2330-6.
 19. de Vasconcelos Generoso S, Rodrigues NM, Trindade LM, Paiva NC, Cardoso VN, Carneiro CM, de Matos Ferreira AV, Faria AM, Maioli TU. Dietary supplementation with omega-3 fatty acid attenuates 5-fluorouracil induced mucositis in mice. *Lipids in Health and Disease*. 2015 Dec;14(1):1-0.
 20. Porrini M, Riso P. Lymphocyte lycopene concentration and DNA protection from oxidative damage is increased in women after a short period of tomato consumption. *J Nutr* 2000; 130:189–192
 21. <https://www.cancer.org/content/dam/cancer-org/cancer-control/en/booklets-flyers/nutrition-for-the-patient-with-cancer-during-treatment.pdf>
 22. Motalebnejad M, Akram S, Moghadamnia A, Moulana Z, Omid S. The effect of topical application of pure honey on radiation-induced mucositis: a randomized clinical trial. *J contemp dent pract*. 2008 Mar 1;9(3):40-7
 23. Cengiz M, Özyar E, Öztürk D, Akyol F, Atahan IL, Hayran M. Sucralfate in the prevention of radiation-induced oral mucositis. *Journal of clinical gastroenterology*. 1999 Jan 1;28(1):40-3.
 24. Ahmadi A. Potential prevention: Aloe vera mouthwash may reduce radiation-induced oral mucositis in head and neck cancer patients. *Chinese journal of integrative medicine*. 2012 Aug 1;18(8):635-40.
 25. Palatty PL, Azmidah A, Rao S, Jayachander D, Thilakchand KR, Rai MP, Haniadka R, Simon P, Ravi R, Jimmy R, D'souza PF. Topical application of a sandal wood oil and turmeric based cream prevents radiodermatitis in head and neck cancer patients undergoing external beam radiotherapy: a pilot study. *The British journal of radiology*. 2014 Jun;87(1038):20130490.
 26. Cawley MM, Benson LM. Current trends in managing oral mucositis. *Clinical journal of oncology nursing*. 2005 Oct 1;9(5).
 27. Winningham ML, MacVicar MG: The effect of aerobic exercise on patient reports of nausea. *Oncol Nurs Forum* 1988; 15(4):447–450.