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Association between Lifestyle habits, Nutrition and Oral Cancer: A Contemporary Update

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ABSTRACT

Oral cancer is a major cause of death from oral disorders worldwide and one of the worldwide major public health problems with a significant incidence and mortality rates in the developing and developed countries. Oral cancer ranks in the top three of all cancers in India, which accounts for over thirty per cent of all cancers reported in the country and oral cancer control is quickly becoming a global health priority.

To reduce the burden of risk of oral cancer, a healthy diet must be optimized mainly by consuming low amount of animal-based fat red or processed red meat. Eating more quantity of vegetables, fruits and cereals are considered to be the primary origin of vitamins and fibers which is sufficient in the everyday diet to provide vitamin C, E antioxidants zinc β-carotene and folate all being an impact in the restraining of oral cancer.

High consumption of healthy grains, unsaturated fats fruits and vegetables effective herbs and low use of animal-based derivatives might be the key to prevention of human cancers including the oral cancers. A public health approach should be adopted though promoting preventive measures to bring awareness among the community for taking optimum nutritive diet and practicing good lifestyle habits.

INTRODUCTION

Good oral health is not only essential for good overall health and freedom from the pain and suffering associated with oral health problems, but also influences self-esteem, quality of life, and performance at school and at work.[1] Improvement in the beauty and harmony of facial appearance has been the main intention of good oral health[2] and suffering from vulnerable disease leads to disturb the mental health and lifestyle practices of a community. Cancer disease is a major public health concern in India. The incidence is more than 1 million new cases every year and is likely to increase due to age and Indian life style.[3]

Oral cancer is a major cause of death from oral disorders worldwide and one of the worldwide major public health problems with a significant incidence and mortality rates in the developing and developed countries. Oral cancer ranks in the top three of all cancers in India, which accounts for over thirty per cent of all cancers reported in the country and oral cancer control is quickly becoming a global health priority.[4,5,6]

Oral cancer cause is multifactorial no single causative agent or factor had characterized or accepted but both extrinsic and intrinsic agents may be at work. Oral mucosa works as a mechanical and immunological barrier. Contact with exogenous material implies the probability of an attack from a microorganism (fungi, bacteria parasite and viruses) and induction of microtrauma irritants toxins and carcinogens.[7]

The oral mucosa is more resistant to the action of chemical carcinogens than the skin. The necessity of using a susceptible tissue and of frequent applications of a chemical carcinogen to induce carcinogenesis in the oral mucosa was first demonstrated by Salley by the application of several polycyclic aromatic hydrocarbons to induce squamous cell carcinomas in the thin mucosal lining of the hamster cheek pouch.

To reduce the burden of risk of oral cancer, a healthy diet must be optimized mainly by consuming low amount of animal-based fat red or processed red meat. Eating more quantity of vegetables, fruits and cereals are considered to be the primary origin of vitamins and fibers which is sufficient in the everyday diet to provide vitamin C, E antioxidants zinc ß-carotene and folate all being an impact in the restraining of oral cancer. Also fried or boiled foods should be avoided because of the formation of heterocyclic amines (HCAs) that increases the risks of oral cancer.[8]

NUTRITION

1- Fruits and vegetables

There are more than hundreds healthy and beneficial contents in fruits and vegetables which contains high amount of fibres, minerals, vitamins and specific phytochemicals (such as flavonoids carotenoids terpenes indoles and sterols) that may prevent cancer.[9] Daily consumption of five or more portions of fruits and vegetables can reduce the risk of oral cancer.[10] Apples and strawberries are the main and primary sources of polyphenols while potatoes lettuces and onions are the most crucial vegetable sources. The overall intake of polyphenol from fruits is about three times more effective than from vegetables.

2- Turmeric and ginger

A polyphenol Curcumin (diferuloylmethane) is derived from the Curcuma longa plant which is widely known as turmeric. For centuries, it has been used extensively in Ayurvedic medicine as it is non-toxic with curative properties (like anti-oxidant anti-inflammatory analgesic and antiseptic activity). Curcumin possesses anti-cancer activities via its effect on mutagenesis oncogene expression cell cycle regulation apoptosis and metastasis. It has an anti-proliferative impact on oral cancer by inhibition of NF-κB and downstream gene products (involving COX-2 c-myc NOS Bcl-2 Cyclin D1 TNF-α interleukins and MMP-9). Curcumin also influences a set of growth factor receptors and also helps in cell adhesion molecules which is implicated in tumour growth angiogenesis and metastasis.[11]

3-Onion and garlic

Allium cepa and Allium sativum consuming deem are considered to be as a marker of a healthier lifestyle because of their potential health benefits.[12] In the Italian diet onion and garlic are often eaten or cooked with foods. The preventive effect of garlic and tomato against the carcinogenic process of hamster buccal pouch was reported.[13]

4- Carbohydrates (whole grains bread cereals and pasta)

Rich content plant foods are considered to be one of the foremost preventable factors of non-communicable diseases. The grasses seeds cultivated for food are called grains or cereals. Whole grains are the complete plant seeds and it consisted of bran germ and endosperm. Purified grains are nutritionally low in content because the milling process substantially reduced the nutrient contents of grains by removing the bran and germ (that rich in fibre protein micronutrients and phytochemicals) leaving a mainly starchy endosperm. Purified grains particles are completely enriched with B vitamins (riboflavin niacin thiamine and iron).[14]

5- Proteins

Barbaresco *et al*. had conducted a systematic review and found that a Western food pattern has a positive correlation with the higher contents of C-reactive proteins which is the primary biomarker of inflammation.[15] Rich glycemic and protein-dense foods dairy products) may increase advanced glycated end (AGEs) product formation which in turn leads to cellular injury at various levels. AGEs perhaps induce changes in the protein texture and its role aberrant cell signalling and irregular of extracellular matrix functions. Disturbances of the primary cell role imply the etiology of several cancers involving oral cancer. High protein dietary patterns have an association with decreased oral cancer risk.[16]

6-Milk and dairy products

Milk is also considered to have a protective mechanism towards oral cancer due to an anti-cancerous feature which is attributed to its calcium and lactoferrin. Chen et al. in their hospital-based case-control study suggest that tea and milk consumption are independent protective factors for oral cancer among non-smoker/non-drinker with a synergistic effect between them (epigallocatechin gallate and lactoferrin interaction)[17]

7- Coffee and tea

As one of the widely consumed beverages in the world i.e. coffee is the most favourite and daily consumed beverage in people's lives. It contains polyphenols antioxidants anticarcinogenic constituents and other biologically active components that perhaps help in protection versus the evolution or progression of cancer besides its daily enjoyment.[18] Zhang *et al*. had conducted a meta-analysis study which proposed that more consumption of coffee might decrease the chance of oral cancer, particularly in Europe.[18]

8- Honey and sweeten syrup

Honey has nutritional and medical benefits due to its antimicrobial antiviral and antiparasitic activity. Its form of organic acids polyphenols proteins amino acids vitamins minerals and aromatic compounds. It pursued apoptosis by up-regulating p53 protein and by modifying the expression of pro and anti-apoptotic proteins reactivation of caspase-3 pathway due to its phenolic and tryptophan ingredients. Honey transduced the apoptotic signal via an initial depletion of intracellular non-protein thiols reducing the MMP by elevation of ROS generation which demands apoptosis. So, honey regulates oral cancer cell line by inducing cell-growth arrest by cell cycle blockage at the sub-G1 phase.[19]

9-Fats and oils

Studies showed that high-fat diets had a link to many types of cancer and saturated fat was particularly dangerous. Choosing fats wisely and eating them in moderation is the trick because some types of fat may protect against cancer. Saturated fatty acids are abundant in animal fat and plant-extracted oils (like sunflower grain oil and corn oil) that are full of linoleic acid (one of the N-6 polyunsaturated fatty acids / arachidonic acid is suggested to enhance cancer development). Oils derived from fish oils N-3 polyunsaturated fatty acids (especially eicosapentaenoic acid and docosahexaenoic acid) and that derived from olive oil (N-9 monounsaturated fatty acids/oleic acid) have protective effects against carcinogenesis.[20]

10-Micronutrients (vitamins and minerals)

Many micronutrients and minerals were taken from diet like iron phosphorus vitamins B, E, K and selenium. Oral cancer development decreases by consuming particular micronutrients decrease oral cancer like vitamins A, C B5, E, carotenoids, phosphorus selenium and potassium. These antioxidants are essential in lowering free radical response.[21] Vitamin C reduces nitrosation by blocking nitrosamines formation acting as a chemopreventive factor and impacts the activity of leukocytes and macrophages.

I Antioxidants:

β carotene was estimated in exfoliated oral mucosa cells in groups of individuals at various risks for oral cancer. It was found that there were low levels of β-carotene in the mucosa of heavy cigarette smokers and alcohol drinkers.

The antioxidant status of an individual is thought to be important in the development of potentially malignant oral lesions and oral squamous cell carcinoma, antioxidant levels were measured in smokers and non smokers. Smokers were found to have a significantly lower levels of plasma β-carotene and tissue α carotene than non smokers.[22]

II Vitamin A:

Vitamin A and its analogs are capable of reversing epithelial lesions induced by chemical carcinogens in organ cultures as well as in vivo in animals.[23] In an experimentally induced cancer in hamsters, the Vitamin A deficiency group had an increased incidence of carcinomas of the cheek pouch.

III Vitamin E:

In an experimental study the animals given Vitamin E had fewer and smaller tumors that were less invasive and produced less surface necrosis than the control animals.[24]

IV Zinc:

Experimental cancer was inhibited by excessive zinc. Addition of zinc to drinking water reduced the susceptibility of oral mucosa to DMBA induced carcinogenesis. Wallenius et al studied the effect of zinc deficient, zinc normal or zinc supplemented diet in oral cancer rats, they noted that in zinc supplemented rats cancer appeared early and survival time was shorter.[25] The investigators concluded that zinc supplementation may accelerate the development of chemically induced cancer in the oral cavity.

11- Plummer- Vinson Syndrome:
The best example of oral carcinogenesis attributed to a dietary imbalance in humans is the Plummer Vinson – Syndrome, first described by Plummer in 1914 and Vinson in 1922 which is one of the manifestations of iron deficiency anaemia and it was most commonly seen in Northern Scandinavian women.
Ahlbon (1936) defined the relationship between atrophy of the mucous membranes of upper alimentary tract and a predisposition to the development of carcinoma of the mouth, pharynx and oesophagus in these women. He also reported that 50% of the female patients treated with carcinoma of hypopharynx had Plummer-Vinson syndrome.[26]
12- Dental Conditions:
Conditions such as dental trauma jagged teeth, the use of ill-fitting dentures and poor oral hygiene have been suggested as etiologic factors for cancer.
13- Chewing Tobacco and Betel Quid:
Nutritional deficiency and infections especially if combined with poor oral hygiene and continuous insult to the oral mucosa due to faulty dentition may be important contributory factors in humans. Suri et al conducted a study and found that repeated topical applications of dimethyl sulfoxide extracts of betel nut to the buccal pouch mucosa of hamsters resulted in the development of leukoplakia and tumors. Tumor incidence increased when the betel nut was mixed with cured tobacco. Extracts of tobacco alone caused leukoplakia but not tumors. The affects appear to be exacerbated by nutritional deficiency.[27]
The carcinogenecity of tobacco extract is enhanced if used in combination with betel nut probably acts as a co-carcinogen or syncarcinogen under certain conditions.
Sadasivan et al found that betel leaf extract increased the frequency of chromatid aberrations in human leukocytes in culture. The interactions between five naturally occurring chemicals that may appear in the mouth of the betel quid user was studied in vitro and found that there was a synergistic effect than only individual chemical was used.[28]
Powdered tobacco mixed with lime (Khaini) is commonly used in Bihar. An elevated frequency of cells with micronuclei an indication of chromosomal aberrations was observed in the scrapings of the oral mucosa of all 27 Khaini users compared to non-users.[29]
14- Alcohol:
Elzay studied the local effects of alcohol in combination with +12 dimethyl benzanthracene (DMBA) on the hamster cheek pouch and suggested that alcohol acts as a co-carcinogen and promoting agent by reducing the latent period of tumorigenesis and producing more aggressive tumours.[30]

CONCLUSION

The beneficial effect of a diet rich in vegetables and fruits is mainly attributed towards different micronutrients, such as polyphenols, lycopene, catechins, flavins, curcuminoid, slowly digesting starches, minerals (selenium, zinc, and copper), carotenes, vitamins (A, B, C, and E), folate and omega 3 acids. These compounds show different mechanisms of action, and when combined, they may have synergistic anti-angiogenic, and anti-proliferative, antioxidant, anti-inflammatory properties.
High consumption of healthy grains unsaturated fats fruits and vegetables effective herbs and low use of animal and animal-based derivatives along with non-broiling non-frying methods might be the key to prevention of many types of human cancers including the oral cancers. A public health approach should be adopted though promoting preventive measures by proper communicative and educational methods,[31] so as to bring awareness among the community for taking optimum nutritive diet and practicing good lifestyle habits.
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